

Leveraging ChatGPT to aid patient education on coronary angiogram

Samuel Ji Quan Koh¹ *MRCP*, Khung Keong Yeo¹ *ABIM*, Jonathan Jiunn-Liang Yap¹ *MRCP*

ABSTRACT

Natural-language artificial intelligence (AI) is a promising technological advancement poised to revolutionise the delivery of healthcare. We aim to explore the quality of ChatGPT in providing medical information regarding a common cardiology procedure—the coronary angiogram—and evaluating the potential opportunities and challenges of patient education through this natural-language AI model in the broader context. In a conversational manner, we asked ChatGPT common questions about undergoing a coronary angiogram according to the areas of: description of procedure, indications, contraindications, complications, alternatives, and follow-up. The strengths of the answers given by ChatGPT were that they were generally presented in a comprehensive and systematic fashion, covering most of the major information fields that are required. However, there were certain deficiencies in its responses. These include occasional factual inaccuracies, significant omissions, inaccurate assumptions, and lack of flexibility in recommendations beyond the line of questioning, resulting in the answers being focused solely on the topic. We would expect an increasing number of patients who may choose to seek information about their health through these platforms given their accessibility and perceived reliability. Consequently, it is prudent for healthcare professionals to be cognisant of both the strengths and deficiencies of such models. While these models appear to be good adjuncts for patients to obtain information, they cannot replace the role of a healthcare provider in delivering personalised health advice and management.

Ann Acad Med Singap 2023;52:374-7

Keywords: artificial intelligence, cardiology, coronary artery disease, medical education, public health, quality of life

Natural-language artificial intelligence (AI) is a promising technological advancement poised to revolutionise the delivery of healthcare.¹ Traditionally, inclusion of technology in the augmentation of healthcare communication comprised the use of chatbots, which is limited by a predetermined set of queries and matched answers.² However, natural-language AI models prompt a paradigm shift, given that they can interpret colloquial inputs to provide new texts based on the large datasets that it was trained. Chat Generative Pre-trained Transformer (ChatGPT) is an example of an open natural-language AI conversational platform that has recently been developed. While there are many other natural-language models, ChatGPT's free, intuitive, and user-friendly interface has attracted the most significant group of users and analysis of its output. It has not only revolutionised the non-medical fraternity with wide-ranging abilities, including creative writing, essay writing,

prompt writing, code writing, and answering questions,³ but has also made inroads in the medical field.⁴ Given its accessibility and reported medical proficiency,⁵ we aim to explore the quality of ChatGPT in providing medical information regarding a common cardiology procedure—the coronary angiogram—and evaluating the potential opportunities and challenges of patient education through this natural-language AI model in the broader context.

In a conversational manner, we asked ChatGPT (<https://openai.com/blog/chatgpt>) common questions about undergoing a coronary angiogram according to the areas of: description of procedure, indications, contraindications, complications, alternatives, and follow-up.

The types of questions asked and the evaluation of the outputs' strengths and deficiencies are outlined in Table 1, with the exact replies made available in the Supplementary Appendix.

¹ Department of Cardiology, National Heart Centre Singapore, Singapore

Correspondence: Dr Samuel Ji Quan Koh and Dr Jonathan Jiunn-Liang Yap, Department of Cardiology, National Heart Centre Singapore, 5 Hospital Dr, Singapore 169609.

Email: Dr Samuel Ji Quan Koh sk_jiquan@yahoo.com.sg; Dr Jonathan Jiunn-Liang Yap jonathan.yap.j.l@singhealth.com.sg

The strengths of the answers given by ChatGPT were that they were generally presented in a comprehensive and systematic fashion, covering most of the major information fields that are required. The language used was easy to understand by the layperson, and medical terminology unfamiliar to persons without clinical experience were avoided. Most responses also appropriately concluded that it was important to involve the healthcare professional in discussing the specific circumstances of the individual, and acknowledged its own deficiencies of providing personalised recommendations.

