The Potential of Telemedicine in Rural Healthcare Delivery in Jordan: A Scoping Review

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ABSTRACT: **Objective**: Telemedicine, the use of technology in healthcare delivery, addresses health challenges in areas with limited access to health facilities and personnel, such as rural Jordan. This systematic review aims to comprehend the role of telemedicine in rural healthcare in Jordan by examining challenges, opportunities, best practices, and guidelines for successful implementation. **Material and Methods**: This review encompasses articles published between 2019 and 2024, focusing on the viability of telemedicine in Jordan's rural areas. The sources accessed included PubMed, Scopus, and ProQuest, utilizing keywords like "telemedicine," "rural healthcare," "Jordan," "barriers," and "facilitators." Thirty-seven articles were found, and twelve were included for the study. Additionally, three interviews were conducted with experts from the Nursing Supreme Council in Jordan to augment the data. Data analysis produced three primary themes: challenges to telemedicine, factors supporting its adoption, and measures for successful implementation. **Results**: The review identified potential difficulties, including technological constraints, legal concerns, and organizational culture. Key enablers included robust technological support, political endorsement, and comprehensive training for healthcare professionals. Strategic recommendations to improve telemedicine encompass enhancing internet access, addressing legal concerns, raising awareness, and involving key stakeholders in the implementation. **Conclusion**: Telemedicine holds promise for enhancing healthcare in rural Jordan by surmounting barriers and leveraging enablers. Systematic approaches, infrastructure enhancements, policy revisions, and augmented training can contribute to narrowing health disparities in rural areas.

INTRODUCTION

Telemedicine, characterized by the use of technology to deliver healthcare services remotely, has garnered significant attention over the years [1]. The concept dates back to the early twentieth century, with the first documented instance being the transmission of an ECG signal via telephone in 1906 [2]. Subsequent decades witnessed substantial growth in telemedicine, aided by advancements in internet and telecommunication technologies [2]. Notably, NASA utilized telemedicine as early as the 1960s to monitor the health of astronauts during space missions. The establishment of telemedicine clinics, such as the Massachusetts General Hospital clinic, further emphasized the potential of telemedicine in bridging geographical healthcare gaps [3]. This historical progression strongly indicates the transformative capability of telemedicine in revolutionizing the healthcare system and overcoming geographical barriers.

Telemedicine offers distinct advantages over traditional healthcare delivery methods, particularly in terms of accessibility, quality, and cost efficiency. Through real-time communication, remote patient monitoring, and sharing of medical data, telemedicine enhances healthcare provision, especially in remote areas. Specialized fields like teledermatology and teleradiology have demonstrated high patient satisfaction and diagnostic accuracy, with teledermatology exhibiting a 98% diagnostic sensitivity for skin cancer [4]. Additionally, teleophthalmology has proven beneficial in screening for diabetic retinopathy, addressing prevalent health concerns in regions like the Middle East [4]. The COVID-19 pandemic further underscored the advantages of telemedicine, prompting the transfer of outpatient care to virtual platforms in countries such as the USA and the UK [5].

The pressing need for telemedicine is particularly evident in rural areas, where its mechanisms are essential. Remote populations often face challenges in accessing healthcare facilities, a shortage of healthcare providers, and financial constraints. Telemedicine addresses these issues by enabling patients to consult healthcare professionals from the comfort of their homes, saving time and energy and ensuring timely treatment. In the Middle East and North Africa (MENA) region, telemedicine has played an instrumental role in delivering healthcare services to rural areas and improving the overall quality of care for patients [5-7].

Extensive research demonstrates the significant impact of telemedicine in facilitating chronic disease management, trauma care, and mental health treatment in rural areas, leading to

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improved health outcomes and patient satisfaction [8]. Jordan has recognized the pivotal role of telemedicine in enhancing healthcare outcomes, especially in rural areas, with the Ministry of Health spearheading efforts to provide telemedicine services, including telecardiology, teledermatology, and telenephrology. These initiatives have demonstrated a high level of effectiveness, with diagnosis rates ranging from 43.2% to 71.1% and treatment plan effectiveness ranging from 62.5% to 77.3% [9]. A pilot telemedicine project during the COVID-19 pandemic in Jordan highlighted the potential for telemedicine to deliver routine primary healthcare services without overwhelming healthcare facilities [5, 10-11].

