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Artificial Intelligence in Cardiac Rehabilitation: Assessing ChatGPT's Knowledge and Clinical Scenario Responses

Kardiyak Rehabilitasyonda Yapay Zekâ: ChatGPT'nin Bilgi Düzeyi ve Klinik Senaryo Yanıtlarının Değerlendirilmesi

ABSTRACT

Objective: Cardiac rehabilitation (CR) improves survival, reduces hospital readmissions, and enhances quality of life; however, participation remains low due to barriers related to access, awareness, and socioeconomic factors. This study explores the potential of artificial intelligence (AI), specifically ChatGPT, in supporting CR by providing guideline-aligned recommendations and fostering patient motivation.

Method: This cross-sectional study evaluated ChatGPT-4's responses to 40 questions developed by two cardiologists based on current cardiology guidelines. The questions covered fundamental principles of CR, clinical applications, and real-life scenarios. Responses were categorized based on guideline adherence as *fully compliant, partially compliant, compliant but insufficient, or non-compliant*. Two expert evaluators assessed the responses, and inter-rater reliability was analyzed using Cohen's kappa coefficient.

Results: ChatGPT provided responses to all 40 questions. Among the 20 general open-ended questions, 14 were rated as *fully compliant*, while six were *compliant but insufficient*. Of the 20 clinical scenario-based questions, 16 were *fully compliant*, and four were *compliant but insufficient*. ChatGPT demonstrated strengths in areas such as risk stratification and patient safety strategies, but limitations were noted in managing elderly patients and high-intensity interval training. Inter-rater reliability was calculated as 90% using Cohen's kappa coefficient.

Conclusion: ChatGPT shows promise as a complementary decision-support tool in CR by providing guideline-compliant information. However, limitations in contextual understanding and lack of real-world validation restrict its independent clinical use. Future improvements should focus on personalization, clinical validation, and integration with healthcare professionals.

Keywords: Artificial intelligence, cardiac rehabilitation, ChatGPT, clinical decision support, digital health

ÖZET

Amaç: Kardiyak rehabilitasyon (KR), hayatta kalma oranlarını artırır, hastaneye yeniden yatışları azaltır ve yaşam kalitesini iyileştirir. Ancak, erişim, farkındalık ve sosyoekonomik engeller nedeniyle katılım oranları düşüktür. Bu çalışma, yapay zekanın, özellikle ChatGPT'nin, KR'yi rehber tabanlı öneriler sunarak ve hasta motivasyonunu artırarak destekleme potansiyelini araştırmaktadır.

Yöntem: Bu kesitsel çalışmada, iki kardiyolog tarafından mevcut kardiyoloji rehberlerine dayanarak geliştirilen 40 soru ChatGPT-4'e sunulmuştur. Sorular, KR'nin temel ilkelerini, klinik uygulamalarını ve gerçek hayat senaryolarını kapsamaktadır. Yanıtlar, rehber uygunluğuna göre "tamamen uygun," "kısmen uygun," "uygun ama yetersiz" veya "uygun değil" olarak kategorize edilmiştir. Değerlendirmeler iki uzman tarafından gerçekleştirilmiş ve değerlendiriciler arası güvenilirlik Cohen'in kappa katsayısı ile analiz edilmiştir.

Bulgular: ChatGPT, 40 sorunun tamamına yanıt vermiştir. 20 genel açık uçlu sorudan 14'ü tamamen uygun, 6'sı ise uygun ama yetersiz olarak değerlendirilmiştir. 20 klinik senaryo bazlı sorudan 16'sı tamamen uygun, 4'ü ise uygun ama yetersiz bulunmuştur. ChatGPT, risk stratifikasyonu ve hasta güvenliği stratejileri gibi alanlarda güçlü performans göstermiş, ancak yaşlı hastaların yönetimi ve yüksek yoğunluklu aralıklı antrenman gibi konularda sınırlılıklar tespit edilmiştir. Cohen'in kappa katsayısı ile değerlendiriciler arası güvenilirlik %90 olarak hesaplanmıştır.

Sonuç: ChatGPT, rehber uyumlu bilgiler sağlayarak KR'de tamamlayıcı bir karar destek aracı olarak potansiyel göstermektedir. Ancak, bağlamsal anlayış ve gerçek dünya doğrulamalarındaki sınırlılıklar, bağımsız klinik kullanımını kısıtlamaktadır. Gelecekteki iyileştirmeler, kişiselleştirme, klinik doğrulama ve sağlık profesyonelleriyle entegrasyon üzerine odaklanmalıdır.

