

Using ChatGPT and Determinologisation to Enhance Understanding of Lung Cancer Information¹

María-José Varela Salinas, Adriana Godoy Lorenzatto

Abstract

Lung cancer is associated to high mortality rates and has a large impact on the quality of life of patients and families, who therefore need suitable information to deal with the situation. However, information provided by health services is often not adapted to lay users and retains a considerable number of technicalities that impair comprehensibility. Accessibility, a concept receiving increasing attention, not only involves physical access but also understanding relevant information when it comes to the medical setting. One of the main intralingual translation procedures used to adapt specialised text is determinologisation, which comprises strategies like using common-speech synonyms, explanations, examples, etc. Recent artificial intelligence generative models offer a promising tool to produce texts at different specialisation levels. In this study, we evaluated the capacity of ChatGPT for determinologisation of terms extracted from a corpus of patient-oriented lung-cancer texts and compared the results with reliable patient-oriented online sources. ChatGPT produced definitions and context information similar to those of the online sources in a very short amount of time. However, both the choice of suitable input prompts and the post-edition process necessary to produce quality final texts on lung-cancer information still required the supervision of human experts.

Keywords: lung-cancer, patient-oriented information, determinologisation, ChatGPT

¹ This work was partially conducted within project FEDER 1381162-R. Oncotrad: Medicina gráfica y Traducción al servicio del paciente oncológico y su entorno en la Sociedad Andaluza.

1 Introduction

According to the World Health Organisation, cancer is one of the most widespread diseases worldwide, and is associated to one of the highest mortality rates, with nearly ten million deaths per year (cf. WHO 2022). In Spain, 295,675 new cases were detected in 2023 and 286,664 are expected in 2024 (cf. EP data 2024), with a large proportion of them corresponding to lung cancer. With 30,853 new detections in 2023 and 32,768 expected in 2024, this cancer type shows the fourth highest incidence, after colorectal, prostate and breast cancers. Moreover, it is the leading cause of malignancy-related death, due to its high associated mortality (cf. REDECAN 2024; SEOM 2024).

Cancer therapy often prevents patients from continuing with a large part of their pre-diagnosis lifestyle, including professional work, sport, or leisure activities, and affects their families. In this context, patients and their relatives expect to receive the information they need to deal with the disease, while maintaining the best possible quality of life. However, the information provided by health services, either oral or written, is often not adapted to their knowledge and may contain a considerable number of medical terms. Several studies have reported the need to improve the adaptation of medical information when it comes to prepare patient-oriented informative materials. However, many of such texts still retain technicalities that are obscure for their receptors and impair comprehensibility (cf. Blanco Perez/Giménez Couto 2002:325f.; McCormack et al. 2013:105ff.; Kwame/Petrucka 2021: 3ff.; Vidal Sabanés 2021:58ff.).

Accessibility is a concept receiving increasing attention from governments and society in general. It has been defined as the conditions that places, processes, goods, products, services, tools and devices must meet, in order to be understandable, usable and practicable to all people in a safe, comfortable and as autonomous as possible way (cf. COCEMFE n. d.). In the medical setting, accessibility not only involves physical access to health facilities and treatments but also comprehensibility of the medical information. This often entails reformulating specialised jargon to make it understandable to all users, in a process known as intralingual translation (cf. Muñoz Miquel 2021:187f.). Several guidelines and recommendations have been published on strategies to adapt specialised text for lay receptors (cf. Montalt/González-Davies 2007:298ff.; Mayor Serrano 2008: 11ff.; Mayor Serrano 2010 29ff.; García Izquierdo 2009; Sanchez Castany 2013: 834ff.; Cobos López 2019: 213ff.). Approaches based on different communication elements such as page layout, graphics, photographs, or video-images have been proposed (cf. Mayor Serrano 2016:55ff.; Lázaro Gutiérrez 2017:141ff.; Prieto Velasco/Montalt 2018:196ff.; Cobos López 2021a:399ff.; Cobos López 2021b:70f.). However, since most patient-information is based on texts, intralingual translation remains essential. One of the most important procedures is *determinologisation* (cf. Campos Andrés 2008:3ff.; Campos Andrés 2013:48ff.).

The word *determinologisation* has been used to describe two related, yet different phenomena. On the one hand, it refers to the spontaneous diffusion of some specialised words into general vocabulary – often followed by changes in their accuracy, connotation or meaning – promoted by the growing development of science and technology, as well as by the

generalisation of communication media. This concept of determinologisation has long been established in Slovak and Czech linguistics, with pioneer studies dating back to the second half of century XX (cf. Nová 2018:388) and a more recent and influential model presented by Meyer/Mackintosh (2001:111ff.). On the other hand, the concept of determinologisation refers to an active strategy, that encompasses several techniques, aimed at reducing the terminological load of specialised texts and adapting them to a general audience (cf. Montalt/González-Davies 2007:298ff.). From this perspective, Campos Andrés (2013:3) defined determinologisation as “a formal, communicative and cognitive process involving procedures through which specialised lexical units are treated with the aim of granting accessibility of lay users to specialised contents”. Different strategies have been proposed for active determinologisation, like substituting technical words by explanations or hypernyms, using common-speech synonyms, if available, instead of specialised terms, introducing explanations between brackets, paraphrasing, providing examples, using analogy, etc. (cf. Campos Andrés 2013:50f.; Hill-Madsen 2015:93ff.).

Given the preponderance of text-based medical information and the consequent importance of intralingual translation procedures like determinologisation, it is worth researching on strategies that facilitate and speed up this procedure, while maintaining accuracy. The emergence and evolution of artificial intelligence (AI) methods opened the possibility to develop useful tools for a range of activities including, image analysis, text classification or translation, thus relieving human operators from several routine time-consuming tasks (cf. Grace et al. 2018: 1ff.). Among the latest AI developments are generative models based on transformers, which can process text sequences and discover relationships between them, assigning more importance to more relevant relationships according to the context (cf. Bello 2023). These so-called Large Language Models (LLMs) include the recently launched LLaMA (Meta), LaMDA (Google) and the generative pre-trained transformer model used in this work, ChatGPT (OpenAI). Their capacity to evaluate, select and relate relevant text in large amounts of information makes these models one of the most promising tools to produce texts at different specialisation levels (cf. Kalyan 2023).