Despite the potential of telemedicine to transform rural healthcare in Jordan, several challenges hinder its implementation. These include inadequate ICT infrastructure, high technology costs, lack of clear governance policies, concerns about data privacy, and resistance from healthcare providers due to increased workload and fear of errors [12-14]. Additionally, limited public understanding of telemedicine, despite positive impressions, further slows adoption. To address these barriers, solutions such as legal frameworks for data security, improved internet infrastructure, healthcare worker training, and public education campaigns are necessary. Governmental support and funding, along with user-centered telemedicine platforms, could enhance telemedicine's integration and success in rural Jordan.

Purpose of study: The aim of this review is to identify the potential of telemedicine in rural Jordan by examining barriers and facilitators, and providing best strategies and recommendations for effective implementation.

MATERIALS AND METHODS

A scoping approach was used in order to provide a clear and detailed reporting of the findings. The electronic databases, such as PubMed, Scopus, and ProQuest Medical Collection, were searched for the relevant studies that have been published in the years 2019 to 2024. The search keywords and Medical Subject Headings (MeSH) included telemedicine AND rural healthcare AND barriers AND enablers AND Jordan. Inclusion criteria were the studies exploring the possibility of telemedicine intervention in rural Jordan, considering the challenges and enablers, as well as best practices and recommendations for successful implementation. Studies of all types of designs were considered and articles had to be published in English and peer reviewed, see Table 1 for further details about search methodology.

In total, the first filter resulted in 37 articles. Applying the inclusion criteria narrowed it down to 12 articles for the final review process. These articles were reviewed, and data extraction was conducted, see Figure 1. In order to support the data, three interviews were carried out with three experienced PhD holders working at the Nursing Supreme Council in Jordan.

After summarizing all included studies in a table as presented in Table 2, data analysis was conducted to generate three major themes in this literature review. These themes were: challenges that limit the application of telemedicine in rural Jordan, factors that may boost the application and efficiency of telemedicine in these areas, and practical suggestions and recommendations for the effective application of telemedicine for the improvement of healthcare delivery in the rural regions of Jordan. These themes were integrated to offer policy recommendations and support telemedicine practice in rural Jordan to policymakers, healthcare officials and other relevant stakeholders.

RESULTS AND DISCUSSION

Barriers hindering the implementation of telemedicine in rural Jordan: Although telemedicine presents several favorable attributes, its implementation and utilization in rural Jordan encounter significant challenges. Foremost among these impediments are technological constraints characteristic of many rural populations. Low broadband penetration in several Jordanian areas significantly hampers the proper functionality of telemedicine applications. Remarkably, rural areas in Jordan exhibit approximately 67% internet usage, a notably lower rate compared to urban areas, as reported by the World Bank [15]. This technological disparity undermines the efficacy and implementation of telemedicine initiatives. Additionally, certain rural regions lack adequate broadband connectivity and suitable telemedicine devices, as noted by Prof. Khaled Suleiman, thus posing a significant constraint to adopting telemedicine interventions [16].

Another substantial hindrance involves regulatory and legal barriers. The absence of clearly defined and coherent telemedicine rules and guidelines results in ambiguity and confusion regarding its application. This is compounded by concerns about patient privacy and health information security, both crucial determinants of telemedicine service acceptance. Abouzid et al. (2022) have identified that inadequate and ambiguous frameworks have failed to provide clear guidance on telemedicine usage and related issues, such as patient data privacy and security, further complicating the formulation of a robust legal framework for telemedicine, which is imperative for ensuring patient information security and telehealth service efficiency [4].

Furthermore, resistance to change among healthcare providers and patients poses another significant obstacle. Telemedicine is not widely recognized among many healthcare professionals and patients in Jordan, leading to doubts about its utility. Such reluctance may stem from a preference for conventional face-to-face consultations. Dr. Salah has highlighted the lack of staff training, emphasizing the necessity for continuous training to enable medical staff to utilize technologies and support patients through telemedicine. This observation aligns with the findings of Khasawneh et al. (2023), which indicate that healthcare providers' knowledge and perception of the service influence their willingness to embrace telehealth services [12]. Notably, limited knowledge about telemedicine technologies significantly curtails their adoption and usage—only 52% of healthcare providers exhibit familiarity with and trust in telemedicine technologies, as indicated in the study.

