



MD-CTS: An integrated terminology reference of clinical and translational medicine

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ABSTRACT

New vocabularies are rapidly evolving in the literature relative to the practice of clinical medicine and translational research. To provide integrated access to new terms, we developed a mobile and desktop online reference—Marshfield Dictionary of Clinical and Translational Science (MD-CTS). It is the first public resource that comprehensively integrates Wiktionary (word definition), BioPortal (ontology), Wiki (image reference), and Medline abstract (word usage) information. MD-CTS is accessible at <http://spellchecker.mfldclin.edu/>. The website provides a broadened capacity for the wider clinical and translational science community to keep pace with newly emerging scientific vocabulary. An initial evaluation using 63 randomly selected biomedical words suggests that online references generally provided better coverage (73%–95%) than paper-based dictionaries (57–71%).

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1. Introduction

When a clinical or translational scientist encounters a new term, Google is among the top resources utilized to find a definition because 1) it is generally available and easy to use, 2) it is free of charge, and 3) better tools are lacking. While dictionaries represent an alternative resource, paper-based dictionaries are not updated frequently, and therefore do not contain new terms. The desirable tool should have near real-time updates as new terms appear in scientific literature. In addition, the tool should illustrate the usage of the term in a scientific context. Besides textual formats of usage, images surrounding the text can also be helpful. An image can often augment a textual definition, serving as an aid to learning and advancement of comprehension.

Currently, no online resource implements and integrates all of the above functionalities.

To address this gap and establish an updated and comprehensive collection of terms used in the clinical and translational medicine domain, we created the Marshfield Dictionary of Clinical and Translational Science (MD-CTS). We utilized an automated approach and adopted the philosophy of Zeng et al. [1] to construct a dictionary by observing the “actual utterances” of scientists and clinicians in scholarly communications. As a proof of concept, we chose Medline abstracts as the source. Our tool is complementary to the search engine found at the PubMed portal providing free access to Medline [2]. Although PubMed permits search of 24 million Medline records, its main functionality is as a query tool and not as a tool for defining terms.

Although usage examples of a term can be obtained automatically by computer, accurate definition of the term has to go through a human editorial process. In contrast to the editorial management by companies who create paper-based dictionaries, Wiktionary crowdsources the editorial effort to the general public via the Internet [3]. As such, it can be updated relatively rapidly. Thus, Wiktionary was integrated into our query website as a look-up tool for those seeking definitions of newly emerging terminology.

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Besides verbal definition, ontology can further elaborate the relationship between terms. To provide access to a library of biomedical ontologies and terminologies, BioPortal [4] was developed by the National Center for Biomedical Ontology (NCBO). Currently, BioPortal covers 372 ontologies including Unified Medical Language System (UMLS) and the Medical Subject Headings (MeSH), Systematized Nomenclature of Medicine (SNOMED), International Classification of Diseases (ICD-9), and Gene Ontology (GO). MD-CTS includes BioPortal search results to provide users with the ontological context of a term.

In this paper, we describe how the MD-CTS tool integrates several available resources to bring together concept definition, ontological definition, example usage in context, related terms, and related images from the rapidly expanding repository of clinical and translational medical terminology. The effectiveness of MD-CTS was comprehensively evaluated against traditional dictionaries and other online resources.

2. Methods

Words in MD-CTS were extracted from Medline abstracts on a quarterly basis. The first download and parsing in Q4 2013 consisted of 24,557,663 xml files in a relational database of terms in the abstracts and titles. For each word, the database evaluated the frequency of appearance and positional information. A list of 2,486,591,581 words was created via splitting the text with spaces created. Some pre-processing steps such as removing stop words, punctuation, and numbers, resulted in a list of 1,795,769 unique words. MD-CTS's server-side code is written in C#, with JavaScript, HTML5, and CSS3 on the

client-side. MD-CTS uses responsive design to deliver a consistent user experience across all mobile devices, tablets, and desktop computers.

