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Exploring the Integration and Impact of Telemedicine in Emergency Medical Services: Advancing Prehospital Care Delivery and Paramedics Outcomes

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Abstract:

Background: Telemedicine, leveraging electronic communication technologies, has significantly evolved emergency medical services (EMS), enhancing prehospital care delivery and outcomes for paramedics. Its applications range from teleconsultation to telemonitoring and tele-education, offering promising advantages in efficiency, accessibility, and patient care.

Aim: This study explores the integration of telemedicine into EMS, emphasizing its impact on prehospital care delivery, paramedics' outcomes, and healthcare resource optimization.

Methods: The study synthesizes findings from multiple telemedicine applications in EMS, including its use in managing strokes, myocardial infarctions, and air medical transport. It also examines alternative EMS practices like treat-in-place models and community paramedicine.

Results: Telemedicine has demonstrated improvements in stroke and myocardial infarction management, reducing critical treatment times and mortality rates. In air medical transport, telemedicine has cut unnecessary transfers, saving costs and enhancing safety. Community paramedicine and treat-in-place models have efficiently redirected patients to appropriate care settings, mitigating ambulance and emergency department burdens. Telemonitoring and tele-education have further strengthened EMS by enabling real-time data transmission, skill retention, and training in complex procedures.

Conclusion: Telemedicine's integration into EMS offers transformative potential, from reducing healthcare costs and improving patient outcomes to addressing staffing shortages and operational inefficiencies. However, challenges such as data privacy, interoperability, and the need for standardized protocols remain.

Keywords: telemedicine, emergency medical services, prehospital care, paramedics, telemonitoring, tele-education, teleconsultation.

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Introduction:

Telemedicine refers to the application of electronic communication technologies to facilitate the remote exchange of medical information [1]. The field of Emergency Medical Services (EMS) has evolved alongside telemedicine, beginning with the use of radios for medical supervision and electrocardiogram

(ECG) transmissions. While these methods remain foundational, modern EMS systems have expanded to incorporate voice and video technologies for transmitting patient information [2]. The transmission can occur in real-time or asynchronously, depending on the context and clinical requirements. The data exchanged may involve interactions between an EMS clinician and a medical expert, such as a physician or subspecialist, or between a patient and a healthcare provider [3]. The integration of telemedicine into EMS offers numerous advantages, including immediate access to specialized expertise, cost reduction, and minimizing unnecessary patient transports.

Telemedicine is generally divided into three distinct categories: teleconsultation, tele-education, and telemonitoring [3]. Teleconsultation entails direct interaction between a healthcare provider and a patient, often used to obtain second opinions, consult specialists, determine alternative dispositions from the scene, or deliver early hospital-grade care to patients in remote locations with extended transport times. This capability is particularly valuable in enhancing the quality of care for individuals in underserved areas. Tele-education leverages telecommunication technologies to train and educate healthcare professionals, such as paramedics and emergency medical technicians (EMTs). This modality allows for the acquisition of new skills, the provision of ongoing professional development, and mentorship for novice practitioners. Tele-education can be conducted in active clinical scenarios or through traditional instructional settings, thereby broadening its applicability. Lastly, telemonitoring focuses on the remote surveillance of patients' health metrics. This method enables continuous monitoring of vital signs and the provision of medication reminders, fostering better compliance and outcomes. Telemonitoring is integral to innovative care models such as community paramedicine and hospital-at-home programs. These programs illustrate the capacity of telemedicine to extend the reach and impact of EMS, bridging gaps in care delivery and optimizing resource utilization.

Issues of Concern: Telemedicine Applications in Stroke, Myocardial Infarctions, and Air Medical Transport

Teleconsultation remains a fundamental application of telemedicine in EMS, particularly when clinicians seek guidance from medical command physicians. Historically conducted via voice communication, teleconsultation has been a cornerstone of EMS practice since its inception. The advent of video communication has enabled real-time audiovisual interactions among EMS clinicians, patients, and physicians [4]. Although less commonly utilized than voice communication, the growing body of evidence supporting telemedicine is encouraging many systems to integrate audiovisual teleconsultation into standard practices. Research by Quadflieg et al demonstrated diagnostic concordance between on-scene physicians and teleconsulting physicians when compared to final hospital diagnoses, highlighting the reliability of teleconsultation [5].