ChatGPT was used to prepare common-speech definitions of terms extracted from the studied text corpus and to provide contextual information. Its output was then compared with definitions and contextual information from reliable online sources that the average patient of lung cancer may consult. The objectives of this study were: 1) to analyse the occurrence of terms in a corpus of lung-cancer information texts intended for patients and other non-specialised receptors, 2) to propose determinologisation strategies for some terms extracted from the corpus, based on definitions and information in patient-oriented online sources and 3) to compare it with the determinologisation results based on the definitions and contextual information provided by ChatGPT for the same terms, in order to assess the usefulness of generative AI in the adaptation of medical texts for patients. Below, the methodology is described, followed by a section of Results and a Discussion. Finally, the conclusions of the work are summarised.

2 Method

This study analysed texts in Spanish published between 2008 and 2022, in eight informative webpages on lung cancer (some of them within a same website), which could be classified into the text genre “fact sheet for patients” also called “patients information leaflet” (cf. Ouchen 2008:140ff.; American Cancer Society 2022:1ff.; Organización Mundial de la Salud 2022). Such documents usually include information on a variety of topics, like types of lung cancer, risk factors, clinical manifestations, early diagnosis, laboratory tests, prognosis, or therapeutic options (cf. Initia Oncología 2017; NCI n. d.). In this analysis, we focused on two main thematic fields of particular importance to oncologic patients: histological findings/tumour names (histology) as classified by the World Health Organisation (cf. Nicholson 2021:363f.), since they may appear in the diagnosis and are relevant in prognosis, and therapeutic options (therapy); thus, the text sources were selected accordingly.

The resulting corpus was then fed into the text-analysis tool Sketch Engine, which generated a list of automatically detected terms. This list was subsequently processed to remove unnecessary or confounding information like multi-word terms that appeared incomplete, terms combined with collocations that did not actually constitute a different term and words with ortho-typographic mistakes, that had been identified by Sketch Engine as new terms. From the processed list, six terms were selected (three per thematic field: histology or therapy) as examples to be analysed and to propose a determinologisation strategy based on online sources and a strategy based on ChatGPT.

The determinologisation process was registered in terminological cards, adapted from those used in project OncoTrad (n. d.). Our cards included the selected term, the thematic field, variants if any, a common-speech definition extracted from a reliable online information source for patients, the determinologisation techniques identified in this definition, contextual information on the term as provided by a referenced online source, a definition proposed by ChatGPT, the determinologisation techniques applied by ChatGPT as identified by the authors and finally, contextual information provided by ChatGPT. For definitions and contextual information from online sources that patients might probably consult, the online dictionary BioDic (BioScripts n. d.) was mainly used. For terms that were not found in this dictionary, alternative patient-oriented sources were used. The determinologisation techniques were identified following the taxonomy proposed by Campos Andrés (2013:50f.), who classified them into: definition (here called *explanation*), paraphrastic reformulation, synonymy, hypernymy, analogy and exemplification. ChatGPT definitions and context were obtained by entering the prompt “*Define [término] y proporciona contexto*” (in English “Define [term] and provide context”), where *[término]* ([term]) corresponded to every analysed term.

3 Results

The final corpus was composed of 28,935 words. After processing the list of terms identified by Sketch Engine, a total of 723 terms were obtained, which were manually allocated to one or the other thematic field: 443 terms were related to “histology” and 280

were related to “therapy”. The following six terms (three per thematic field) were selected for subsequent analysis and determinologisation: *adenocarcinoma*, *EGFR* and *cuerpo de psammoma* (adenocarcinoma, EGFR and psammoma body) for “histology” and *inmunoterapia*, *terapia dirigida con radioligandos* and *terapia fotodinámica* (immunotherapy, targeted radioligand therapy and photodynamic therapy) for “therapy”. The corresponding determinologisation cards are shown and commented in the tables 1 to 6 below.

Term	adenocarcinoma
Thematic field	Histology
Variants	carcinoma glandular
Definition from a patient-information source	El cáncer que empieza en las células glandulares (secretoras). Las células glandulares se encuentran en el tejido que reviste ciertos órganos internos; producen y liberan sustancias en el cuerpo, como el moco, los jugos digestivos u otros líquidos (BioScripts n. d.).
Determinologisation strategies in the patient-information source	Explanation, hypernymy, synonymy, exemplification
Context from a patient-information source	La mayoría de los cánceres de mama, páncreas, pulmón, próstata y colon son adenocarcinomas (BioScripts n. d.).
Definition by ChatGPT	Un "adenocarcinoma" es un tipo de cáncer que se origina en las células glandulares del cuerpo. Estas células glandulares son responsables de producir y secretar sustancias como moco, enzimas y otros fluidos corporales.
Determinologisation strategies used by ChatGPT	Explanation, hypernymy, exemplification
Context provided by ChatGPT	El adenocarcinoma puede afectar una variedad de órganos, como el pulmón, el colon, el estómago, el páncreas, el útero, la próstata y otros. Este tipo de cáncer es uno de los más comunes y suele ser agresivo en su naturaleza. La característica distintiva del adenocarcinoma es el crecimiento descontrolado y anormal de las células glandulares, lo que lleva a la formación de tumores malignos. El tratamiento del adenocarcinoma puede variar según la ubicación y la etapa del cáncer, e incluye opciones como cirugía, quimioterapia, radioterapia y terapias dirigidas. La detección temprana es fundamental para mejorar las perspectivas de tratamiento y supervivencia.

Tab. 1: Analysis and determinologisation of term *adenocarcinoma*, based on the definition and context provided by a patient-information source versus generated by ChatGPT.

The first example, *adenocarcinoma* is a compound of two Greek derived terms, *adeno* (gland) and *carcinoma* (cancer) (cf. Universidad de Salamanca n. d.). In the common-speech definition in BioDic, the determinologisation techniques hypernymy, synonymy, explanation and exemplification were used. According to Campos Andrés (2013:50f.), a definition (here called *explanation*) is a statement that describes a certain concept and permits its differentiation from other concepts. This procedure is profusely used in dissemination of specialised knowledge, and it generally consists of a paragraph. In this case, single-word term *adenocarcinoma* was described in a paragraph. Hypernymy is a procedure by which a term is clarified through a hierarchically higher one, often followed by a mention of some of its characteristics (cf. Campos Andrés 2013:51f.). In this case, the specific cancer type *adenocarcinoma* was described by using the hypernym *cáncer* (cancer) followed by the explanatory segment *que empieza en las células glandulares* (starting in glandular cells). In addition, the common-speech synonym *secretoras* (secretory) was used to clarify *glandular*, although this term is well-known. Furthermore, examples of secretions by glandular cells were provided. BioDic definition did not contain terms, although its contextual information included *enzimas* (enzymes). ChatGPT produced a definition based on explanation, hypernymy and exemplification. It used the hypernym *tipo de cancer* (cancer type) and like BioDic, provided examples of secretions. No synonym was provided for *glandulares* but, as mentioned, this term is rather generalised and well-known. In this case, both determinologisation strategies were similar in terms of understandability and accessibility.

