Large Language Models Applied to *Controlled Natural Languages* in Communicating Diabetes Therapies

Federica Vezzani*, Sara Vecchiato**, Elena Frattolin***

* Centro studi in Terminologia Computazionale, DISLL, U. of Padua, Italy
** Laboratorio di redattologia e traduttologia, DILL, U. of Udine, Italy
*** DPIA, U. of Udine, Italy

federica.vezzani@unipd.it ; sara.vecchiato@uniud.it ; elena.frattolin@uniud.it

Abstract

The aim of this exploratory study is to test the possibility of enhancing the quality of institutional communication related to diabetes self-treatment by switching from manual to prompt-based writing. The study proposes an investigation into the use of prompts applied to controlled natural language, particularly in Italian, French and English. Starting from a corpus of three comparable texts concerning the so-called *Rule of 15*, a reformulation is undertaken in accordance with the principles of controlled natural languages. Feedback will be gathered through a Likert scale questionnaire and a comprehension test administered to anonymous volunteers.

1 Introduction

This study lies at the crossroads of Terminology and Writing Studies, as fields aimed at delivering clear and accessible information (Cleary 2021; Schubert 2012; Giles 1990; Clerc 2022). It focuses on controlled natural languages, or CNLs (Ryan 2009) as an alternative to plain language for communicating very specialised content that requires terminological precision, such as instructions for administering drugs. Examples of CNLs include Simplified Technical English (STE), Italiano Tecnico Semplificato (ITS), and Français rationalisé (FR) (ASD 2021; COM&TEC 2024; GIFAS 1998). This research has two closely related objectives. First, it evaluates the applicability of CNLs in the medical field, with a focus on texts related to diabetes management. Second, it investigates the effectiveness of using Large Language Models

(LLMs) for automatic text simplification through CNL-based prompts. In doing so, the study also compares the quality of automated simplifications with those produced by human editors, assessing their respective strengths and limitations. It also highlights the benefits of terminological standardization and proposes updates to the simplification rules and glossary of FR. For each language, we started with a single prompt with instructions, which was then followed by some adjustments. In particular, the instruction concerning the number of words per sentence had to be rechecked and corrected.

2 Research Context

2.1. Medical instructional texts

The study is set against the backdrop of Type 1 Diabetes (T1D) and the necessity of clear informational materials for self-management, particularly in cases of hypoglycaemia. In diabetes, hypoglycaemia presents immediate risks, such as seizures, unconsciousness, and coma, as well as long-term complications, including cardiovascular diseases and neuropathy (Cryer & Arbeláez 2017). Effective written communication is crucial to ensure that individuals with diabetes can understand and apply self-care guidelines correctly (Beck & al. 2017; Aprile 2007). A specific focus is placed on the *Rule of 15*, [1] a protocol for managing mild to moderate hypoglycaemia. Using a corpus of institutional texts from diabetology, this research aims to assess the applicability of the technical guidelines provided by STE, FR and ITS in prompt engineering.

2.1 Controlled Natural Languages vs Plain Language vs Easy Language

CNLs differ from plain and easy languages in a number of characteristics. As Kittredge (2003)

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[1] https://www.pharmacists.ca/cpha-ca/assets/File/diabetes/Infographic_Hypoglycemia.pdf

pointed out, plain language is based on universal principles applicable to all languages, whereas CNLs are tailored to the specific morphological, syntactic, and lexical characteristics of each language. On the other hand, Vecchiato & al. (forth.), suggested describing CNLs by considering the lexical level separately from syntax in contrast to easy languages, which work with a basic vocabulary and morphosyntax. For this reason, CNLs lend themselves well to communication with an audience that is familiar with the disciplinary content in question.

2.2 FR vs STE vs ITS

FR differs from STE and ITS in its development. While STE and ITS are regularly updated by their respective organizations, FR has not seen the same progress. Introduced in the 1990s, the project was eventually abandoned in favour of English (Emorine 1995). Unlike STE and ITS, which are continuously refined, the French guidelines (FR) have not undergone significant updates since their original development. This lack of modernization affects FR across all domains, not just in the medical field. As a result, FR faces challenges in meeting contemporary readability standards and user needs. Nevertheless, the principles outlined in FR remain relevant, particularly in specialised domains where French is still used as a language of communication. One such domain is aeronautics, as discussed by Condamines (2018a; 2018b).

3 Method

3.1 Corpus selection

A reference corpus was established, consisting of three texts, each written in one of the three languages considered. The three texts selected for analysis provide essential information on hypoglycaemia and the *Rule of 15*. They were written by scientific societies or local and national associations of diabetes specialists, who guide patients in the self-management of the disease. Therefore, they share a similar communication framework, including the client (patient), writer, and reader (Clerc 2022). They are also characterised by a similar use of images, the presence of complementary information, the use of scientific terminology, and a more or less complex syntax. Furthermore, the texts belong to the so-called explanatory and procedural text types (Adam 2017), but depending on the texts, one type prevails over the other. The French and English text are translations of each other and show a slight discrepancy in word count, which can be linked to a more general tendency of the French language to use more words than English (Liberman 2022): in fact, the English documents has 488 words, the French text contains 558, and the Italian 316 words. An initial assessment of the text difficulty was obtained using software based on readability formulas. The French text has an overall difficulty rating of 2 out of 5 according to the AMesure test (François & al. 2018). The English text scored 53.49 ("fairly difficult") on the Flesch Reading Ease scale. The Italian text received a score of 47 on the Gulpease index, indicating that it may be challenging for readers with lower secondary education, but accessible for those with upper secondary education (Lucisano, & CORRIGE 2024).