One significant telemedicine application is in the management of stroke, particularly through telestroke services. While telestroke is widely used in emergency departments [6], its prehospital implementation varies in sensitivity and feasibility. Studies have shown that teleconsultation enables earlier evaluation by neurologists, facilitating timely treatment for stroke patients [6][7][8]. However, challenges such as inconsistent teleconsultation access remain; in some instances, EMS clinicians only succeeded in reaching consultants 50% of the time. While it is uncertain whether telestroke surpasses traditional EMS practices—such as trained clinicians using stroke assessments and directing patients to appropriate facilities—its impact is notable. For example, research by Bilotta et al revealed that telehealth consultations reduced door-to-computed tomography times for suspected stroke patients by five minutes, a critical factor in maintaining the thrombolytic window [9]. Alternative models, such as EMS stroke response units equipped with neurologists and CT scanners, have also been explored, though their outcome data remain inconclusive [10][11][12][13].

Telemedicine has also enhanced the management of ST-Elevation Myocardial Infarctions (STEMI), particularly for patients in remote locations. By enabling the prehospital use of fibrinolytic therapy, telemedicine facilitates timely treatment while ensuring appropriate patient selection through expert consultation [14][15][16][17]. The transmission of prehospital 12-lead ECGs to medical command

physicians and interventional cardiologists expedites the activation of catheterization labs, thereby reducing treatment times. One European study reported that telemedicine enabled treatment within 90 minutes of first medical contact, compared to a 42% longer door-to-balloon time for patients without teleconsultation [19]. Additionally, telemedicine reduced time to treatment by an hour and decreased one-year mortality rates in STEMI patients [20].

In the domain of air medical transport, telemedicine offers a solution to concerns about overutilization and associated costs. Air transport, while vital to EMS systems, is often employed for patients with minor or non-critical injuries, leading to unnecessary expenses and risks [21]. Telemedicine allows physicians to remotely assess patients, ensuring air transport is reserved for those who genuinely require it. A study in Taiwan demonstrated a 36.2% reduction in air transport utilization through video telemedicine, saving nearly half a million dollars [25]. Similar findings were reported for burn patients, with nearly 20% deemed treatable at the sending facility [26]. Additionally, research by Bergreath et al showed that the implementation of a comprehensive prehospital telemedicine system nearly halved helicopter EMS use [27]. These findings underscore the potential of telemedicine to improve cost-efficiency and enhance the safety of both patients and air medical crews.

Refusal of Medical Care, Treatment in Place, and Alternate Destination Choices

In the United States, EMS clinicians frequently seek the guidance of medical command physicians when patients refuse medical care or request to be released following on-scene treatment. Research indicates that patients are more likely to agree to hospital transport when they can directly communicate with a physician [28][29]. Integrating video into these interactions could enhance the decision-making process, foster a stronger therapeutic alliance between patients and physicians, and promote more informed choices [30][31].

Several systems have begun piloting "treat-in-place" models to address minor complaints that can be resolved at the scene with the assistance of a physician via telemedicine. For instance, the Regional Emergency Medical Services Council of New York City has established inclusion criteria for 911 patients eligible for telemedicine visits, including conditions such as asymptomatic hypertension, dysuria, toothache, and joint pain. A notable example of this approach is Houston's Emergency Telehealth and Navigation (ETHAN) program, which aims to redirect patients with primary care needs or minor illnesses away from emergency departments. During its first year, the ETHAN program achieved a 56% reduction in ambulance transports and a 44-minute decrease in turnaround times, enabling ambulances to return to service more quickly [32]. Varughese et al reported a 67% reduction in transports, with respiratory complaints being the most frequently avoided transports [33]. Importantly, neither study observed an increase in prehospital intervals due to telemedicine use. Additionally, the Center for Medicare & Medicaid Services has been piloting reimbursement models for alternate destination transports and treat-in-place services to encourage innovation, particularly as EMS agencies contend with staffing shortages, growing call volumes, and ambulance offload delays at emergency departments.

