

The use of artificial intelligence chat to improve readability of patient-facing materials

Authors: Martha Gauthier, Shayna Egan, and Nathan Johnson

Affiliation: Lumanity, Patient-Centered Outcomes

INTRODUCTION



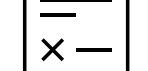
- Artificial intelligence (AI) chat has become increasingly available and widely applied across a variety of use cases
- It is important that materials used for patient-centric research are clear and understandable to patients^{1,2}
- Clear study enrollment materials (for example, study invitations, informed consent forms [ICFs]) are critical to ensure that potential study participants understand the responsibilities of study participation and their rights as participants
- Development of tools to collect patient perspectives, such as patient-reported outcome (PRO) measures, necessitates clear and patient-friendly language to support the face validity of the measure
- Qualitative research materials that are patient-facing, such as interview guides, need to have clear and straightforward questions to minimize confusion

OBJECTIVES

- This work aimed to examine AI chat's ability to assess and improve the readability level of patient-facing materials, inclusive of PRO measures

METHODS

- AI chat was queried to evaluate the readability statistics (i.e. Flesch-Kincaid and Coleman-Liau formulas) on text from three sources representing various types of patient-facing materials:

-  An established PRO measure, the 12-Item Short Form Health Survey (SF-12)³
-  Text from a patient interview guide
-  An ICF

- Depending on the established readability level, AI chat was then queried to revise the text to be appropriate for a 6th or 3rd grade reading level (Figure 1)
- Each revision recommended by the chat was reviewed and evaluated for appropriateness

Figure 1. Example queries to improve clarity of patient-facing materials

- Evaluate the readability level of the following text:
- Revise the following text so that it is readable to a sixth grader:
- Provide an alternate word for [term]

RESULTS

Overall

- Across all three sources, AI chat-recommended revisions focused on simplifying the language, breaking down multipart sentences, and removing complex terminology and/or replacing words with more appropriate vocabulary for each reading level
- In most cases, revisions were determined to retain the intended meaning of the text

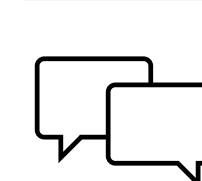


Established PRO measure (SF-12)

- The SF-12 instructions, item, and associated response options were determined to have a Flesch-Kincaid readability level of around the 10th grade and were revised to a 6th grade reading level by AI chat (Table 1)

Table 1. Evolution of SF-12 text based on AI feedback

Original text	Recommended revision for 6 th grade reading level	Summary of changes
The following questions are about activities you might do during a typical day.	The questions below are about activities you might do during a typical day.	<ul style="list-style-type: none"> AI chat-revised text attempts to simplify the language (e.g. changed "such as" to "like"), use shorter sentences, and remove complex terminology to make it more accessible for an 8-year-old reader Some language or wording additional could potentially add complexity (e.g. changed "now" to "currently") and sentence structure (e.g. added "how much does it limit you"), or make it less appropriate for a PRO measure (e.g. changing from a question to a statement) Recommended revisions to the SF-12 did not retain the format of a PRO question Some words (e.g. strenuous) were identified as candidates for further simplification
Does your health now limit you in these activities? If so, how much?	Does your health currently limit you from doing these activities? If it does, how much does it limit you?	
Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports.	Activities like running, lifting heavy objects, or participating in strenuous sports.	
<input type="checkbox"/> Yes, limited a lot. <input type="checkbox"/> Yes, limited a little. <input type="checkbox"/> No, not limited at all.	You can choose from the following options: limited a lot, limited a little, or not limited at all.	
Reading level: 10 th grade	Reading level: 6 th grade	



Interview guide text

- The interview guide text related to collecting participant feedback about meaningful change was revised from a 6th grade to a 3rd grade reading level (Table 2)

Table 2. Evolution of interview guide text based on AI chat feedback

Original text	Recommended revision for 3 rd grade reading level	Summary of changes
Thinking about improvement in your symptom, what would need to improve for it to be meaningful to you?	What would make you feel better when your symptom improves?	<ul style="list-style-type: none"> AI chat-revised text attempts to simplify the language, breaks down complex sentences, and uses more child-friendly vocabulary to enhance comprehension for a 3rd-grade reader The revision of the initial statement does not capture the original intended meaning of the question related to meaningful improvement Recommended revisions to some interview guide questions led to a loss of precision in the question being asked
Meaningful means an improvement in your health where you feel better – it does not mean that your symptom is completely cured.	Meaningful improvement means feeling better in terms of your health, even if the symptom doesn't go away completely.	
How often you have symptom?	How often do you have the symptom?	
How long the symptom lasts?	How long does it last?	
How bad or severe the symptom is?	How much does it bother you or make you feel bad?	
Reading level: 6 th grade	Reading level: 3 rd grade	



ICF

- The ICF was revised from a 7th grade to a 3rd grade reading level (Table 3)

Table 3. Evolution of ICF text based on AI chat feedback

Original text	Recommended revision for 3 rd grade reading level	Summary of changes
If are eligible to participate, you will be scheduled for a 90-minute interview at a time convenient for you. The interview will be conducted by Lumanity personnel at your doctor's office or in a nearby professional meeting room. The interview will be audio-recorded with your consent. In addition, the interview may be observed from a nearby viewing room by other members of the Lumanity team and/or the study sponsor. If you are not comfortable with or do not want to be audio-recorded, you should not participate in this research study.	If you qualify to take part, we will schedule a 90-minute interview at a time that works well for you. The interview will be held by Lumanity staff at your doctor's office or a nearby professional meeting room. We will ask for your consent to record the interview. Other members of the Lumanity team and/or the study sponsor may also observe the interview from a nearby room. If you feel uncomfortable or do not want the interview to be recorded, you should not participate in this research study.	<ul style="list-style-type: none"> AI chat-revised text attempts to use more child-friendly vocabulary to make it more accessible for a 3rd-grade reader The statement was shortened, and the original intended meaning was retained
Reading level: 7 th grade	Reading level: 3 rd grade	

CONCLUSIONS

- AI chat review of patient-facing materials is a useful tool for identifying potentially challenging language and assessing readability to determine if modifications are needed
- Revisions made by AI chat still need to be evaluated by researchers for appropriateness, as AI chat does not understand the intended context of use for the text being assessed
- AI chat cannot replace the value of engaging with patients directly, especially given the need to consider the unique perspectives of patients in various disease populations, including pediatric patients or patients with cognitive impairment
- Future work could assess additional types of patient-facing materials and/or explore other types of readability formulas (e.g. Dale-Chall)

REFERENCES

- Gauthier M, Johnson N. Identification and recommendations of readability tests for the evaluation of clinical outcome assessments (COAs). International Society for Quality of Life Research 26th Annual Conference; San Diego, CA: October 21, 2019.
- McGee J. Toolkit for Making Written Material Clear and Effective. Centers Medicare Medicaid Serv. 2010;1-43.
- Ware, J., Kosinski, M., Keller S. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. Medical care 34, no. 3; 220-233. 1996



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