3.2 Rewriting in CNL using prompt engineering

As it is well known, the guidelines of CNLs organise the text on several levels. Firstly, the content is required to be carefully planned, according to a logical sequence. In addition, it is required to use only terms selected from a pre-established glossary, and to use them in a redundant manner, i.e., avoiding the use of hypernyms or other elements that might create doubts about the referent. Finally, the syntax is extremely simplified, with the indication, for example, to express one concept per period, to always use affirmative sentences where possible, and to use only certain verb tenses and modes. A separate section deals with the use of punctuation, in particular exclamation marks and cautionary words (ASD 2021; COM&TEC 2024; GIFAS 1998).

The three original texts underwent reformulations to CNLs. An initial reformulation was conducted by humans using STE, ITS and FR guidelines; the resulting texts were then compared with the originals, highlighting differences in terminology, sentence structure, and readability (Vecchiato & al. forth.). A second reformulation was carried out on the same texts, this time using a large language model (chatGPT-4). In order to do this, prompts were written in alignment with the STE, ITS and FR guidelines. This second draft was compared with the original and the first reformulation in CNL.

3.3 Feedback

In order to evaluate the improvement of the effectiveness (Beaudet 2001) of reformulated texts, a comprehension questionnaire modelled on previous work on plain language is being developed (Vecchiato & al 2022). A first part of the questionnaire consists of questions aimed at finding out the respondents' attitudes towards the text (Joshi & al. 2015; Likert 1932). A second part of the questionnaire consists of a text comprehension test, with questions intended to test the effectiveness of the reformulation with regard to some particularly complex and difficult to understand/implement points of the *Rule of 15*. In particular, the comprehension of the terms indicating substances that can be used as well as the actions to be performed with these substances will be tested.

This aspect highlights the crucial balance between terminological precision and accessibility in medical texts (Vecchiato 2022). In line with Gabriele Pallotti's (2015: 118) approach, we identify three types of complexity: *structural complexity, cognitive complexity*, and *developmental complexity*. While technical accuracy ensures that health guidelines are correctly interpreted and applied, excessive structural complexity (i.e., specialised terms) can lead to excessive cognitive complexity, and hinder comprehension for non-specialist readers. CNLs provide a structured approach to addressing this challenge by enforcing controlled vocabularies and standardised sentence structures, allowing for greater clarity without compromising essential medical information.

For example, instead of *"Ingest 15 grams of a rapid-acting carbohydrate"*, a CNL-based reformulation could specify: *"Eat one tablespoon of sugar or drink half a glass of fruit juice."* Similarly, *"Administer an appropriate dose of glucagon"* might become: *"If unconscious, inject one dose of glucagon as instructed on the package."* These adjustments make critical information more applicable and easier to understand.

Indeed, the impact of such simplifications on medical comprehension is especially relevant in diabetes management, where clear and applicable instructions are vital. By comparing human and AI-assisted text reformulations, this study aims to evaluate whether CNL-based simplifications enhance understanding while preserving medical accuracy. The findings will contribute to refining CNL guidelines for healthcare communication, ensuring that essential information remains both precise and accessible.

The questionnaire will be submitted to three groups of anonymous volunteers who have been diagnosed with type 1 diabetes. The first group will respond on the original text, the second group on the text modified by a human, and the third group on the text modified via prompt. The respondents will be chosen from among people from different countries through cooperation with diabetes associations. The selected participants will be over 18 years of age. In an initial anonymous questionnaire, they will be asked some information that is considered predictive of a certain approach. In particular, they will be asked to specify how long ago they received their diagnosis, whether and how they regularly inform themselves about diabetes (e.g., from newspapers, social networks or through participation in an association, *see* Dietz & al. 2023), and to give indications about their level of literacy (Sikora & al. 2019).

4 Discussion

The use of CNLs in medical communication presents both advantages and risks. Particular attention is given to the benefits of text simplification, which may enhance comprehension for a broader audience, including individuals living with the disease. At the same time, potential risks associated with overgeneralisation of specialised information will be considered to ensure accurate and effective communication for all stakeholders. Simplification improves readability and accessibility, making vital health information comprehensible to a broader audience. However, excessive simplification can lead to loss of critical medical nuances, increasing the risk of misinterpretation. For this reason, the use of CNLs can be a reasonable compromise between syntactic simplification and terminological precision.

5 Conclusion and Perspectives

In this exploratory study, the question was raised as to the effectiveness of medical texts offered to people with diabetes for the self-management of hypoglycaemia. The three chosen texts (Italian,

French, and English) are representative of those used for patient education. These texts were reformulated according to the guidelines of CNLs, first by humans and then using prompt engineering. In order to evaluate the effectiveness of the two reformulations, a questionnaire will be submitted to three groups of anonymous volunteers.

The answers to the questionnaire will allow us to assess the extent to which CNLs can improve the communication of the *Rule of 15*, and whether there is a gap in effectiveness between manual and automated editing. Furthermore, the presence of three languages may provide additional data regarding this margin for improvement, due to the fact that these three languages do not have the same tradition of clear writing (Sabatini 2002; Meschonnic 1997; Schriver 2017; Cutts 2020). Finally, this survey also offers the advantage of proposing an update of FR, to bring it into line with the current medical lexicon.

Declaration on the use of Generative AI and Machine Translation

During the preparation of this work, the authors used X-GPT-4 in order to: Grammar and spelling check, formulation of examples in section 3.3. Part of this text was written in English, while part of it was written in Italian and translated into English with DeepL.com. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the publication's content.

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