Community paramedicine represents a non-traditional EMS approach, integrating EMTs and paramedics into the broader healthcare system to address specific community needs [34]. These pilot programs focus on dispatching EMTs and paramedics to non-urgent calls that do not require immediate, life-sustaining intervention. The objectives include identifying potential social service interventions, arranging alternative transport modes, providing treatment at home, or referring patients to non-emergency department facilities [35]. For example, a visiting doctors program in New York City employed a non-911 ambulance to support on-call physicians. In this model, when a patient contacts the on-call doctor, the physician may dispatch a community paramedicine ambulance to perform physical assessments and establish real-time telemedicine connections [36]. However, no standardized protocols currently exist for these programs, and additional evidence is required to validate their safety and efficacy. Medical oversight, often conducted remotely, is critical for these programs, offering significant opportunities for research into telemedicine's role in supporting community paramedicine initiatives [37].

Telemonitoring

Telemonitoring involves the remote monitoring of patients' medical data through advanced computerized technology [38]. This method is increasingly employed across diverse settings, such as homes, hospitals, and ambulances. In the prehospital context, telemonitoring facilitates the transmission of critical data, including electrocardiograms (ECGs), vital signs, and other essential medical information, directly to the receiving hospital [39][40][41]. This capability is particularly transformative in enhancing community paramedicine programs and hospital-at-home initiatives. By enabling oversight of multiple patients simultaneously, telemonitoring optimizes resource allocation and patient care. When abnormal vital signs are detected by telemonitoring systems, they can prompt an immediate prehospital response, ensuring timely intervention and treatment.

The use of telemonitoring in ambulatory settings enhances continuity of care by integrating patient data into broader healthcare networks. This integration supports not only the diagnosis and treatment process but also the ongoing monitoring of chronic conditions. Telemonitoring systems can leverage artificial intelligence and machine learning algorithms to identify patterns and predict potential health crises, providing an additional layer of precision to prehospital care. Moreover, these systems facilitate enhanced communication between healthcare providers and EMS personnel, ensuring that patients receive care aligned with their specific medical needs. The evolving applications of telemonitoring underscore its potential to transform emergency medical services by reducing delays, improving diagnostic accuracy, and enhancing patient outcomes. However, its widespread adoption requires addressing challenges related to data privacy, interoperability, and the standardization of protocols to ensure safe and effective implementation across diverse healthcare systems.

Tele-education

Tele-education, a subset of telemedicine, enables remote teaching and training by healthcare providers. This approach has gained significant traction in various healthcare fields, including emergency medicine and EMS settings. Tele-education addresses a critical challenge in EMS: the need to maintain proficiency in high-risk, low-frequency procedures. Such procedures, which paramedics rarely perform, are prone to skill degradation without continuous training. Tele-education mitigates these risks by providing remote learning opportunities and real-time guidance during clinical procedures.

Airway management is one such high-risk, low-frequency skill that benefits greatly from tele-education. Paramedics often have limited opportunities to perform intubation in prehospital settings, which can result in diminished proficiency. Research has demonstrated that paramedics who receive real-time, remote assistance during intubation achieve higher success rates compared to those without such support [42][43]. Despite the challenges of transmitting high-quality video and audio data in real-time, tele-education also offers asynchronous training options to help paramedics refine their intubation skills remotely.

Point-of-care ultrasound (POCUS) is another valuable tool for emergency medicine that tele-education supports effectively. While increasingly introduced into prehospital care, POCUS is highly operator-dependent, requiring specialized training to ensure accurate diagnosis and procedural assistance. Without adequate training, EMS clinicians may underdiagnose critical conditions or misinterpret findings. Telemedicine can enhance the accuracy of POCUS in prehospital scenarios by enabling remote physicians to provide real-time guidance to EMS personnel. Studies have shown that remote guidance improves the acquisition and interpretation of ultrasound images, facilitating better diagnostic and treatment outcomes [46]. For instance, a study conducted in Taiwan demonstrated that telemedicine-assisted POCUS not only improved diagnostic accuracy but also enabled pre-notification to trauma centers, optimizing emergency care workflows [47]. By integrating tele-education with clinical practice, EMS systems can elevate their standard of care, enhance procedural success, and foster a culture of continuous professional development.