Term	EGFR
Thematic field	Histology
Variants	Receptor del factor de crecimiento epidérmico, ErbB1, HER1 (BioScripts n. d.)
Definition from a patient-information source	Se dice de la proteína que se encuentra en la superficie de algunas células a la cual se une el factor de crecimiento epidérmico y hace que las células se multipliquen (BioScripts n. d.).
Determinologisation strategies in the patient-information source	Explanation, hypernymy
Context from a patient-information source	Se encuentra en concentraciones anormalmente altas en la superficie de muchos tipos de células cancerosas, de manera que estas células se multiplican de forma excesiva en presencia del factor de crecimiento epidérmico: también se llama ErbB1, HER1, y receptor del factor de crecimiento epidérmico (BioScripts n. d.).
Definition by ChatGPT	El término "EGFR" es una abreviatura de "Epidermal Growth Factor Receptor", en español, "Receptor del Factor de Crecimiento Epidérmico". El EGFR es una proteína de membrana celular que se encuentra en la superficie de muchas células en el cuerpo humano y

	desempeña un papel importante en el control del crecimiento y la división celular.
Determinologisation strategies used by ChatGPT	Explanation, hypernymy
Context provided by ChatGPT	El contexto en el que se utiliza el término "EGFR" es principalmente en la investigación y el tratamiento del cáncer. Mutaciones en el gen que codifica el EGFR pueden llevar al desarrollo de ciertos tipos de cáncer, como el cáncer de pulmón, y se ha convertido en un objetivo terapéutico importante. Los medicamentos que se dirigen específicamente a las células con mutaciones de EGFR, como los inhibidores de tirosina quinasa del EGFR, han demostrado ser efectivos en el tratamiento de ciertos subtipos de cáncer de pulmón, por ejemplo. El EGFR también desempeña un papel en el funcionamiento normal de las células y es un objetivo de investigación en otros campos, como la biología celular y la terapia génica.

Tab. 2: Analysis and determinologisation of term *EGFR* (acronym of *Epidermal Growth Factor Receptor*), based on the definition and context provided by a patient-information source versus generated by ChatGPT.

EGFR is an acronym for the English term *Epidermal Growth Factor Receptor* (in Spanish, *factor de crecimiento epidérmico*). Besides the name in Spanish, other variants corresponded to different acronyms in English. The BioDic definition was based on explanation and hypernymy. Thus, to explain EGFR, the hypernym *proteína* (protein) was used, followed by an explanation of some characteristics: *que se encuentra en la superficie de algunas células* (found in the surface of certain cells). Remarkably, the explanation continues by saying that this protein is the receptor of the Epidermal Growth Factor without further explaining this latter term, so that very little information is provided. This also occurs in the context information provided by BioDic. ChatGPT used explanation and hypernymy. Interestingly, its explanation included the meaning of the acronym both in English and Spanish and did not include terms. Like in BioDic, the hypernym *proteína* (protein) was used, this time followed by its characteristic *de membrana celular* (of cell membrane), which was then explained through *que se encuentra en la superficie de muchas células* (on the surface of many cells). Its context, however, included *tirosina quinasa* (tyrosin kinase) and *terapia génica* (gene therapy). In this case, ChatGPT's definition was clearer and more complete than that of BioDic, although the context retained two terms. It is worth noting that ChatGPT's contextual information included the segment *El contexto en el que se utiliza el término "EGFR" es el de la investigación y el tratamiento del cáncer* (the context in which term "EGFR" is used is cancer research and treatment) which, although informative, is scarcely relevant and contributed to unnecessarily lengthening of the text.

Term	Cuerpo de psamoma
Thematic field	Histology
Variants	Psamoma
Definition from a patient-information source	La masa redondeada con múltiples capas de material calcáreo que aparece en neoplasias benignas y malignas de tejido epitelial y conectivo y en algunos tejidos con inflamaciones crónicas (BioScripts n. d.).
Determinologisation strategies in a patient information source	Explanation, paraphrastic reformulation
Context from a patient-information source	Los cuerpos de los psamoma se parecen a anillos concéntricos endurecidos cuando se observan bajo un microscopio. Pueden ser un signo de inflamación crónica (Titi Tudorancea®).
Definition by ChatGPT	Una masa redondeada con capas de material calcificado que se encuentra en tumores benignos y malignos. También puede encontrarse en tejidos con inflamaciones crónicas.
Determinologisation strategies used by ChatGPT	Explanation, paraphrastic reformulation
Context provided by ChatGPT	La presencia de pequeñas formaciones calcificadas en los tumores, conocidas como cuerpos de psamoma, no influye en el pronóstico de los mismos.

Tab. 3: Analysis and determinologisation of term *cuerpo de psamoma* (psammoma body), based on the definition and context from different patient-information sources versus those generated by ChatGPT.

The third example, *cuerpo de psamoma* (psammoma body), is a syntagmatic compound that includes *psamoma* (psammoma), derived from the Greek word for *sand* (cf. DBpedia n. d.). The definition offered by BioDic was based on explanation and paraphrastic reformulation, where the term was called *masa redondeada* (rounded mass) and further described by *con múltiples capas de material calcáreo* (with multiple layers of calcareous material). This definition included the terms *calcáreo*, *neoplasia*, *epitelial* and *conectivo* (calcareous, neoplasia, epithelial, connective). The context information did not contain terms. ChatGPT produced a definition rather similar to that of BioDic, by using the same strategies. However, it used two simpler words, *calcificado* instead of *calcáreo* (*calcified* instead of *calcareous*) and *tumores* instead of *neoplasia* (*tumors* instead of *neoplasia*), omitted two non-critical terms, *epitelial* and *conectivo* (epithelial, connective) and used two sentences instead of one, all of which contributed to facilitate comprehension. Its contextual information did not contain terms. Thus, although the results were not very different, ChatGPT produced easier-to-understand information.