Anahtar Kelimeler: Yapay zeka, kardiyak rehabilitasyon, ChatGPT, klinik karar destek, dijital sağlık

ORIGINAL ARTICLE
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Cardiovascular diseases (CVDs) remain the leading cause of mortality worldwide, accounting for approximately 17.9 million deaths in 2019, which represents 32% of all global deaths. This statistic highlights the significant burden of CVDs, not only at the individual level but also as a major public health challenge. The impact is particularly pronounced in low- and middle-income countries, where disparities in healthcare access further exacerbate the consequences of CVDs. Following acute coronary events such as myocardial infarction (MI), nearly 20% of patients experience a recurrent MI or stroke within the first year, reflecting a substantial risk of adverse outcomes.[1] These findings emphasize the critical need for effective secondary prevention strategies to reduce morbidity and mortality associated with recurrent cardiovascular events and to address broader disparities in cardiovascular care.

Cardiac rehabilitation provides a multidisciplinary, systematic, and personalized approach for individuals with CVDs, aiming to implement evidence-based secondary prevention strategies effectively. Through comprehensive interventions, including exercise training, nutritional counseling, psychosocial support, and risk factor management, cardiac rehabilitation (CR) serves as a crucial tool for reducing mortality, improving quality of life, and enhancing physical capacity.[2] Despite these well-documented benefits, only 20-25% of patients who experience a cardiovascular event participate in CR programs. This low participation rate is attributed to factors such as lack of awareness, socioeconomic barriers, and infrastructural challenges within healthcare systems.[3]

The need for innovative approaches to expand the reach of CR and improve participation rates is becoming increasingly critical. Digital health technologies and artificial intelligence (AI)-based tools represent some of the most promising solutions in this field. Artificial intelligence and natural language processing (NLP)-based large language models (LLMs) offer transformative opportunities in healthcare. Advanced LLMs, such as ChatGPT, are trained on vast datasets, enabling them to understand, process, and generate human language. These capabilities make them valuable tools for patient education, clinical decision support systems, and the provision of guideline-aligned information, benefiting both healthcare professionals and patients.[4]

This study aims to evaluate the potential role of ChatGPT in cardiac rehabilitation, analyze its alignment with clinical guidelines, and assess its performance in addressing various clinical scenarios. Furthermore, it provides a broader perspective on the future role of digital health technologies in cardiac rehabilitation, while exploring the opportunities and limitations of AI in this field.

Materials and Method

This study was conducted as a cross-sectional analysis without the involvement of human subjects, aiming to assess the knowledge level of ChatGPT-4o in the field of cardiac rehabilitation. Two experienced cardiologists (MG and UÇY) developed a total of 40 open-ended questions, including general and clinical scenarios, based on the current guidelines of leading cardiology societies.[2,5-7] These questions were carefully designed to encompass the core principles, clinical applications, and real-life scenarios of cardiac rehabilitation, closely adhering to the latest recommendations. Structured around common challenges encountered in clinical practice, the questions were diversified to address both open-ended and scenario-specific contexts, ensuring comprehensive coverage of the subject.

To ensure an objective and standardized evaluation of ChatGPT's responses, the questions were presented as independent prompts across three separate sessions using the "New Chat" function, and the responses were recorded. By restarting ChatGPT in each session, the system's consistency and reliability were analyzed. Throughout the process, no personal information was shared, and confidentiality standards were strictly maintained.

The reliability of the responses was evaluated by two cardiologists and categorized as follows:

1. Guideline-Compliant: Responses that fully and accurately aligned with the relevant guidelines without contradictions.
2. Guideline-Compliant but Insufficient: Responses that adhered to guideline-aligned information but were incomplete or lacked certain details while remaining free of contradictions.
3. Partially Guideline-Compliant: Responses that included guideline-aligned information but contained some contradictory statements.
4. Guideline-Noncompliant: Responses that contradicted the information provided in the guidelines.

The inter-rater agreement between the two evaluators was measured using Cohen's kappa coefficient and calculated as 90%, indicating a high level of reliability in the assessment. Responses that were not classified as guideline-compliant were analyzed in detail, and the strengths and weaknesses of ChatGPT were discussed. Since this study did not involve human or animal participants and ChatGPT is a publicly available tool, ethical approval was deemed unnecessary. Studies like this, which explore the potential of ChatGPT in providing scientific information, offer valuable insights for the development of artificial intelligence applications in healthcare. In this article, artificial intelligence has been examined to assess its potential in clinical decision-making processes, and AI tools have been utilized within this scope.