Telemedicine in Special Environments

The COVID-19 pandemic introduced unprecedented challenges to healthcare systems, necessitating innovative approaches such as the expanded use of telemedicine across various healthcare settings, including prehospital care. Telemedicine proved instrumental during the pandemic by enabling healthcare delivery while minimizing physical contact, thereby reducing clinician exposure to infection and conserving personal protective equipment. In England, telemedicine was effectively utilized for triage from dispatch centers, allowing safe management of low-acuity cases without requiring in-person assessments [48]. Such systems, when successfully implemented, could play a critical role in managing future pandemics, demonstrating the long-term utility of telemedicine in public health emergencies. Military medicine has historically led advancements in remote paramedical care, driven by the demands of battlefield environments. Combat scenarios often involve patients in remote or inaccessible locations, far from definitive care, making telemedicine consultation a necessity. In the civilian sector, these principles are applied to tactical emergency medical services (EMS), where potential patients may be trapped and challenging to extricate. Similarly, wilderness EMS systems rely heavily on telemedicine for real-time specialist consultations and the efficient allocation of limited resources [49]. Without telemedicine infrastructure, patients in such environments might face delays of hours or even days before receiving expert input, significantly impacting outcomes.

Telemedicine also demonstrates substantial potential in mass casualty incidents (MCIs), addressing the limitations of traditional paper-based triage tags. These tags often pose challenges such as illegible handwriting, difficulties in updating patient information, and the repeated collection of the same data as patients progress through disaster medical systems [50]. Bar-coded triage tags offer a more efficient alternative by electronically storing and transmitting patient information wirelessly to downstream medical facilities. This facilitates pre-notification, enabling receiving hospitals to prepare for incoming patients and maintain accurate counts of casualties. A study on the use of bar-coded triage tags revealed their superior efficiency compared to conventional methods [51]. Future developments may include telemonitoring technologies for MCIs, enabling rapid remote re-triage of patients to further enhance disaster response capabilities. Through its adaptability and efficiency, telemedicine continues to transform healthcare delivery in challenging environments, ensuring timely, accurate, and effective care in situations where conventional medical support is limited or delayed.

Clinical Significance

The future of telemedicine in emergency medical services (EMS) holds significant potential, yet further research is required to determine its cost-effectiveness and its influence on patient outcomes [52]. Telemedicine applications in EMS include patient monitoring, immediate access to specialists, and assistance with destination decisions and treatment-in-place protocols. While the feasibility of telemedicine has been explored, gaps remain in understanding its clinical impact. For instance, although telemonitoring has proven practical, there is insufficient evidence regarding its ability to prevent patient deterioration during transport. Similarly, there is a lack of data on whether teleconsultations with neurologists enhance stroke patient outcomes, such as mortality rates or functional status. Moreover, the diversity of prehospital telemedicine solutions creates considerable heterogeneity, complicating comparisons across studies [53]. Ongoing clinical trials aim to provide higher-quality evidence to address these gaps. One such trial conducted in Germany evaluated patient outcomes when paramedics were paired with a tele-EMS physician compared to scenarios involving an on-scene EMS physician. This randomized clinical trial demonstrated non-inferiority in patient outcomes between the two groups, including adverse events such as medication-induced allergic reactions [54][55]. These findings suggest that tele-EMS physicians can deliver care comparable to their on-scene counterparts, further validating the role of telemedicine in EMS.

However, implementing a prehospital telemedicine program faces several barriers. These include challenges in gaining paramedic support, financial constraints, patient expectations, regulatory restrictions, technology limitations, and access to physician resources. Significant initial investments are

required for purchasing and maintaining communication interfaces, as well as training personnel. Moreover, traditional paramedicine and EMT curricula often do not emphasize the skills necessary for discharging patients on-site or forgoing transport [56].

Physician resources pose additional challenges, encompassing not only the staffing of telemedicine providers but also the development of quality assurance programs and updates to prehospital protocols to facilitate telemedicine consultations. Regulatory frameworks may hinder EMS clinicians from initiating telemedicine encounters or providing treatment-in-place options. Financial considerations also play a crucial role, as the replacement of EMS transport by telemedicine encounters could lead to lost revenue opportunities. This necessitates establishing reimbursement agreements with commercial insurers and government agencies such as the Centers for Medicare and Medicaid Services to ensure appropriate compensation for telemedicine services [57]. Addressing patient expectations is another critical component. Public awareness campaigns could help foster community acceptance of telemedicine by emphasizing the benefits and improvements these services bring to care delivery. Despite being in its early stages, prehospital telemedicine holds considerable promise for enhancing patient outcomes and reducing healthcare costs, provided these challenges are systematically addressed.