Term	Inmunoterapia
Thematic field	Therapy
Variants	Terapia inmunológica
Definition from a patient-information source	La inmunoterapia es un tipo de terapia para la que se usan sustancias a fin de estimular o inhibir el sistema inmunitario y de esta manera ayudar al cuerpo a combatir el cáncer, las infecciones y otras enfermedades (BioScripts n. d.).
Determinologisation strategies in a patient-information source	Explanation, hypernymy
Context from a patient-information source	Se aplica al tratamiento de una enfermedad mediante la potenciación o debilitamiento de los mecanismos inmunitarios: consiste en provocar o en aumentar la inmunidad del organismo. Algunos tipos de inmunoterapia solo se dirigen a ciertas células del sistema inmunitario. Otras afectan el sistema inmunitario en general. Los tipos de productos que se usan para la inmunoterapia son las citocinas, las vacunas, el bacilo de Calmette-Guérin (BCG) y algunos anticuerpos monoclonales (BioScripts n. d.).
Definition by ChatGPT	Es un tratamiento que ayuda a nuestro cuerpo a luchar contra enfermedades. La inmunoterapia usa sustancias para hacer que nuestras defensas sean más fuertes o más débiles. Así, ayuda a combatir problemas como el cáncer y las infecciones.
Determinologisation strategies used by ChatGPT	Explanation, hypernymy
Context provided by ChatGPT	Esto podría mejorar el efecto del tratamiento que utiliza sustancias para estimular o inhibir el sistema inmunitario, ayudando al cuerpo a combatir enfermedades como el cáncer. Sin embargo, hay muy pocos estudios que analicen en detalle los beneficios de combinar este tratamiento con aquel que usa radiación.

Tab. 4: Analysis and determinologisation of term *inmunoterapia* (immunotherapy), as an example of thematic field “therapy” of the studied corpus, with definition and context extracted from a patient-information source or generated by ChatGPT, and determinologisation strategies in each case.

The fourth example, *inmunoterapia* (immunotherapy), is composed of two words: *immune* (immune) from the Latin *immunis* and *terapia* (therapy), from the Greek *therapia* (meaning *medical care*) (cf. Anders n. d.). The BioDic definition was based on explanation and hypernymy (using hypernym *terapia*). This definition did not include terms, except for

sistema inmunitario (immune system), although this expression is widespread enough as to be considered comprehensible for the general audience. The context however, besides expressions related to the immune system like *mecanismo inmunitario*, *inmunidad* and *sistema inmunitario* (immune mechanism, immunity, immune system), included terms: *citocinas*, *bacilo de Calmette-Guérin*, *BCG* and *anticuerpos monoclonales* (cytokines, bacillus Calmette–Guérin, BCG and monoclonal antibodies). ChatGPT in turn provided a term-free definition (excluding highly specialised concepts and using only those belonging to general knowledge) based on explanation and hypernymy, and a context that included the well-known terms *sistema inmunitario* (immune system) and *radiación* (radiation). In this case, both definitions were comparable in terms of accessibility although when the context is considered, ChatGPT performed better.

Term	terapia dirigida con radioligandos
Thematic field	Therapy
Variants	terapia con radioligandos
Definition from a patient-information source	Es una forma innovadora de terapia oncológica que administra una sustancia, el radioligando, que combina un compuesto de precisión, el ligando, localizador de las células cancerosas, con una partícula radioactiva terapéutica, el radioisótopo. De esta manera, el radioligando ubica las células cancerosas en cualquier parte o partes del cuerpo y emite radiación concreta y específicamente dirigida a dichas células. El radioisótopo daña el tumor, alterando su capacidad para replicarse y/o desencadenando el mecanismo de muerte celular (Novartis n. d.).
Determinologisation strategies in a patient-information source	Explanation, hypernymy
Context from a patient-information source	Las terapias dirigidas con radioligandos suponen un nuevo pilar en oncología ya que representan una opción precisa, eficaz y sostenible mediante el uso de técnicas moleculares tradicionalmente destinadas al diagnóstico. Estas terapias, ya en uso, demuestran mejores resultados de supervivencia y mayor calidad de vida, contribuyendo en gran medida a alcanzar los objetivos de la medicina de precisión y personalizada (Martínez Olmos et al. n. d.).
Definition by ChatGPT	El tratamiento se basa en usar una sustancia especial que puede encontrar células de cáncer en el cuerpo. Esta sustancia, llamada <i>radioligando</i> , une dos cosas: una que detecta las células cancerosas y otra que es una pequeña partícula que emite rayos, conocida como <i>radioisótopo</i> . Cuando el radioligando encuentra las células de cáncer, el radioisótopo envía rayos específicamente a esas células. Estos rayos, que son una forma de radiación, dañan al cáncer,

	dificultando que las células enfermas sigan creciendo o incluso causando que mueran.
Determinologisation strategies used by ChatGPT	Explanation, hypernymy
Context provided by ChatGPT	Este enfoque terapéutico tiene la ventaja de ser muy específico y puede ser eficaz cuando otros tratamientos no son tan selectivos. Sin embargo, también conlleva consideraciones de seguridad y gestión de la radiación, por lo que su uso está restringido a situaciones clínicas específicas y es administrado por profesionales de la medicina nuclear.

Tab. 5: Analysis and determinologisation of term *terapia dirigida con radioligandos* (targeted radioligand therapy), as an example of thematic field “therapy” of the studied corpus. Definition and context from different patient-information sources are shown, as well as those produced by ChatGPT. Dterminologisation strategies were identical.

The fifth analysed example is a four-word term including the compound term *radioligando* (radioligand), where the Latin-derived prefix *radio* refers to the radioactive nature of the molecule used as *ligando* (ligand), which comes from Latin *ligare*, meaning *to link* (cf. Anders n. d.). The complete term, *terapia dirigida con radioligandos*, refers to a novel recently developed therapeutic approach (cf. Novartis n. d.), that did not appear in BioDic; thus definition and context were extracted from different sources. The definition was based on explanation and hypernymy, by using the hypernym *terapia oncológica* (oncologic therapy). This definition included terms like *terapia oncológica*, *radiación*, *radioligando* and *radioisótopo* (oncologic therapy, radiation, radioligand, radioisotope). However, the first term is well-known and the remaining three were explained. Noticeably, the syntax of the definition was rather complex. The contextual information did not contain terms, though the syntax was complex too. ChatGPT also based its definition on explanation and hypernymy, by using the hypernym *tratamiento* (treatment). Its definition included *radioligando* and *radioisótopo* (radioligand, radioisotope), which were also explained. This definition, however, did not include *terapia oncológica* and the syntax was much less complex, both in the definition and the context, especially due to the use of shorter sentences. In this case, ChatGPT produced a clearer, simpler information.