Moreover, numerous rural healthcare centers need more telecommunication facilities to support telemedicine. The absence of fundamental telemedicine equipment and dependable internet connectivity significantly hinders the sustainable development of telemedicine. Prof. Hani Al Nawafleh has identified challenges such as internet disruptions, limited internet coverage in rural areas, and the need for resources such as LCDs to strengthen telemedicine practice. Subsequently, a survey by El-Halabi et al., has revealed that a mere 35% of Jordan's rural health facilities possess the necessary telemedicine infrastructure [9] especially where the patients mostly unaware about the utilizing the primary healthcare resources [10,11].

The sustainability of telemedicine initiatives also poses a valid concern. Long-term funding and support are indispensable for sustaining and advancing telemedicine services. Dr. Salah has pinpointed funding instability as a critical issue, with a study by Saifan et al. (2022) affirming that a meager 45% of telemedicine projects maintain sustainable funding post-pilot phase [17].

Facilitators enhancing the adoption and effectiveness of telemedicine in rural Jordan: The successful integration and efficacy of telemedicine in rural Jordan can be attributed to several key factors that serve to surmount existing barriers and enhance healthcare delivery. These factors include technology, government support, training and education, and public

perception, all of which contribute to creating a conducive environment for the implementation of telemedicine.

Technology and Infrastructure: The success of telemedicine hinges upon a reliable internet connection and user-friendly telemedicine applications. Both patients and physicians must have easy access to stable internet connectivity for telemedicine applications to be effective. The Jordanian government has prioritized improving digital connectivity, with internet access currently at 89% across the country, although discrepancies persist between urban and rural areas [9].

Government Assistance and Policies: Government backing is crucial for establishing a robust framework for telemedicine. The Ministry of Health in Jordan has actively promoted telemedicine services, particularly in the fields of telecardiology, teledermatology, and telenephrology in hospitals located in the northern and southern regions of Jordan [9]. Supportive policies are essential for the viability of telemedicine. Prof. Hani Al Nawafleh emphasized the need for active engagement of decision-makers and other stakeholders in advocating for equal access to conventional and telemedicine services. Furthermore, the establishment of legal guidelines addressing privacy, security, and reimbursement is vital to fortify the role of telemedicine in healthcare delivery.

Continuing Education and Training for Health Care Personnel: Telemedicine technologies necessitate comprehensive training for healthcare providers, making training programs pivotal. Dr. Salah underscored the need for continuous training to enable medical staff to proficiently use technology and deliver appropriate care through telemedicine. Implementation of educational programs that familiarize healthcare providers with telemedicine systems and equip them to utilize these tools is imperative. Khasawneh et al. (2023) noted that healthcare providers who received training were more inclined to support and utilize telemedicine services [12].

Public Favorability and Acceptance: Public awareness and perception significantly influence the success of telemedicine. A study by Khasawneh et al. (2023) revealed that Jordanians exhibited positive attitudes toward telemedicine and expressed willingness to avail themselves of telehealth services if offered [12]. Similarly, logistic regression analysis from the same study demonstrated that individuals with higher summated capability scores were more inclined to utilize telehealth services ($p < 0.001$), indicating a correlation with the level of technological requirements and availability.

Interoperability with Current Healthcare Networks: The seamless integration of telemedicine with existing healthcare systems can facilitate its adoption. Telemedicine can complement conventional healthcare procedures, such as telecardiology and telenephrology, to ensure effective follow-ups and consultations, thereby enhancing patients' well-being and reducing the need for extensive travel. Prof. Suleiman emphasized that telemedicine enables patients to access and receive treatment from physicians at their homes or the nearest clinic without the hassle of traveling long distances to urban hospitals.

Cost-Effectiveness and Resource Optimization: Telemedicine presents a cost-effective healthcare delivery method, eliminating the need for patients to travel long distances to access healthcare facilities. A study by Shdaifat et al. (2022) demonstrated that pharmacist-led telemedicine counseling for pediatric asthma reduced parental wage loss from 55.44 JD to 39.51 JD (P<0.001) and decreased hospital burden cost from 85.64 JD to 40.88 JD (P<0.0001) [18]. These findings underscore the cost-saving potential of telemedicine, rendering it a viable solution for consumers and healthcare providers alike.