Telemedicine and Paramedics:

Telemedicine has emerged as a transformative innovation in emergency medical services (EMS), significantly enhancing the scope and efficacy of paramedic care. It facilitates remote consultations, enables real-time patient monitoring, and augments the decision-making capacity of paramedics in prehospital settings. This integration of telemedicine into paramedic workflows has demonstrated immense potential to improve patient outcomes, optimize resource utilization, and mitigate barriers associated with traditional EMS practices.

Enhanced Decision-Making and Remote Consultation

Paramedics often face critical decisions in the field, particularly when dealing with time-sensitive conditions such as cardiac arrests, strokes, or trauma. Telemedicine empowers paramedics by providing immediate access to specialists who can guide diagnosis and treatment. For instance, a neurologist can remotely assess a suspected stroke patient via teleconsultation, offering insights into whether thrombolytic therapy is appropriate, thus saving critical time and reducing the risk of long-term disability. The ability to consult specialists remotely ensures that patients receive expert-level care without the need for direct physician presence at the scene. This capability is particularly relevant in rural or underserved areas where access to medical expertise is limited. By connecting paramedics with remote physicians, telemedicine bridges geographical disparities, ensuring timely interventions that would otherwise be unavailable. This approach not only enhances care quality but also reduces unnecessary transports to hospitals, thereby alleviating the burden on emergency departments and optimizing EMS resources.

Real-Time Monitoring and Diagnostics

Telemedicine has also expanded the diagnostic capabilities of paramedics through real-time monitoring and data transmission. Devices that measure vital signs, electrocardiograms (ECGs), and other critical parameters can transmit data to remote physicians, allowing for a comprehensive assessment of the patient's condition. In cardiac emergencies, for example, the transmission of a 12-lead ECG from the ambulance to the receiving hospital enables the activation of catheterization labs before the patient's arrival, minimizing door-to-balloon time and improving outcomes for patients with acute myocardial infarction. Additionally, telemedicine facilitates advanced diagnostic tools such as point-of-care ultrasound (POCUS) in prehospital settings. While paramedics may lack the expertise to interpret ultrasound results independently, telemedicine allows remote guidance from experienced clinicians. Studies have demonstrated that this collaborative approach improves diagnostic accuracy for conditions like pneumothorax or internal bleeding, thereby enabling more precise and timely interventions.

Training and Skill Development

Telemedicine is not limited to patient care; it also plays a pivotal role in enhancing paramedic training and maintaining skill proficiency. High-risk, low-frequency procedures, such as intubation or advanced airway management, are critical in prehospital care but can lead to skill degradation due to infrequent practice. Through tele-education, paramedics can receive remote guidance and feedback from specialists during live clinical scenarios or simulated training sessions. Tele-education also enables asynchronous learning, where paramedics can access recorded sessions, tutorials, and case reviews at their convenience. This approach ensures that paramedics remain updated on the latest protocols and practices, contributing to continuous professional development. Furthermore, telemedicine platforms facilitate collaborative learning by connecting paramedics with their peers and mentors across different regions, fostering knowledge exchange and standardizing care practices.

Challenges in Telemedicine Implementation

Despite its numerous advantages, integrating telemedicine into paramedic care is not without challenges. One major barrier is the lack of standardized protocols and guidelines for telemedicine use in EMS. Variability in the availability of telemedicine infrastructure and differences in regional policies can hinder its widespread adoption. Regulatory issues, such as licensing requirements for physicians providing remote consultations, further complicate implementation. Financial constraints also pose significant obstacles. The initial investment required for telemedicine equipment, including communication interfaces, monitoring devices, and data transmission tools, can be substantial. Additionally, ongoing costs related to maintenance, personnel training, and software updates must be considered. Reimbursement models for telemedicine services in EMS remain underdeveloped, necessitating negotiations with insurance providers and government agencies to ensure sustainable funding. Paramedic acceptance and buy-in are also critical to the success of telemedicine programs. EMS clinicians must be adequately trained to use telemedicine tools and integrate them into their workflows. Resistance to change and apprehension about the potential loss of autonomy in decision-making may hinder adoption. Addressing these concerns through comprehensive training programs and demonstrating the value of telemedicine in improving patient outcomes can foster acceptance among paramedics.