ABBREVIATIONS

AI	Artificial intelligence
AMI	Acute myocardial infarction
CR	Cardiac rehabilitation
CVDs	Cardiovascular diseases
ECG	Electrocardiography
HIIT	High-intensity interval training
HRR	Heart rate reserve
LLMs	Large language models
MI	Myocardial infarction
ML	Machine learning
NLP	Natural language processing
PCI	Percutaneous coronary intervention
RPE	Rate of perceived exertion
VAD	ventricular assist device

Results

This study evaluated ChatGPT-4o, a natural language processing and comprehension tool developed by OpenAI, by assessing its knowledge level and alignment with clinical guidelines in the field of cardiac rehabilitation through an analysis of responses to general open-ended questions and clinical scenarios. Among the 20 responses to general open-ended questions, 14 (70%) were fully compliant with guidelines, while six (30%) exhibited information gaps (Appendix 1). These deficiencies were particularly concentrated in areas such as the metrics used for evaluating exercise intensity (e.g., percentage of heart rate reserve (%HRR), peak watt values), insufficient detail on high-intensity interval training (HIIT) and resistance training, and technical aspects related to device optimization. For the clinical scenario-based questions, 16 responses (80%) were fully guideline-compliant, while four (20%) displayed information gaps (Appendix 2). Deficiencies in clinical responses included the omission of pharmacological treatment options in smoking cessation programs, lack of consideration for hormonal and metabolic causes in cases of unsuccessful weight loss, and insufficient medication management for symptoms such as dizziness and muscle weakness observed during cardiac rehabilitation.

The inter-rater agreement, with a Cohen's kappa coefficient of 90%, indicated a high level of reliability in the evaluation of responses. ChatGPT demonstrated strong performance in explaining the fundamental principles of multidisciplinary cardiac rehabilitation, offering individualized approaches, and developing strategies aimed at ensuring patient safety. However, it was observed that the model's depth of knowledge was limited in more complex clinical topics, such as device optimization, specific exercise protocols, and medication management. Additionally, the reasons for responses categorized as insufficient, partially compliant, or non-compliant, as well as the strengths of ChatGPT's responses, are further detailed in Appendices 1 and 2.

Discussion

This study evaluated the potential use of AI-based systems, such as ChatGPT-4o, which are widely accessible to the public, in CR by analyzing the accuracy of responses to open-ended general and clinical scenario-based questions. The findings indicate that ChatGPT-4o demonstrated a high level of alignment with clinical guidelines when responding to open-ended and clinical scenario-based questions related to cardiac rehabilitation. The strengths of the model's responses included comprehensive and guideline-compliant explanations of the objectives of multidisciplinary approaches, risk stratification processes, and the fundamental principles of exercise prescription. Notably, ChatGPT-4o proved valuable in addressing patient safety, promoting engagement strategies, and offering practical solutions applicable to clinical practice. Additionally, its ability to provide personalized recommendations tailored to different patient profiles aligns well with the core objectives of cardiac rehabilitation. However, the responses highlighted limitations in specific areas, particularly a lack of depth in certain topics. For example, detailed guidance on HIIT and resistance training for elderly or frail patients was insufficiently addressed. Additionally, more complex issues, such as pharmacological therapy and metabolic-related problems, lacked advanced evaluation. Furthermore, the omission of technical details related to exercise intensity (e.g., %HRR, peak watt values) and insufficient emphasis on device optimization further reduced the comprehensiveness of the responses from an application standpoint.

ChatGPT generally provides systematic, clear, and comprehensive responses to user queries. Most of its answers are supported by clear and effective explanations of fundamental concepts, making the information easily understandable for users. Additionally, since ChatGPT generates responses without accessing personal data, its emphasis on the importance of consulting a healthcare professional for decisions regarding individual health conditions demonstrates a strong sense of responsibility. This approach highlights the critical role of human experts in decision-making processes that require detailed information in the context of healthcare services and aligns with current scientific literature.[8] This characteristic of ChatGPT underscores its ability to facilitate access to information while reinforcing the indispensable need for human expertise, offering a balanced perspective. This study is one of the pioneering investigations in the literature evaluating the knowledge level of widely accessible AI-based tools like ChatGPT in the field of cardiac rehabilitation, shedding light on the potential role of AI in healthcare services.

In recent years, studies on AI and machine learning (ML)-based approaches for cardiac health monitoring have gained significant attention. Agliari et al.[9] developed a model capable of detecting cardiac conditions such as atrial fibrillation and congestive heart failure with up to 85% accuracy by analyzing heart rate variability time series derived from 24-hour Holter recordings. Similarly, Hijazi et al.[10] developed an ML-based system to identify cardiac risk patterns and predict risk stratification in patients with Long QT Syndrome. This system was tested on 434 electrocardiography (ECG) recordings and demonstrated the potential for personalized health monitoring. With the increasing prevalence of continuous ECG sensors, AI tools for analyzing ECG signals have become more widely utilized in cardiac health surveillance. Fu et al.[11] made significant contributions to this field by designing a hardware device capable of collecting high-quality ECG data. In another study, Vieira et al.[12] demonstrated that virtual reality-supported exercise methods were significantly more effective than traditional physical exercise approaches. Additionally, the study by Raja et al.[13] highlighted AI's potential to support reporting processes in healthcare, identifying data deficiencies and inaccurate predictions as fundamental challenges in health systems. Moreover, it emphasized that data-driven features such as advanced coaching, self-monitoring, and education could better support patients and clinical staff, enabling remote and more objective monitoring of adherence rates.