Community Participation and Stakeholder Engagement: Involving the community and engaging stakeholders in the planning and implementation process are critical for the success of telemedicine. Prof. Hani Al Nawafleh emphasized the importance of involving patients in telemedicine programs and engaging them in decision-making processes related to treatment and care, which significantly enhances acceptance. Moreover, collaboration with stakeholders such as government agencies, healthcare providers, and technology companies is essential for ensuring sustainable telemedicine project implementation.

Telemedicine Success Stories: Several studies have shed light on the successful implementation of telemedicine in Jordan. For instance, the telecardiology program in hospitals in the northern and southern regions of Jordan has facilitated precise and convenient patient follow-ups, particularly for individuals with heart diseases, resulting in improved patient outcomes and overall relief.

Strategic recommendations for successful integration of telemedicine into rural healthcare delivery in Jordan: The successful implementation of telemedicine in rural areas of Jordan requires thorough consideration of technological, infrastructure, educational, and policy solutions. Based on research and interviews, the following tactics and best practices are proposed to achieve this goal. enhance technological infrastructure reliable internet connectivity and user-friendly interfaces are vital for the success of telemedicine. With 89% internet penetration in Jordan, efforts should focus on increasing broadband access in rural areas to ensure basic technological support for telemedicine services. Also, government support and policy development establishing a comprehensive policy framework is essential for the successful operation of telemedicine. Policy challenges such as data privacy, security, and reimbursement need to be addressed to encourage adoption. Clear and specific policies will help improve the definition and quality of telemedicine services. Furthermore, training programs for healthcare providers continuous training for medical staff is crucial for the effective use of telemedicine technologies. Trained healthcare providers are more likely to incorporate telemedicine services appropriately, highlighting the importance of ongoing education in this area. In addition, community mobilization and education initiatives increasing social acceptance and awareness of telemedicine is crucial. Mass media campaigns and education initiatives should focus on promoting understanding of telemedicine, its benefits, and how to access services. Patient narratives and educational materials can also be effective tools for improving knowledge and attitudes.

Further, integration with existing healthcare systems Telemedicine should complement traditional healthcare delivery, not replace it. Integrating telemedicine with conventional healthcare systems, such as telecardiology and telenephrology solutions, can improve patient care by allowing for timely follow-ups and consultations without extensive travel. As well, financial and resource allocation sustained funding for telemedicine projects is essential for their success. Both the government and the private sector should ensure adequate financial resources for infrastructure, training, and maintenance. Additionally, reimbursement rates for healthcare providers using telemedicine technology can promote its adoption.

Another suggestion is removing legal and regulatory constraints and addressing legal and regulatory issues, including telemedicine rules and patient privacy concerns, is critical. Establishing a clear legal framework defining the practice of telemedicine, liability, and patients' privacy rights is necessary for its effective implementation. 8. Building on Pilot Programs and Success Stories Successful pilot projects, such as telecardiology and teledermatology programs, can serve as examples to promote the adoption of telemedicine. These success stories can be used to gain stakeholder support and

increase the acceptance of telemedicine services. Another strategic recommendation is continuous monitoring and evaluation the application of key performance indicators and performance monitoring is crucial in evaluating the ongoing success and effectiveness of telemedicine programs. Regular monitoring and evaluation will help identify areas for improvement and ensure the continued success of telemedicine initiatives.

The current review presents a comprehensive overview which reveals a nuanced landscape featuring both challenges and prospects for the effective integration of telemedicine in rural Jordan. The synthesis of evidence from various studies and expert interviews substantiates the assertion that telemedicine holds potential for addressing healthcare deficiencies in the targeted regions.

Among the primary obstacles identified is the inadequate technological infrastructure and communication systems prevalent in most rural areas. Many regions lack sufficient internet connectivity and requisite equipment to facilitate telemedicine. This was further emphasized by Prof. Hani Al Nawafleh, who highlighted challenges such as "internet disruptions and the need for resources like LCDs and other essential equipment."