However, there were certain deficiencies in its responses. First, while infrequent, there were some

factual inaccuracies. These included inadequate differentiation between antiplatelet and anticoagulation among blood thinners and the resultant decision to continue or discontinue it prior to the procedure; certain inaccurate indications for angiography (e.g. family history, prior stroke, monitoring); some inaccurate risks of angiography (e.g. blood clot—rather than calcifications—dislodgement by catheter); and incorrect contraindications (e.g. severe heart failure). Second, there were some significant omissions. For example, it excluded the important indication of active acute coronary syndromes, for which coronary evaluation via angiography would be recommended. Third, there were some inaccurate assumptions made. For example,

Table 1. Evaluation of outputs by ChatGPT on patient education on coronary angiogram.

Questions	Strengths	Deficiencies
1. Procedural description		
Can I find out more about coronary angiogram?	Offered a generally factually accurate explanation of how a coronary angiogram is performed.	Some details lacking, including the expected duration.
How long is the procedure? Will I be awake or asleep for the procedure? Is it painful?	Provided generally reasonable and accurate answers.	The role of sedation may vary and should be acknowledged. In most instances, the procedure will be carried out under local anaesthesia and sedation only if needed. The need for general anaesthesia is extremely rare.
What do I need to do beforehand to prepare?	Provided both medical and logistics advice on what to do and prepare prior to the procedure.	—
Should I stop or take blood thinners for my angiogram?	Reasonable attempt at providing general advice and mentioned that the physician needs to individualise advice.	Could have better differentiated the differences between antiplatelet and anticoagulation. Continuation of antiplatelet is usually routine and the decision to continue anticoagulation may vary depending on the individual, access site and indication for anticoagulation. Did not include common antiplatelets that are used nowadays, like ticagrelor and prasugrel, especially in the setting of acute coronary syndromes.
2. Indications		
What are some reasons why I need to go for an angiogram?	Balanced answer towards the role of angiogram in the presence of symptoms stating that the symptoms may be indicative of heart disease but will need further consultation with a physician that may entail other diagnostic testing. Decision for angiography will vary depending on the situation.	Provided several incorrect indications that would not necessitate an angiogram—these include prior stroke, family history and “monitoring of progress of heart disease”.
If I have chest pain when climbing up the stairs should I go for an angiogram?		Excluded the important indication of active acute coronary syndromes usually requiring angiograms.
I get increasingly breathless, is an angiogram useful?		Should include simple mention on potential non-cardiac causes of chest pain or breathlessness.
What are the benefits of going for an angiogram?		—
If I have a heart attack, should I go for an angiogram?	Provided a firm recommendation that in such instances, an angiogram should be performed urgently or emergently, especially if symptoms are ongoing.	—

Table 1. Evaluation of outputs by ChatGPT on patient education on coronary angiogram. (Cont'd)

Questions	Strengths	Deficiencies
3. Contraindications		
What are some reasons I should not go for an angiogram?	Provided a comprehensive list of both absolute and relative contraindications.	The contraindication of “severe heart failure” should be better explained, as patients generally may undergo coronary angiography to work up low ejection fraction. This is probably more accurately stated as active heart failure, and that steps to first optimise the patient prior to undergoing coronary angiography in the elective setting.
4. Complications		
What are some complications of an angiogram?	Provided comprehensive list of both common and rarer complications.	Some inaccurate portions, including the risk of dislodgement of blood clots by the catheter potentially causing heart attack or stroke, although this is usually caused by calcifications.
What are the harms of going for an angiogram?		
5: Alternatives		
Are there alternatives to an angiogram?	Provided reasonable lists of alternatives.	—
Would you recommend I go for it?	Good explanation of its limitation that as an AI language model, it cannot provide medical advice or make recommendations for individual cases.	—
6: Follow-up		
What do I need to do after an angiogram?	Provided reasonable guidelines on what to do.	—
Do I need a follow up appointment?	Provided a reasonable list of recommended follow up plans, including a list of common medications to take.	Some inaccurate parts, including the angiogram being able to show that a patient has high cholesterol.
Are there medications to take after an angiogram?		

it suggested that sedation is usually given but this may vary. Lastly, the model also appeared inflexible in recommendations beyond the line of questioning, resulting in the answers only focused on the topic. For example, the model was not able to consider non-cardiac causes of common clinical presentations of chest pain and breathlessness in the context of asking about symptoms and need for coronary angiography.