Cardiac rehabilitation is one of the most effective interventions in modern medicine, aiming to improve quality of life and reduce mortality among individuals with CVD. However, specific patient groups, such as individuals with language barriers, those living in rural and remote areas, socioeconomically disadvantaged populations, and women, often do not fully benefit from these services. Globally, low- and middle-income countries face challenges in delivering cardiac rehabilitation services to larger populations due to limited resources, creating inequities in access to CR programs.[14,15] In recent years, digital health technologies and AI-based tools have demonstrated significant potential in addressing these disparities.[13] Home-based cardiac rehabilitation and hybrid models combine the benefits of center-based cardiac rehabilitation with greater flexibility and accessibility, facilitating increased patient participation. The importance of remote health management tools has grown, particularly during the Coronavirus Disease 2019 (COVID-19) pandemic, when access to in-person rehabilitation services was restricted. Digital health tools, such as telephone-based coaching, smartphone applications, and sensor-based activity monitoring, have introduced a new dimension to patient care. These tools have proven effective in providing remote monitoring and personalized feedback.[16] However, there is currently no standardized terminology or framework for the application of digital health tools in CR. AI-based solutions, with their capacity to deliver personalized care, can contribute significantly to this standardization process. Hybrid CR models that incorporate AI-supported robots and algorithms present opportunities to optimize rehabilitation methods and enhance patient care.[17] These systems can utilize customizable algorithms that account for factors such as age, sex, comorbidities, and socioeconomic status, enabling the development of personalized rehabilitation programs tailored to individual patient needs. AI-powered wearable devices and remote monitoring systems can analyze patient data in real time, allowing for more flexible and accessible rehabilitation programs. Additionally, integrating social robots and emotion analysis technologies into AI-based systems can more effectively address patients' psychosocial needs. AI-driven systems offer innovative opportunities to enhance patient motivation and provide clinical support throughout the CR processes. For example, ChatGPT could be integrated into home-based rehabilitation programs to remind patients of their personalized exercise plans and provide guideline-aligned information to improve adherence. Moreover, it could serve as a "pre-assessment tool" for clinicians in risk stratification and exercise intensity calculations. The integration of social robots providing motivational support and enhancing patient participation could further improve the achievement of rehabilitation goals.[17]

Cardiac rehabilitation is a multidisciplinary process that requires the integration of various fields, including cardiology, physical medicine and rehabilitation, nutrition, psychology, and exercise physiology. Navigating these processes can be challenging and time-consuming for patients. The effective use of AI-supported technologies in this context could significantly accelerate and optimize clinical decision-making processes while improving patient adherence and long-term engagement. Such technologies have the potential to integrate contributions from various healthcare professionals onto a single digital platform, creating opportunities for time and cost savings. Additionally, reducing barriers to healthcare access caused by geographical or logistical challenges is a key advantage of these innovative approaches. The implementation of an AI-based model in a highly multidisciplinary domain such as cardiac rehabilitation could not only improve clinical efficiency but also strengthen patient-centered care.[18]

AI and digital health solutions hold significant potential to address the unique needs of different patient groups in CR. Patients with high health literacy, particularly those at low to moderate risk, tend to understand and utilize digital health tools more effectively. For these patient groups, remote CR models can increase participation rates in rehabilitation programs and reduce dependence on in-person CR services.[19] This approach allows for more efficient utilization of existing rehabilitation resources, creating additional capacity to allocate to high-risk patient groups. For instance, patients with advanced left ventricular dysfunction or those using mechanical support devices typically benefit more from intensive clinical support and supervision provided by in-person CR services. Employing digital health tools in remote applications for low- and moderate-risk patients allows in-person CR services to be reserved for high-risk patients. This strategy facilitates a more equitable and needs-based allocation of resources, thereby enhancing the overall clinical effectiveness of rehabilitation.