Term	terapia fotodinámica
Thematic field	Therapy
Variants	PDT (American Cancer Society 2019)
Definition from a patient-information source	Se aplica al tratamiento con medicamentos que se activan con la exposición a la luz; es posible, que al activarse, estos medicamentos destruyan células cancerosas (BioScripts n. d.).

Determinologisation strategies in a patient-information source	Explanation, hypernymy
Context from a patient-information source	La PDT se puede utilizar en personas con ciertos tipos de cáncer para ayudarles a vivir más tiempo y mejorar su calidad de vida. Cada vez se reconoce más como una opción de tratamiento valiosa para ciertos tipos de cánceres localizados (cánceres que no se han propagado lejos de donde comenzaron) (American Cancer Society 2019).
Definition by ChatGPT	Es un tratamiento donde se usan medicamentos que funcionan con luz. Cuando estos medicamentos reciben luz, pueden eliminar células de cáncer.
Determinologisation strategies used by ChatGPT	Explanation, hypernymy
Context provided by ChatGPT	Se utiliza en el tratamiento de ciertos tipos de cáncer, especialmente cáncer de piel, esófago, vejiga y pulmón. Esta terapia tiene ventajas, como su capacidad para ser selectiva y focalizada en las áreas afectadas, minimizando el daño a tejidos sanos circundantes. Sin embargo, puede causar efectos secundarios, como sensibilidad a la luz solar, hinchazón y enrojecimiento temporal.

Tab. 6: Analysis and determinologisation of term *terapia fotodinámica* (photodynamic therapy), as an example of thematic field “therapy” of the studied corpus. Definition and context extracted from different patient-information sources versus those of ChatGPT are shown, with the identified determinologisation strategies.

The sixth and last example included *fotodinámica* (photodynamic), a word compound of two Greek derivatives: prefix *foto* (photo) meaning *light* and *dinámica* (dynamic) for *strength or potency* (cf. Anders n. d.). The BioDic definition was based on explanation and hypernymy (using hypernym *tratamiento*, treatment) and did not contain terms. However, this source did not provide context, thus it had to be extracted from a different source, where the English acronym *PDT* (photodynamic therapy) was used as an equivalent. This context information did not include terms. ChatGPT also based its definition on explanation and hypernymy (by using hypernym *tratamiento*, treatment). This definition was free of terms, as well as the contextual information. In this case, both definitions were comparable in terms of accessibility.

4 Discussion

The high incidence and mortality rates associated to lung cancer, as well as the high impact of this disease on the quality of life, evidence the importance of providing complete and accurate, yet comprehensible, information to patients and their families. In this work, 723

terms were detected in a corpus of patient-information documents on lung cancer. This finding suggests that many intended readers might struggle to comprehend these contents. This is in line with other authors, who reported the occurrence in patient-oriented texts of terms from highly specialised fields or sub-fields, which cannot be found in general medical dictionaries (cf. Blanco Pérez/Gutiérrez Couto 2002:322f.; Hoppe 2010:490; Vidal Sabanés 2021:314). Thus, even in documents designed for non-expert readers, the amount of terms may hinder the objective of conveying specialised information to this audience. Efforts to democratise information are praiseworthy but must be paired with adequate means and resources for receptors to be able to access complete and understandable information. We would like to highlight that quality informative websites in Spanish can be found, like that of the Grupo Español de Pacientes con Cáncer (Spanish Group of Patients with Cancer), which contains complete and understandable texts on different types of cancer, with few terms, systematically followed by explanations (cf. GEPAC 2017). Thus, accessible patient-information can actually be produced, provided that the necessary knowledge and means are applied. To our knowledge, no acceptable number of terms in patient-information documents has been established and a minimum, close-to-zero amount is generally desired. However, it may be argued that some terms should appear in these texts for patients to learn about them, provided that they are followed by comprehensible explanations or synonyms. This issue requires further qualitative and quantitative analysis of large text corpora and constitutes an interesting line of research for the future.

Since, as mentioned, patients' accessibility to medical information not only involves physical access but also comprehensibility (cf. Muñoz Miquel 2021:187), intralingual translation and reformulation procedures are essential (cf. Pedersen 2014:57ff.; Mayor Serrano 2016:5FF.; Lázaro Gutiérrez 2017:144). In this context, determinologisation can be seen as a toolkit for conveying complex medical information to lay receptors through strategies like replacing technical terms with common-speech words if available, adopting methods like simplification, rewording, or exemplification when no common synonym is available (a situation often encountered), or using techniques like hypernymy, synonymy or analogy, among others (cf. Montalt/González-Davies 2007:298ff.; Campos Andrés 2008:6; Campos Andrés 2013:50f.; Hill-Madsen 2015:91ff.). In this work, we present determinologisation proposals for six terms extracted from patient-information documents on lung cancer. One of the main difficulties in this process consisted in finding reliable sources with comprehensible definitions and contextual information. This task required an extensive search, and the finally selected sources not always offered information free of terms. Thus, when it comes to producing informative texts for a general audience, finding term definitions in common speech is a considerable challenge, because existing sources often require a certain degree of medical knowledge on top of a high level of education.

