

## Letter to the Editor

# Artificial intelligence in patient education: a case study on peripheral artery disease

Sir,

The Gemini chatbot is a conversational artificial intelligence (AI) system developed by Google and launched in December 2023. It functions as a multimodal large language model (LLM).<sup>1</sup> This means it's not limited to understanding and generating texts; it can process and respond to various types of information, including images, audios, and videos. Users can interact with it by typing or speaking prompts.<sup>1</sup>

The integration of AI chatbots into patient education platforms presents a fascinating frontier in healthcare, offering both promising advantages and notable limitations.<sup>2</sup> To explore this dynamic, we engaged in a simulated conversation with Gemini, a leading AI chatbot, focusing on peripheral vascular disease (PVD). Our objective was to assess the chatbot's ability to provide accurate, comprehensive, and patient-friendly information, thereby highlighting the pros and cons of leveraging such AI tools in guiding patients through their disease journey.

This project aims to illuminate how AI, like Gemini, can empower patients with accessible information while simultaneously identifying the critical areas where human oversight, empathy, and personalized medical judgment remain indispensable.

Peripheral vascular disease has high prevalence and public health burden which affects over 200 million people worldwide, including a significant population over 50 years of age.<sup>3,4</sup> This widespread impact means that a large number of patients could potentially benefit from accessible educational resources, making it an ideal candidate to assess the reach and utility of AI chatbots.

Table 1 describes a conversation comprising of ten questions, between a common man and Gemini about PVD.

According to our observation, Gemini chatbot provides comprehensive and largely accurate information, structured to address common patient questions about PVD's definition, causes, symptoms, diagnosis, and treatment. It's interesting to note Gemini even guides users to consult which specialists if they have peripheral artery disease (PAD) symptoms such as "vascular surgeons, vascular medicine specialists, cardiologists." Answers are accessible and patient-centric, highlighting key lifestyle changes and warning about serious complications like critical limb ischemia, while also guiding on when to seek professional help such as "seek immediate attention for sudden, severe leg pain not relieved by rest, sudden coldness/numbness/weakness in a limb."

**Table 1: PAD: common patient questions & answers.**

Question number	Question	Answer summary
1.	What exactly is PVD / PAD?	A circulatory problem where narrowed arteries (usually due to atherosclerosis) reduce blood flow to limbs, most commonly the legs. PAD is the more precise term for arterial narrowing.
2.	What caused my PVD/PAD?	Primarily atherosclerosis (plaque buildup in arteries), accelerated by factors like smoking, diabetes, high blood pressure, high cholesterol, age, obesity, and family history.
3.	What are the symptoms of PVD/PAD, and how will it affect my daily life?	Common symptoms include claudication (leg pain with activity, relieved by rest), numbness, coldness, non-healing sores, skin/nail changes, and weak pulses. It can limit walking and daily activities.
4.	How is PVD/PAD diagnosed? What tests will I need?	Diagnosis involves a physical exam and tests like Ankle-Brachial Index (ABI), ultrasound, and various types of angiography (CT, MR, conventional).
5.	What are the treatment options for PVD/PAD?	Treatment includes lifestyle changes (smoking cessation, exercise, diet), medications (statins, antiplatelets, blood pressure/sugar control), and procedures (angioplasty/stenting, atherectomy, bypass surgery).

Continued.

Question number	Question	Answer summary
6.	Are there lifestyle changes I can make to improve my condition?	Yes, crucial changes include quitting smoking, regular exercise (supervised is best), a heart-healthy diet, weight management, strict control of diabetes/BP/cholesterol, and meticulous foot care.
7.	What are the potential risks and complications of PVD/PAD if it's left untreated?	Risks include Critical Limb Ischemia (CLI), non-healing ulcers, infections, amputation, and significantly increased risk of heart attack and stroke.
8.	Can PVD/PAD be cured or reversed?	Generally not "cured" (atherosclerosis remains), but it can be effectively managed. Symptoms can improve, progression can be slowed/halted, and complications reduced through treatment and lifestyle changes.
9.	When should I be concerned and seek immediate medical attention for my symptoms?	Seek immediate attention for sudden, severe leg pain not relieved by rest, sudden coldness/numbness/weakness in a limb, or worsening/infected non-healing sores (signs of CLI).
10.	What kind of doctor specializes in treating PVD/PAD, and who should I see?	Specialists include vascular surgeons, vascular medicine specialists, cardiologists, and interventional radiologists. Start with your primary care physician for referral.

However, there are limitations which stems from its nature as an AI: lack of personalization, empathy, and ability to provide direct medical advice or diagnosis. There is also potential for information overload and information is based on general medical knowledge, there are no cited sources so authenticity of information cannot be always trusted.

The emergence of AI chatbots like Gemini presents a transformative, yet complex, opportunity for patient health education. These tools offer significant advantages, including 24x7 accessibility, instant information delivery, and the potential for increased personalization and consistent messaging, however their use comes with critical drawbacks including concern of information authenticity due to incited sources. This means while AI can effectively supplement traditional education by handling routine queries and reinforcing information, it cannot replace the essential human connection, clinical judgement, and verifiable credibility that healthcare professional provides.

Successful integration of AI chatbots In patient education hinges on their responsible development, transparent communication of their limitations, and clear emphasis on their role as supplementary tools.

Physicians' collaboration with AI chatbot makers is essential to developing a truly powerful and reliable patient education tool, drastically reducing errors and building greater trust.

### Declaration

The author declares the use of AI as research tools in this study. The author did not use any generative AI or AI-

assisted technology for the writing or editing of this manuscript.

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