The explicit acknowledgment by AI tools that the information they provide is guideline-aligned and requires verification by a healthcare professional would enhance their safety in use. Additionally, anonymization of patient data and protection through robust encryption methods are fundamental requirements for ensuring system reliability. Measures that promote the ethical and secure use of AI systems will support their role as effective and reliable support tools in clinical decision-making processes. Although national and international guidelines and principles have been established on these issues, more comprehensive solutions are needed to ensure the secure and efficient use of AI systems, particularly concerning data privacy and security. Transparency and fairness in AI algorithms are critically important for reducing healthcare inequities and enhancing public trust in healthcare services. Ensuring that the datasets used to train algorithms are representative and unbiased is essential to prevent biases and promote equity in healthcare delivery. In this context, further research and regulation are needed to address issues related to data protection, algorithmic transparency, and fairness.[19,20]

Limitations

One of the major limitations of this study is that the complexity and dynamic nature of real-world clinical cases differ significantly from the scenarios addressed in this research. The small sample size of 40 questions limits the generalizability of the findings and does not fully capture the diversity of real-life medical conditions. Additionally, this study did not assess ChatGPT's impact on patient outcomes, clinician workload, or patient satisfaction, making it challenging to fully understand the real-world contributions of AI tools to healthcare. ChatGPT's reliance solely on the provided input data highlights the potential for critical insights to be overlooked when information is incomplete or inadequately expressed. Furthermore, the interpretation of AI-generated recommendations can be influenced by the clinician's level of expertise, cultural factors, and potential biases, all of which may affect clinical outcomes.

While AI-based systems demonstrate promising levels of accuracy, further research is needed, particularly in the context of complex clinical scenarios. Preventing false negatives and reducing false positives are critical for improving the reliability of such systems. Real-time data analysis, user-friendly designs, and professional feedback loops could enhance the effectiveness and acceptance of AI systems in clinical practice. Additionally, ensuring data security and protecting patient privacy must remain a priority to uphold ethical standards in healthcare. In conclusion, it is evident that ChatGPT and similar AI tools should serve as complementary decision support systems under the supervision of experienced clinicians, rather than as standalone solutions. Broader, prospective studies are required to better understand the clinical reliability and long-term implications of these technologies.

Conclusion

This study highlights the potential of AI-based tools like ChatGPT to support clinical decision-making and patient education in specialized fields such as cardiac rehabilitation. ChatGPT has emerged as an auxiliary AI tool capable of providing accurate, rapid, and guideline-compliant responses to assist in informed decision-making. However, it is not yet suitable for independent clinical use and requires systematic improvements and human oversight to ensure safe application. While AI systems offer promising contributions in areas such as personalized care, remote monitoring, and enhancing patient motivation, achieving more effective integration into clinical practice will require reducing false negatives, improving real-time data analysis, and developing professional feedback mechanisms. Additionally, data security, patient privacy, and ethical considerations must remain top priorities.

In conclusion, supporting artificial intelligence technologies with larger-scale and multicenter studies in healthcare can strengthen their role in clinical applications. In critical fields such as cardiac rehabilitation, the potential of AI to improve patient outcomes and support healthcare systems may contribute to delivering a more accessible and efficient healthcare model in the future.