Similarly, prior research conducted in diverse settings, including rural areas of the United States of America, underscores the crucial role of robust internet connectivity in effectively implementing telehealth services [19]. However, the implementation of telemedicine encounters challenges stemming from insufficient legal frameworks governing telemedicine services. Incomplete strategies addressing data confidentiality, security, and medico-legal concerns contribute to uncertainties surrounding healthcare providers and patients. This was underscored by El-Halabi et al. (2021), advocating for the establishment of a comprehensive legal framework to support telemedicine [9]. This finding is consistent with the study by Scott & Mars, (2015) and other international research, emphasizing the indispensability of legal frameworks in promoting the use of telemedicine [20].

Furthermore, the imperative for adequately training healthcare professionals is evident in this context. Dr. Salah also highlights the necessity of "continuous training for medical staff in utilizing telemedicine platforms." Similar training requisites have been identified across different regions, underscoring the need for ongoing training to enhance technology utilization among caregivers [21-23].

An additional critical issue pertains to the funding and resource commitment essential for sustaining telemedicine programs. Dr. Salah raised potential concerns regarding the sustainability and funding of telemedicine projects. The advocacy for strategic investment in technology and infrastructure to bolster the advancement of telehealth is supported by studies conducted in other low and middle-income countries.

Moreover, integrating telemedicine into existing frameworks of traditional healthcare delivery is essential. The analysis also discusses the successful implementation of telecardiology, teledermatology, and telenephrology services in Jordan, aiding in follow-up and consultations without necessitating travel [9]. This initiative aims to enhance healthcare resource utilization while simultaneously improving patient access to healthcare services. The integration of telemedicine requires continuity in service provision once implemented.

Other vital considerations for telemedicine encompass community engagement and awareness. According to Prof. Hani Al Nawafleh, patient interpretation and educational tools should be utilized to enhance awareness and acceptance of telemedicine. Public awareness campaigns should inform the population about the benefits of telemedicine and its accessibility. This aligns with successful utilization of telemedicine in other regions, highlighting the necessity of community support [23] and thus could minimize the violence especially in rural areas in Jordan [24].

Implications and recommendations: This research review revealed that telemedicine has enormous possibilities for improving the accessibility of healthcare in rural areas of Jordan as well as important challenges to overcome. To build on the advantages of adopting the telemedicine model, it is necessary to enhance the technological resources which include availability of adequate internet connection and pertinent digital facilities in dispersed areas. The guidelines provided to healthcare providers and patients should have clear frameworks of data safety, security, and medico-legal implications in order to develop trust and adherence. Healthcare givers require adequate resource training on digital practices and operations of the telemedicine platforms. Secondly, a consistent financial commitment and strategic approach to resource deployment is critical to the long-term viability of telemedicine projects. Telemedicine can complement current healthcare structures to enhance the efficiency of resources and positively impact patients' experiences to provide a continuity of care. Another factor is the education of the population through community mobilization and awareness on the relevance and availability of telemedicine services. These recommendations are in compliance with the international practices and serve as a guide for policymakers, healthcare professionals, and stakeholders in how to carry out the telemedicine in the rural areas of Jordan to enhance health care for the underserved communities. Finally, we acknowledge that telemedicine faces similar challenges in both rural and urban areas in Jordanian contexts and recognize the importance of considering these broader implications.

Table (1): Search methodology for database.

Databases	Search Time frame	Search Keywords/ MeSH Terms	Inclusion Criteria	Exclusion Criteria	Initial Search Results	Filtering Process	Final Articles for Review	Additional Data Collection	Data Analysis Themes	Outcome
PubMed, Scopus, ProQuest Medical Collection	2019 to 2024	Telemedicine AND rural healthcare AND barriers AND enablers AND Jordan	- Studies exploring telemedicine intervention in rural Jordan - Challenges, enablers, best practices, and recommendations for successful implementation - All study designs considered - Published in English - Peer-reviewed articles	- Studies not focused on rural Jordan or telemedicine - Articles not in English - Non-peer-reviewed literature	37 articles	Inclusion criteria applied to narrow down the search results	12 articles	Three interviews with experienced PhD holders from the Nursing Supreme Council in Jordan	- Challenges limiting telemedicine in rural Jordan - Factors boosting telemedicine efficiency - Practical suggestions and recommendations for telemedicine implementation	Policy recommendations for stakeholders to support telemedicine practice in rural Jordan

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Table (2): Characteristics of included studies.