The use of the AI-application ChatGPT to produce term definitions adapted to patients showed similar results in terms of accessibility, although it considerably reduced the time allocated to finding suitable sources. If used to prepare patient-oriented texts, it could also reduce the effort and time necessary to integrate information from different sources and elaborate statements, thus constituting a very useful tool (cf. Fernández 2023). However,

although it is tempting to let ChatGPT directly simplify an entire piece of text intended for determinologisation, it would mean completely relinquishing control over the writing process. In using Generative AI models for text determinologisation several aspects must be considered. On the one hand, using ChatGPT for generating definitions and contextual information requires some preliminary trials and/or post-editing procedures. Its determinologisation of *adenocarcinoma* is as an example of this. In this case, two prompts were initially entered: *Define "adenocarcinoma"* and *Proporciona contexto para "adenocarcinoma"* ("Define *adenocarcinoma*" and "Provide context for *adenocarcinoma*"). Both prompts produced definitions and context, and their outputs overlapped to a considerable extent. A combined prompt asking for both, definition and context (see Method) produced similar results, so that manual post-editing was needed to identify definition and contextual information separately. This procedure had to be repeated with every analysed term. In addition, ChatGPT generated some irrelevant text segments that should be removed to avoid unnecessarily long texts., even when we specified in the prompts to provide concise answers. Moreover, since these models are not deterministic, the repetition of a certain question does not necessarily produce the same answers every time. Breaking instructions down into their relevant elements, i.e., using several specific prompts, may help guide the model, although this requires repeating information inputs and approaching the process step by step, while making the necessary assumptions to improve the output. In a word, producing quality results with ChatGPT requires good prompt engineering and output monitoring by expert professionals. In the context of determinologisation, specific prompting strategies are particularly relevant. For instance, stipulating the target audience or defining the text's skopos can guide the model toward generating output that aligns with the communicative intent and comprehension level of non-expert readers. Additionally, employing examples in a one-shot or few-shot setting helps to anchor the model's responses in concrete examples, ensuring clarity and relevance. Other useful strategies include providing explicit instructions on the style or tone of the text, such as simplifying terminology or adapting explanations to suit specific lay audiences. These approaches enhance the ability of the model to produce content that is not only accurate but also accessible to those outside specialized fields (cf. Dwivedi et al. 2023).

The landscape of AI applications is rapidly evolving and, by the time this article is published, the array of available AI solutions will probably be larger and produce better results. We centred our work on ChatGPT because it was the first open-access generative AI application to be publicly available, and its use is extensively widespread. However, as of October 2023 (ChatGPT-4), the information it produces may potentially be incomplete, false or biased; and the sources are not indicated, which hinders the evaluation of quality and reliability. Nevertheless, by entering adequately designed text prompts, post-editing the output and validating the contents (something of paramount importance in sensitive matters like health), useful results can be obtained.

Undeniably, AI tools cannot currently substitute language professionals, but they can relieve them from highly time-consuming tasks (like searching good information sources) and improve accuracy. Linguists should therefore consider incorporating them in their work if

they want to remain competitive. However, it must be emphasised that sensitive information should never be fed into these applications for safety reasons (cf. Techforward n. d.). Moreover, developing the potential of AI-applications for producing patient-oriented information requires further research on aspects such as patients' acceptance of AI-generated medical contents, or AI-management of linguistic variation (in this case, between different Spanish-speaking countries). Last but not least, besides completeness, accuracy and accessibility, conveying this type of information to patients and their relatives requires utmost sensitivity, because it often entails communicating distressing news that may increase their anxiety and worsen their quality of life. A fine assessment and adjustment of the degree of detail that is appropriate to share, while honouring the individuals' right to be informed is essential and deserves further research. In this regard, tools like ChatGPT and other large language models can potentially assist by suggesting various formulations that consider sensitivity, tone, and clarity. This would allow copywriters to choose the most appropriate phrasing for the specific context, thus improving the quality of the communication. However, this is an aspect that would require further investigation and is beyond the scope of the current study.

5 Conclusions

The majority of currently available patient information texts on lung-cancer still present accessibility issues in terms of specialised terminology, which hinder comprehensibility. Terminologisation is a toolkit for conveying complex medical information to lay receptors by using different strategies. However, finding reliable sources with comprehensible definitions and context for medical terms is a major challenge. The AI-application ChatGPT can produce common-speech term definitions and contextual information similar to those in online patient-oriented documents, when prompted accordingly, while dramatically reducing the time required to find suitable sources. However, both the input of suitable prompts and the production of a quality final result require the supervision of human experts. Proposed future research lines include establishing the proportion of terminology that is acceptable in patient-oriented texts, investigating patients' acceptance of AI-generated medical contents and assessing AI-management of linguistic variation in this domain.

6 Bibliography

American Cancer Society (2019): Terapia fotodinámica. *Cancer.org* <https://www.cancer.org/es/cancer/como-sobrellevar-el-cancer/tipos-de-tratamiento/radioterapia/terapia-fotodinamica.html> (16 October 2023).

American Cancer Society (2022): Acerca del cáncer de pulmón. *Cancer.org* <https://www.cancer.org/content/dam/CRC/PDF/Public/9436.00.pdf> (15 September 2023).

Anders, Valentin (n. d.): Etimologías de Chile. *DECEL - Diccionario Etimológico Castellano En Línea*. <https://etimologias.dechile.net/> (30 October 2023).

Bello, Elena (2023): Inteligencia Artificial Generativa, la nueva era de la IA. *Iebs*. <https://www.iebschool.com/blog/inteligencia-artificial-generativa-tecnologia/> (19 October 2023).

BioScripts: Centro de Investigación y Desarrollo de Recursos Científicos (n. d.): BioDic: Diccionario de términos científicos, sencillo. <https://www.biodic.net/> (11 October 2023).

Blanco Pérez, Azucena/Gutiérrez Couto, Uxía (2002): Legibilidad de las páginas web sobre salud dirigidas a pacientes y lectores de la población general. *Revista Española de Salud Pública*. 76(4), 321–331. http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1135-57272002000400007&lng=es&tlng= (30 November 2023).

Campos Andrés, Olga (2008): La desteterminologización en las guías para pacientes. *Jornades de Foment de la Investigació*. Barcelona: Universitat Jaume I <https://repositori.uji.es/xmlui/handle/10234/78053> (25 November 2023).

Campos Andrés, Olga (2013): Procedimientos de desteterminologización: traducción y redacción de guías para pacientes. *Panace@* 14(37), 48–52. <http://hdl.handle.net/10234/183031> (25 November 2023).

Cobos López, Ingrid (2019): Traducir para el paciente: acercamiento y adaptación como modalidad de traducción. *Quaderns de Filologia*. 24(24), 211–228. <https://doi.org/10.7203/qf.24.16307> (30 November 2023).

Cobos López, Ingrid (2021a): La medicina gráfica como herramienta para la traducción y la adaptación de textos biosanitarios. *Mutatis Mutandis Revista Latinoamericana de Traducción* 14(2), 397–426. <https://doi.org/10.17533/udea.mut.v14n2a06> (30 November 2023).

Cobos López, Ingrid (2021b): La traducción social como instrumento para la medicina gráfica. *Panace@* 22(54), 63–74. <http://hdl.handle.net/10234/197993> (30 November 2023).