Ethics Committee Approval: Since this study did not involve human or animal participants and ChatGPT is a publicly available tool, ethical approval was deemed unnecessary.

Informed Consent: Written informed consent was not required.

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Appendix 1. Evaluation of ChatGPT's Responses to Open-Ended Questions on General Cardiac Rehabilitation in Terms of Guideline Compliance

	Questions	Compatible with the Guidelines	Insufficient or Incompatible with the Guidelines
1.	How do the primary goals of cardiac rehabilitation programs address both physical and psychosocial recovery?	Compatible	
2.	What are the barriers to cardiovascular disease (CVD) prevention and cardiac rehabilitation (CR) at the patient, clinician, and healthcare system levels?		Compatible but Insufficient – Barriers at the patient, clinician, and healthcare system levels were only superficially addressed.
3.	Which healthcare professionals should be available at a cardiac rehabilitation center, either on-site or through referral?	Compatible	
4.	What are the indications for CR?	Compatible	
5.	What are the aims of a well-designed multidisciplinary CR programme?	Compatible	
6.	When should cardiac rehabilitation be initiated?	Compatible	
7.	What initial assessments should be conducted before starting CR?	Compatible	
8.	What are the steps and key parameters involved in the risk stratification process for patients entering cardiac rehabilitation?	Compatible	
9.	What are the contraindications to exercise testing and/or training in cardiac rehabilitation?	Compatible	
10.	How does physical activity and exercise training affect cardiovascular risk factors, and how should the exercise prescription be adjusted based on the level of cardiovascular risk?	Compatible	
11.	What are the characteristics of low-risk patients, and how should an exercise testing protocol be chosen for them?		Compatible but Insufficient – Information about test duration goals and protocol was provided superficially.
12.	What are the common modes of aerobic endurance training?	Compatible	
13.	What are the characteristics of different endurance exercise intensity domains?		Compatible but Insufficient – ● Percentage of heart rate reserve (%HRR) and Peak Watts: These metrics for exercise intensity were not mentioned. ● Perceived Effort [rate of perceived exertion (RPE)]: The ranges of perceived effort at different intensity levels were not specified.
14.	What are the different modes of dynamic resistance training?	Compatible	
15.	What are the characteristics of different dynamic resistance training domains?		Compatible but Insufficient – ● %HRR and Peak Watts: These metrics for exercise intensity were not mentioned. ● Perceived Effort (RPE): The ranges of perceived effort at different intensity levels were not specified.
16.	What are the characteristics of high-risk patients, and how should an exercise testing protocol be chosen for them?	Compatible	
17.	What are the benefits and considerations of implementing exercise training (ET) in patients with implantable cardioverter-defibrillators (ICD), cardiac resynchronization therapy (CRT), or assist devices?		● Device Optimization: The need for programming and optimizing ICD/CRT device settings during exercise was not emphasized. ● Contraindicated Exercises: Specific activities to avoid, such as swimming and high-impact exercises, were not addressed. ● Monitoring in Ventricular Assist Device (VAD) Patients: Strategies to optimize venous return, such as proper posture, fluid balance, and preventing excessive sweating, were not highlighted.
18.	What are the general principles of a healthy diet recommended in cardiac rehabilitation programs?	Compatible	
19.	What are the specific considerations and resistance training recommendations for sarcopenic or frail elderly patients in cardiac rehabilitation?	Compatible	
20.	How can we effectively prescribe, recommend, and promote regular physical activity after phase II cardiac rehabilitation to ensure long-term adherence and health benefits?		● Details of Aerobic Exercise Missing: Specifics regarding type, intensity, duration, and frequency were not provided. ● Lack of High-Intensity Interval Training (HIIT) Details: Benefits and considerations for HIIT were not clearly outlined. ● Resistance Training Details Missing: Information about target muscle groups, number of repetitions, sets, and intensity levels was insufficient.