Author(s)	Country	Aim	Design	Sample & Sample Size	Main Findings
El-Halabi et al.	Jordan	Assess the impact of telemedicine interventions in telecardiology, teledermatology, and telenephrology.	Case Study	Two hospitals, not specified	Successful diagnosis and treatment plans, cost and time savings, improved quality of life.
Obeidat & El-Salem	Jordan	Discuss the feasibility and necessity of a national telemedicine program in Jordan.	Editorial	Not specified	Telemedicine feasible and necessary, requires policy support and infrastructure.
Khasawneh et al.	Jordan	Explore public perceptions and barriers towards telehealth.	Cross-sectional	1,136 responses	Positive public perception but limited knowledge, influenced by internet and device access.
Saifan et al.	Jordan	Explore perspectives of patients and healthcare providers on telehealth in managing CVD.	Qualitative	24 participants	Telehealth aids in managing CVD, highlighted benefits during COVID-19.
Alarabyat et al.	Jordan	Explore barriers to effective telehealth use in CVD care.	Qualitative	24 healthcare professionals	Identified barriers like patient improper use, provider concerns, procedural faults.
Shdaifat et al.	Jordan	Evaluate the impact of pharmacist-led telemedicine on pediatric asthma management.	RCT	90 patients	Improved asthma control, reduced costs, high satisfaction.
Abu Farha et al.	Jordan	Assess community pharmacists' perceptions and readiness towards telepharmacy.	Cross-sectional	218 pharmacists	Positive perceptions, concerns about workload and error rates, readiness to implement.
Alkouri et al.	Jordan	Develop a telemedicine group educational program for heart failure patients.	Delphi Study	32 healthcare staff, 7 IT experts	Consensus on program structure, need for patient reminders and training.
Al-Rawashdeh et al.	Jordan	Examine factors influencing telemedicine acceptance in public healthcare.	Quantitative	320 respondents from three hospitals	Significant factors: policy, external suppliers, project team, management support.
Abu-Farha et al.	Jordan	Explore perception and willingness to use telepharmacy among the general population.	Cross-sectional	800 participants	Positive attitude towards telepharmacy, highlighted benefits and concerns.
Aufa et al.	Jordan	Assess feasibility, acceptance, and factors for telemedicine in rural areas.	Scoping Review	Articles from 2010-2022	Telemedicine enhances access, but requires overcoming technological and acceptance barriers.
Abouzid et al.	Middle East and North Africa	Review telemedicine applications, benefits, and challenges in the MENA region.	Literature Review	Articles from various sources	Telemedicine effective in multiple specialties, but faces infrastructural and legal challenges.

Strengths and limitations

The strength of this review is the vast integration of various types of sources that include empirical evidence and expert opinion which offers a broad perspective of the opportunity and barriers of telemedicine in rural Jordan. The use of recent studies and perspectives from stakeholders enhances the study and provides real-world recommendations for application. The review also has a few limitations: it only includes studies published in English, which can lead to missing non-English literature. Also, there is a considerable emphasis on the literature review and opinions from experts, which may lead to biases and does not consider the dynamics in telemedicine technology and policies, which could impact the external validity of the study in the long run.

CONCLUSION

The in-depth analysis highlights the considerable potential of telemedicine to transform healthcare in rural areas of Jordan. Its impact is evident in the improvement of access, quality, and continuity of care for non-communicable diseases (NCDs). The analysis identifies crucial drivers such as technological infrastructure, governmental support, and the education and training of healthcare personnel. At the same time, it acknowledges significant obstacles including technological constraints, regulatory limitations, and resistance to change. Effective integration strategies involve enhancing internet accessibility, expanding legal frameworks, raising public awareness, and engaging stakeholders. Overcoming these challenges and implementing the identified facilitators could make telemedicine an essential component of Jordan's healthcare system, effectively addressing disparities in rural areas. In conclusion, despite the obstacles, the recommendations and best practices outlined in this analysis offer a strong strategic framework for advancing telemedicine in Jordan. A comparative analysis with other studies emphasizes the widespread prevalence of these challenges and the potential for collaborative efforts to address them in diverse contexts.

Disclosure Statement

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