COCEMFE: Confederación Española de Personas con Discapacidad Física y Orgánica (n. d.): Definiciones básicas. *Observatorio de la Accesibilidad*. <https://observatoriodelaaccessibilidad.es/archivos/3104> (29 September 2023).

DBpedia (n. d.): About: Cuerpo de psamoma. https://dbpedia.org/page/Psammoma_body (18 October 2023).

Dwivedi, Yogesh/Kshetri, Nir/Hughes, Laurie/Slade, Emma L./Jeyaraj, Anand/Kar, Arpan K./Baabdullah, Abdullah M./Koohang, A./Raghavan, Vishnupriya/Ahuja, Manju/Albanna, Hanaa/Ahmad Albashrawi, Mousa/Al-Busaidi, Adil/Balakrishnan, Janarthanam/Barlette, Yves/Basu, Sriparna/Bose, Indranil/Brooks, Laurence/Buhalis,

Dimitrios/Carter, Lemuria/Chowdhury, Soumyadeb/Crick, Tom/Cunningham, Scott/Davies, Gareth/Davison, Robert/ Dé, Rahul/Dennehy, Denis/Duan, Yanqing/Dubey, Rameshwar/Dwivedi, Rohita/Edwards, John/Flavián, Carlos/Gauld, Robin/Grover, Varun/Hu, Mei-Chih/Janssen, Marijn/Jones Paul/Junglas, Iris/Khorana, Sangeeta/Kraus, Sascha/Larsen, Kai/Latreille, Paul/Laumer, Sven/Malik, F. Tegwen/Mardani, Abbas/Mariani, Marcello/Mithas, Sunil/Mogaji, Emmanuel/Horn Nord, Jeretta/O'Connor, Siobhan/Okumus, Fevzi/Pagani, Margherita/Pandey, Neeraj/Papagiannidis, Savvas/Pappas, Ilias/Pathak, Nishith/Pries-Heje, Jan/Raman, Ramakrishnan/Rana, Nripendra/Rehm, Sven-Volker/Ribeiro-Navarrete, Samuel/Richter, Alexander/Rowe, Frantz/Sarker, Suprateek/Stahl, Bernd Carsten/Kumar Tiwari, Manoj/van der Aalst, Wil/Venkatesh, Viswanath/Viglia, Giampaolo/Wade, Michael/Walton, Paul/Wirtz, Jochen/Wright, Ryan (2023): So what if ChatGPT wrote it? Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management* 71, 102642. <https://doi.org/10.1016/j.ijinfomgt.2023.102642> (18 October 2023).

EP data (2024): El cáncer en España, datos y estadísticas. <https://www.epdata.es/datos/cancer-espana-datos-estadisticas/289> (29 June 2024).

Fernández, Yúbal (2023): ChatGPT: qué es, cómo usarlo y qué puedes hacer con este chat de inteligencia artificial GPT. *Xataka*. <https://www.xataka.com/basics/chatgpt-que-como-usarlo-que-puedes-hacer-este-chat-inteligencia-artificial> (20 October 2023).

García Izquierdo, Isabel (2009): *Divulgación médica y traducción: El género Información para pacientes*. Berlin: Lang.

GEPAC: Grupo Español de Pacientes con Cáncer (2017): Guías de patologías. <https://www.gepac.es/informacion-medica/guias/> (18 October 2023).

Grace, Katja/Salvatier, John/Dafoe, Allan/Zhang, Baobao/Evans, Owain (2018): When will AI exceed human performance? Evidence from AI experts. *Journal of Artificial Intelligence Research* 62, 729–754. <https://doi.org/10.48550/arXiv.1705.08807> (7 October 2023).

Hill-Madsen, Aage (2015): Lexical strategies in intralingual translation between registers. *HERMES – Journal of Language and Communication in Business* 27(54), 85–105. <https://doi.org/10.7146/hjlc.v27i54.22949> (7 October 2023).

Hoppe, Ian C. (2010): Readability of patient information regarding breast cancer prevention from the web site of the National Cancer Institute. *Journal of Cancer Education* 25(4), 490–492. <https://doi.org/10.1007/s13187-010-0101-2> (15 October 2023).

Initia Oncología (2017): Guía para el paciente oncológico. *Hospital Quirón Salud Valencia* <https://initiaoncologia.com/guia-para-el-paciente-oncologico/> (07 October 2023).

Kalyan, Katikapalli Subramanyam (2023): A survey of GPT-3 family large language models including ChatGPT and GPT-4. *Natural Language Processing Journal*, 100048.

Kwame, Abukari/Petrucka, Pammla M. (2021): A literature-based study of patient-centered care and communication in nurse-patient interactions: barriers, facilitators, and the way forward. *BMC Nursing* 20, 158. <https://doi.org/10.1186/s12912-021-00684-2> (15 October 2023).

Lázaro Gutiérrez, Raquel (2017): Healthcare videos addressed to the migrant population: From intercultural mediation to transcreation. *Revista de Lenguas para Fines Específicos* 23(1), 140–162. <https://ojsppdc.ulpgc.es/ojs/index.php/LFE/article/view/876> (02 October 2023).

Martínez Olmos, José/Cervera Taulat, Manuel/Rodríguez-Lescure, Álvaro/Castell Conesa, Joan/Capdevila Castellón, Jaume/Climent, Miguel Á./Herández Martínez, Antonio/Cordero Ramajo, José A./Guarás González, Blanca/Martínez Cortés, Marcos/Panera Hernández, Cristina/Ramírez Puerta, Dulce (n. d.): Terapias dirigidas con Radioligandos. https://seom.org/images/Documento_consenso_en_Terapias_Dirigidas_con_Radioligandos_RLT.pdf (13 October 2023).

Mayor Serrano, María B. (2008): Cómo elaborar folletos de salud destinados a los pacientes. *Fundación Dr. Antoni Esteve*. <https://www.researchgate.net/publication/318726261> (29 September 2023).

Mayor Serrano, María B. (2010): Revisión y corrección de textos médicos destinados a los pacientes... y algo más. *Panace@* 10(31), 29–36. <https://www.researchgate.net/publication/45513185> (30 March 2024).

Mayor Serrano, María B. (2016): *El cómic como recurso didáctico en los estudios de Medicina*. Barcelona: Fundación Dr. Antoni Esteve. <https://www.researchgate.net/publication/313030758> (30 March 2024).