To compare MD-CTS with paper-based medical dictionaries and the curated biomedical ontology of MeSH, we randomly selected 63 biomedical words from a collection of 50 articles of clinical and translational science published in the week of July 22, 2013. These articles were randomly selected from the following journals: *Science*, *Nature*, *Science Translational Medicine*, *New England Journal of Medicine*, and *Lancet*. Criteria for publication selection included occurrence of the publication date after latest construction of the MD-CTS lexicon from PubMed so those publications were not already indexed by MD-CTS. We reported the percentages of the randomly selected 63 biomedical words found in each of the paper-based medical dictionaries and in the curated biomedical ontology of MeSH as well as each of the four databases integrated into MD-CTS. We also reported the count of overlapped words in between Taber's, Stedman's and Dorland's paper-based dictionaries and the online MeSH resources with integrated access from MD-CTS.

3. Results

We created MD-CTS, a mobile and desktop online reference, available for users across platforms and not constrained to a specific hardware or browser (Fig. 1). To help users search terminology and its usage, MD-CTS provides a simple query interface to display up to five different sections of information (Fig. 1A). The first section, named "Example Usage", contains ten snippets from random Medline abstracts. These snippets assist the user in inferring the definition for the word

MD-CTS / Marshfield Dictionary of Clinical and Translational Science

Search: biosimilar

1 Example Usage
Information retrieved from PubMed abstracts

- ...largely absent, and the questions about interchangeability and substitution between originator and biosimilar LMVHs have yet to be fully resolved. [\(more\)](#)
- ...Ethical issues and concerns about the use of biosimilar granulocyte colony-stimulating factors for the mobilization of stem cells in normal donor. [\(more\)](#)
- ...breasted approval route to market for biological products (also known as biologics) that are "biosimilar" to an existing marketed product. The brief introduction will provide a basic compar... [\(more\)](#)
- ...Non-clinical safety studies on biosimilar recombinant human erythropoietin. [\(more\)](#)
- ...Next generation and biosimilar monoclonal antibodies: essential considerations towards regulatory acceptance in Europe. [\(more\)](#)
- ...refere there cannot be an absolute equivalence between the original (innovative) medication and its biosimilar counterpart. ETDs have been proven useful in the treatment of several rheumatic diseases. [\(more\)](#)
- ...Managing chemotherapy-induced anemia with biosimilar epoetin a is consistently cost efficient over treatment with originator epoetin a. [\(more\)](#)
- ...Patents of innovator biopharmaceutical products, such as epoetin are expiring, and biosimilar versions of these products may soon enter European and American markets. Copies of these. [\(more\)](#)

2 General Definition
Information retrieved from Wiktionary

Noun

- (medicine) A variant of a biopharmaceutical that is marketed following the expiry of the original patent

Source: Wiktionary | Edit this entry

3 Ontological Information
Information retrieved from BioPortal

Definition

A biosimilar of pegfilgrastim, a long-acting pegylated form of recombinant human granulocyte colony-stimulating factor (G-CSF) filgrastim, with hemotopoietic activity. In a similar manner to G-CSF, pegfilgrastim biosimilar LA-EP2006 binds to and activates specific cell surface receptors, stimulating neutrophil progenitor proliferation and differentiation and selected neutrophil functions. Therefore, this agent may prevent the incidence and shorten the duration of chemotherapy-induced neutropenia. Conjugation of the cytokine with a branched polyethylene glycol molecule significantly increases this agent's therapeutic half-life compared to filgrastim.

Synonyms

LA-EP2006

Source: NCI

4 Contextual Terms
Terms found in close proximity to your query

anemia biologics biopharmaceutical chemotherapy-induced comparability drugs epoetin HSA innovator interchangeability issues JFDA Jordan monoclonal originator recombinant registration requirements

Not all terms may be found in the example uses shown to the left.

5 Related Images
Images retrieved from Wikipedia

Source: Wikipedia

Download the supplemental dictionary for MS Word

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Fig. 1. The design of the MD-CTS website. A) Desktop version on a computer screen. B) Mobile version on smaller screens such as Smartphones.

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