Appendix 2. Evaluation of ChatGPT's Responses to Clinical Scenario-Based Questions on Cardiac Rehabilitation in Terms of Guideline Compliance

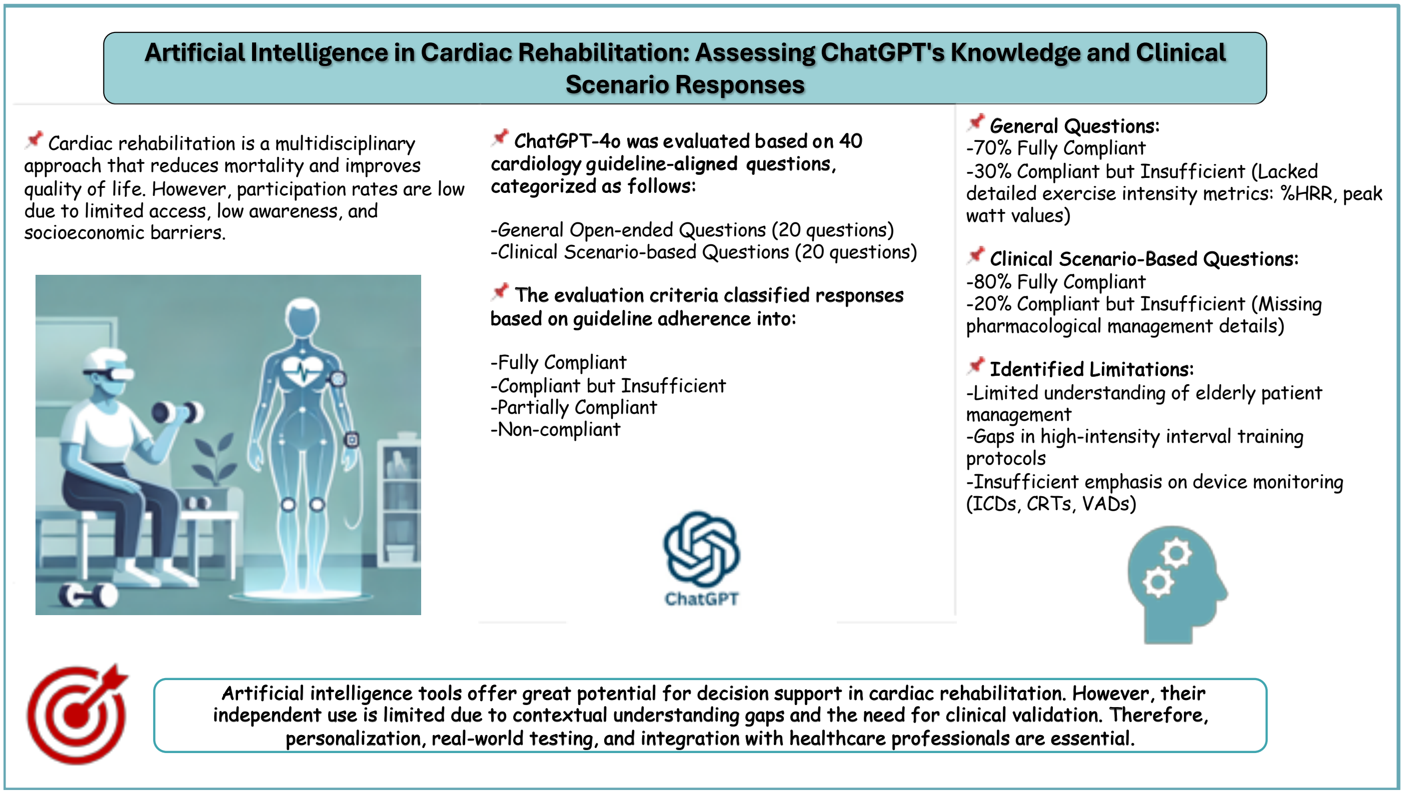
	Questions	Compatible with the Guidelines	Insufficient or Incompatible with the Guidelines
1.	A 45-year-old male patient was discharged from the hospital one week after experiencing an acute myocardial infarction (AMI). The patient is a smoker, has an irregular diet, and works in a high-stress job environment. His medical history includes hypertension and hyperlipidemia. Following his discharge, the patient seeks guidance on lifestyle modifications before beginning cardiac rehabilitation. What lifestyle modification recommendations should be provided to this patient after an acute myocardial infarction, and why are these recommendations important?	Compatible	
2.	A 62-year-old female patient with a history of coronary artery disease recently completed Phase 1 of cardiac rehabilitation following percutaneous coronary intervention (PCI) due to a myocardial infarction. She has been advised to continue her rehabilitation at home as part of a structured Phase 2 cardiac rehabilitation program. The patient has no significant comorbidities that limit mobility but expresses concern about exercising safely without direct supervision. What types of exercise programs can be safely recommended to this patient during the home-based rehabilitation process, and what strategies can be implemented to ensure the safety and effectiveness of these exercises?	Compatible	
3.	A 65-year-old patient with hypertension and stable angina is curious about how target heart rate is calculated during cardiac rehabilitation. How is this calculation explained, and what factors are taken into consideration?	Compatible	
4.	A 58-year-old male patient undergoing cardiac rehabilitation after a recent myocardial infarction reports experiencing symptoms of depression and anxiety. He expresses feelings of low motivation to participate in the program and concerns about his long-term recovery. The patient has no prior history of mental health conditions but acknowledges that his mood has significantly worsened since his cardiac event. He seeks guidance on addressing these psychosocial challenges within the framework of his rehabilitation program. What strategies and interventions can be implemented in cardiac rehabilitation to address the patient's symptoms of depression and anxiety, and how can these approaches improve overall rehabilitation outcomes?	Compatible	
5.	A 68-year-old male patient recovering from heart valve replacement surgery is enrolled in a Phase 2 cardiac rehabilitation program. During one of his supervised sessions, the patient inquires, "If I feel fatigued during exercise, should I push through or stop?" He expresses concern about whether continuing despite fatigue might harm his recovery or whether stopping prematurely could hinder his progress. How should healthcare professionals address this patient's concern, and what specific guidelines and warnings should be provided regarding exercising while feeling fatigued after heart valve surgery?	Compatible – ● Referenced the Borg Perceived Exertion Scale. ● Highlighted Warnings: Exercise should stop immediately if chest pain, shortness of breath, dizziness, or fainting occurs, and medical advice should be sought. ● For heart valve surgery patients, it emphasized avoiding excessive exertion to prevent the risk of infection and complications.	

Appendix 2 (cont). Evaluation of ChatGPT's Responses to Clinical Scenario-Based Questions on Cardiac Rehabilitation in Terms of Guideline Compliance