McCormack, Lauren/Sheridan, Stacey/Lewis, Megan/Boudewyns, Vanessa/Melvin, Katy L./Kistler, Christine/Lux, Linda/Cullen, Katherine/Lohr, Kathleen (2013): Communication and dissemination strategies to facilitate the use of health-related evidence. *Evidence Report/Technology Assessment* 213, 1-520. <https://hdl.handle.net/11250/3041515> (30 March 2024).

Mearian, Lucas (2023): What are LLMs, and how are they used in generative AI? *Computerworld*. <https://www.computerworld.com/article/3697649/what-are-large-language-models-and-how-are-they-used-in-generative-ai.html> (19 October 2023).

Meyer, Ingrid/Mackintosh, Kirsten (2001): When terms move into our everyday lives: An overview of de-terminologization. *Terminology* 6(1), 111–138. <http://doi.org/10.1075/term.6.1.07mey> (23 March 2024).

Montalt, Vicent/González-Davies, María (2007): *Medical translation step by step: Learning by drafting*. Manchester: St. Jerome. <http://dx.doi.org/10.4324/9781315760377> (07 October 2023).

Muñoz-Miquel, Ana (2012): From the original article to the summary for patients: Reformulation procedures in intralingual translation. *Linguistica Antverpiensia, New Series* 11: 187–206. <https://doi.org/10.52034/lanstts.v11i.303> (10 April 2024).

NCI: National Cancer Institute (n. d.): A to Z list of cancer types. <https://www.cancer.gov/types> (07 October 2023).

Nicholson, Andrew G./Tsao, Ming S./Beasley, Mary B./Borczuk, Alain C./Brambilla, Elisabeth/Cooper, Wendy A./Dacic, Sanja/Jain, Deepali/ Kerr, Keith M./Lantuejoul, Sylvie/Noguchi, Masayuki/Papotti, Mauro/Rekhtman, Natasha/Scagliotti, Giorgio/van Schil, Paul/Sholl, Lynette/Yatabe, Yasushi/Yoshida, Akihiko/Travis, William D. (2022): The 2021

WHO classification of lung tumors: Impact of advances since 2015. *Journal of Thoracic Oncology* 17(3), 362–387. <http://doi.org/10.1016/j.jtho.2021.11.003> (10 April 2024).

Nová, Jana (2018): Terms embraced by the general public: How to cope with determinologization in the dictionary? In: Čibej, Jaka/Gorjanc, Vojko/Kosem, Iztok/Krek, Simon (Eds.): *Proceedings of the XVIII EURALEX international congress*. Ljubljana: University Press, 387–398. <https://euralex.org/publications/terms-embraced-by-the-general-public-how-to-cope-with-determinologization-in-the-dictionary/> (05 December 2023).

Novartis España (n. d.): 23 términos que debes conocer si tienes un tumor neuroendocrino. *Tucuentasmucho.com*. <https://www.tucuentasmucho.com/23-terminos-que-debes-conocer-si-tienes-un-tumor-neuroendocrino> (16 October 2023).

OncoTRAD (n. d.): ¿En qué te puedo ayudar? *OncoTRAD*. <https://enquetepuedoayudar.org/oncotrad/> (01 October 2023).

Organización Mundial de la Salud (2022): Cáncer. <https://www.who.int/es/news-room/fact-sheets/detail/cancer> (15 September 2023).

Ouchen, F. Soimout (2008): Tema 14: Neoplasias. Definiciones. Nomenclatura. Características. https://www.academia.edu/31767319/Tema_14_Neoplasias (15 September 2023).

Pedersen, Daniel (2014): Exploring the concept of transcreation – transcreation as ‘more than translation’? *Cultus: The Journal of Intercultural Mediation and Communication* 7, 57–71. https://www.cultusjournal.com/files/Archives/pedersen_5_p.pdf (21 October 2023).

Prieto Velasco, Juan A./Montalt, Vicent (2018): Encouraging legibility and comprehensibility through multimodal patient information guides. *Linguistica Antverpiensia* 17, 196–214. <http://hdl.handle.net/10234/182353> (25 March 2024).

REDECAN: Red Española de Registros de Cáncer (2024): Estimaciones de la incidencia del cáncer en España, 2024. <https://redcan.org/storage/documents/031b5800-a7fe-4c2b-8a09-a38d046365df.pdf> (28 June 28 2024).

Sáiz Hontagas, Paula/Ezpeleta Piorno, Pilar/Muñoz Miquel, Ana (2016): El uso de imágenes en guías para pacientes: una primera aproximación desde la perspectiva del nivel de activación del paciente. *Panace@* 17(44), 99–100. https://www.tremedica.org/wp-content/uploads/n44_tribuna-PSaiz-HontagasEtAl.pdf (30 March 2024).

Sánchez-Castany, Roser (2013): Los géneros de Información para pacientes en el contexto español: una primera aproximación. *Fòrum de Recerca* 18, 833–846. <http://doi.org/10.6035/ForumRecerca.2013.54> (25 January 2024).

SEOM: Sociedad Española de Oncología Médica (2024): Las cifras del cáncer en España 2023. https://www.seom.org/images/LAS_CIFRAS_2024.pdf (28 June 2024).

Sketch Engine (2017): Tools for text analysis. <https://www.sketchengine.eu/tools-for-text-analysis/> (01 October 2023).

Techforword (n. d.): Confidentiality for translators and interpreters in the age of AI *Techforword*. <https://www.techforword.com/blog/confidentiality-for-translators-and-interpreters-in-the-age-of-ai> (21 October 2023).

Titi Tudorancea® (n. d.): Cuerpo del psamoma. *The Titi Tudorancea Bulletin*. https://www.tititudorancea.es/z/cuerpo_del_psamoma.htm (18 October 2023).

Universidad de Salamanca (n. d.): Dicciomed: Diccionario médico-biológico, histórico y etimológico. <https://dicciomed.usal.es/palabra/adenocarcinoma> (11 October 2023).

Vidal Sabanés Laia (2021): *La terminologia en els textos mèdics per a pacients: el cas d'una comunitat de dones amb càncer de mama*. Universitat Pompeu Fabra: PhD thesis. <http://hdl.handle.net/10803/672627> (28 November 20, 2023).

WHO: World Health Organization (2022): Cancer. <https://www.who.int/news-room/fact-sheets/detail/cancer> (20 October 2023).