The shortcomings of a natural-language AI platform like ChatGPT may be due to several issues.

First, given that the models are limited by the data inputs, latest developments may not be fully captured by datasets that the software was trained on. Further, given that information had been derived from all sources of internet, there may be inaccurate information that are presented to the reader.

Second, the model required further probing and prompting for information that would otherwise have normally been given by healthcare providers as part of the counselling process. Such omissions in the

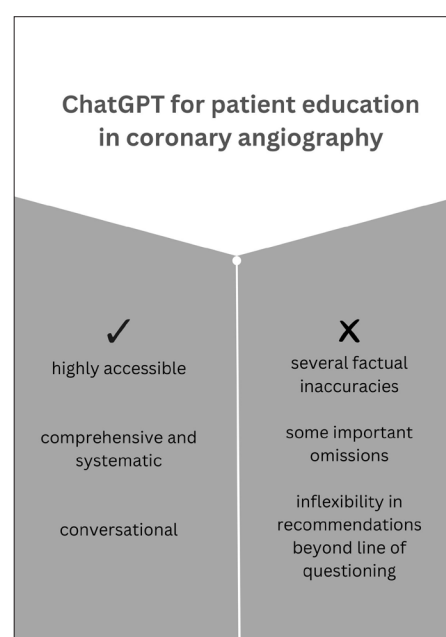


Fig. 1. Overview of strengths and deficiencies of ChatGPT patient education on coronary angiogram.

initial explanation may result in potentially important information not being given to patients or caregivers that may subsequently impact their decision-making process.

Third, the inability for the model to be flexible in recommendations beyond the line of questioning may be due to the conversational nature and scoping of the topic. This may be acceptable if patients only require more knowledge about the particular topic, but it can be counter-productive when it involves looking laterally, especially for differential diagnoses.

Overall, the performance of ChatGPT was thought-provoking. We would expect an increasing number of patients who may choose to seek information about their health through these platforms given its accessibility and perceived reliability. Consequently, it is prudent for healthcare professionals to be cognisant of both the strengths and deficiencies of such models. The ability to harness and incorporate these models into our healthcare systems may transform and improve healthcare delivery bringing potential benefits to both patients and physicians alike, particularly with constant improvements of this model; the release of improved iterations, including the paid version of ChatGPT Plus, which operates on increasingly more datapoints and

parameters, may further improve the accuracy and performance of their outputs.⁶ Nevertheless, while these models appear to be good adjuncts for patients to obtain information, they cannot replace the role of a healthcare provider in delivering personalised health advice and management.

REFERENCES

1. Baumgartner C. The potential impact of ChatGPT in clinical and translational medicine. *Clin Transl Med* 2023;13:e1206.
2. Bibault JE, Chaix B, Guillemassé A, et al. A Chatbot Versus Physicians to Provide Information for Patients With Breast Cancer: Blind, Randomized Controlled Noninferiority Trial. *J Med Internet Res* 2019;21:e15787.
3. Taecharungroj V. “What Can ChatGPT Do?” Analyzing Early Reactions to the Innovative AI Chatbot on Twitter. *Big Data Cogn Comput* 2023;7:35.
4. Xue VW, Lei P, WC C. The potential impact of ChatGPT in clinical and translational medicine. *Clin Transl Med* 2023;13:e1216.
5. Kung TH, Cheatham M, Medenilla A, et al. Performance of ChatGPT on USMLE: Potential for AI-assisted medical education using large language models. *PLOS Digit Health* 2023;2:e0000198.
6. Ray PP. ChatGPT: A comprehensive review on background applications, key challenges, bias, ethics, limitations and future scope. *Internet of Things and Cyber-Physical Systems* 2023;3:121–54.