	Questions	Compatible with the Guidelines	Insufficient or Incompatible with the Guidelines
6.	During a cardiac rehabilitation session, a 58-year-old patient with a history of myocardial infarction states that they are unwilling to change their diet despite recommendations from the healthcare team. What strategies can be employed to improve the patient's motivation and encourage the adoption of healthy eating habits?	Compatible – ● Highlighted the importance of personalized approaches. ● Suggested incorporating healthier alternatives for preferred foods into the diet. ● Emphasized the need to assess psychological factors (e.g., depression, anxiety) underlying a lack of motivation.	
7.	A 65-year-old patient attending cardiac rehabilitation is on long-term beta-blocker therapy, making it difficult to assess their target heart rate accurately. What measures can be taken to ensure the safety and effectiveness of their exercise regimen?	Compatible – ● Communication with Healthcare Professionals: Highlighted the importance of individualizing the exercise program based on the beta-blocker dosage and the patient's overall condition. ● HRR: Emphasized the use of heart rate reserve as a target for exercise.	
8.	A 70-year-old patient expresses unwillingness to participate in group exercises during cardiac rehabilitation. How can an individualized exercise plan be designed, and what steps can be taken to address the lack of social interaction?	Compatible	
9.	During a cardiac rehabilitation session, a 62-year-old patient asks, "What should I do if I feel chest pain during exercise?" How should this concern be addressed, and what steps should be implemented to manage such a situation effectively?	Compatible – ● Communication with Healthcare Professionals: Highlighted the importance of individualizing the exercise program based on the beta-blocker dosage and the patient's overall condition. ● Heart Rate Reserve: Emphasized the use of heart rate reserve as a target for exercise. ● Highlighted the importance of immediately stopping exercise and seeking medical assistance. ● Emphasized the necessity of a proper warm-up before exercise and monitoring exercise intensity. ● Stressed the importance of establishing an emergency protocol and communicating it to the patient.	
10.	A 55-year-old patient in a cardiac rehabilitation program reports difficulty quitting smoking despite understanding its health risks. What strategies and support programs can be implemented to help the patient successfully quit smoking and maintain this behavior over time?		Compatible but Insufficient – ● Pharmacological Therapy: The response did not mention medications such as bupropion or varenicline, which can help reduce nicotine cravings and increase smoking cessation success rates.
11.	A 68-year-old patient in a cardiac rehabilitation program, who has been advised to make dietary changes, asks, *"Why do I need to reduce the amount of salt in my diet?"* How should this question be answered, and how can the impact of salt consumption on cardiovascular health be effectively explained?	Compatible	
12.	A 72-year-old patient with heart failure asks during a consultation, *"How can cardiac rehabilitation help someone like me?"* How should the goals and benefits of cardiac rehabilitation be explained to this patient in a clear and encouraging manner?	Compatible	

Appendix 2 (cont). Evaluation of ChatGPT's Responses to Clinical Scenario-Based Questions on Cardiac Rehabilitation in Terms of Guideline Compliance

	Questions	Compatible with the Guidelines	Insufficient or Incompatible with the Guidelines
13.	A 50-year-old patient reports being unable to lose weight despite participating in a rehabilitation program. What additional recommendations can be provided to support weight loss in this situation?		Compatible but Insufficient – ● Advanced Medical Evaluation: The potential for hormonal imbalances (e.g., thyroid disorders) or other metabolic causes was not addressed. Additionally, the management of underlying conditions, such as insulin resistance, was not considered.
14.	A 45-year-old patient states that they cannot regularly attend the rehabilitation program due to a busy work schedule. What methods can be recommended to improve the patient's adherence to the program in this situation?	Compatible	
15.	A 60-year-old patient in a cardiac rehabilitation program reports experiencing muscle soreness and fatigue after exercise sessions. What strategies and recommendations can be offered to address these symptoms and ensure continued participation in the program?		Compatible but Insufficient – ● Overload Warning: The potential effects of overexertion during exercise (muscle damage, lactic acid buildup) were not addressed.
16.	A 68-year-old patient reports consistently elevated blood pressure during exercise. What evaluations should be conducted, and how should this condition be managed?	Compatible	
17.	A 55-year-old patient with chronic obesity asks during a consultation, "How will losing weight improve my cardiovascular health?" How should this question be addressed, and how can the positive effects of weight loss on heart health be explained clearly and effectively?	Compatible	
18.	A 60-year-old patient attending cardiac rehabilitation asks, "Besides aerobic exercises, what other types of exercises can benefit my heart health?" How should this question be answered, and what alternative exercise options should be recommended?	Compatible	
19.	A 60-year-old patient with a history of diabetes and hypertension reports experiencing frequent dizziness during cardiac rehabilitation sessions. What steps should be taken to address this issue, and how can the potential causes of dizziness be explained to the patient?		Compatible but Insufficient – ● Medication Management: The potential side effects of the patient's medications (e.g., antihypertensive agents) were not evaluated, nor was the need for dose adjustments to prevent dizziness emphasized.
20.	A 60-year-old male patient who underwent PCI after an AMI is participating in the second phase of a cardiac rehabilitation program. The patient reports experiencing muscle weakness and low exercise tolerance despite engaging in the standard aerobic exercises included in the program. Additionally, he occasionally experiences muscle cramps during exercise. His current medical therapy includes beta-blockers, angiotensin-converting enzyme inhibitors, and statins. He expresses concerns and asks, "How can I make my exercise program more effective?" How should the exercise program be individualized for this patient with muscle weakness and low exercise tolerance, and what strategies should be implemented to manage these symptoms?	Compatible – ● Attention to Statin Use: It was highlighted that statins could cause muscle cramps. ● Alternative Exercises: Resistance exercises aimed at strengthening muscles without overstraining them were mentioned.	



HHR, Heart rate reserve; ICDs, Implantable cardioverter-defibrillators, CRT, Cardiac resynchronization therapy; VAD, Ventricular assist device.