Future Prospects

The future of telemedicine in paramedic care is promising, with advancements in technology poised to expand its applications further. Artificial intelligence (AI) and machine learning algorithms can enhance telemedicine by analyzing patient data in real time, providing paramedics with predictive insights and decision support. For example, AI-driven tools could identify patterns in ECG readings that signal impending cardiac events, enabling earlier interventions. Wearable devices and Internet of Things (IoT) technologies also hold potential for enhancing telemedicine in EMS. These innovations can provide continuous monitoring of patients during transport, transmitting critical data to receiving hospitals and enabling dynamic care adjustments. Moreover, telemedicine has the potential to revolutionize disaster response and mass casualty incidents (MCIs). By facilitating remote triage and resource allocation, telemedicine can improve efficiency and ensure that limited resources are directed where they are needed most. The integration of telemedicine into paramedic care during pandemics has already demonstrated its value in minimizing clinician exposure and conserving personal protective equipment, highlighting its adaptability to various crises. Telemedicine represents a paradigm shift in paramedic care, offering opportunities to enhance decision-making, diagnostics, training, and resource optimization. While challenges in implementation remain, the potential benefits far outweigh the barriers. With continued investment in technology, infrastructure, and training, telemedicine is set to become an integral component of prehospital care, improving outcomes for patients and redefining the role of paramedics in emergency medicine.

Conclusion:

The integration of telemedicine into EMS has redefined the landscape of prehospital care, providing unparalleled benefits across various domains. Its application in stroke and myocardial infarction

management has been instrumental in reducing treatment delays and improving patient outcomes. For instance, telestroke services enable early neurologist evaluation, ensuring timely interventions, while teleconsultation in myocardial infarctions facilitates rapid activation of catheterization labs and lowers mortality rates. Similarly, telemedicine's role in air medical transport highlights its potential to curtail unnecessary expenses and improve operational efficiency, reserving critical resources for genuinely urgent cases. Innovative models like treat-in-place and community paramedicine programs underscore telemedicine's capacity to transform EMS operations. These approaches have alleviated emergency department overcrowding, reduced ambulance turnaround times, and tailored care delivery to patients' specific needs. By incorporating telemonitoring, EMS systems can ensure continuous patient surveillance, optimize resource allocation, and proactively address medical emergencies, while tele-education sustains paramedics' proficiency in high-risk, low-frequency procedures, such as intubation and point-of-care ultrasound. Despite these advancements, challenges persist. Data privacy and security concerns, lack of standardized protocols, and technical limitations in real-time data transmission pose barriers to widespread telemedicine adoption. Moreover, achieving interoperability between telemedicine systems and existing healthcare networks is crucial for maximizing its potential. Addressing these issues requires robust policies, investment in technology infrastructure, and comprehensive training for EMS personnel. In conclusion, telemedicine represents a pivotal advancement in EMS, offering a strategic avenue to enhance prehospital care delivery, improve paramedic outcomes, and optimize healthcare resources. As EMS systems worldwide adopt telemedicine, ongoing research and innovation will be vital to overcoming implementation challenges, ensuring its safe, effective, and equitable integration into emergency medical care.

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استكشاف دمج وتأثير الطب عن بعد في خدمات الطوارئ.

الطبية: تعزيز تقديم الرعاية قبل دخول المستشفى وتحسين نتائج المسعفين

الملخص:

الخلفية :يعد الطب عن بعد، الذي يعتمد على تقنيات الاتصال الإلكتروني، تطورًا كبيرًا في خدمات الطوارئ الطبية(EMS) ، حيث أسهم في تحسين تقديم الرعاية قبل دخول المستشفى وتحسين نتائج المسعفين. تشمل تطبيقاته الاستشارات الطبية عن بعد والمراقبة والتعليم عن بعد، مما يوفر مزايا واعدة من حيث الكفاءة وسهولة الوصول وجودة الرعاية الصحية.

الهدف :تهدف هذه الدراسة إلى استكشاف دمج الطب عن بعد في خدمات الطوارئ الطبية، مع التركيز على تأثيره على تقديم الرعاية قبل دخول المستشفى، وتحسين نتائج المسعفين، وتعزيز استخدام الموارد الصحية.

الطرق :تستعرض الدراسة نتائج تطبيقات الطب عن بعد المتعددة في خدمات الطوارئ الطبية، بما في ذلك استخدامه في إدارة السكتات الدماغية، واحتشاء عضلة القلب، ونقل المرضى جواً. كما تناقش ممارسات بديلة مثل نماذج العلاج في الموقع والطب المجتمعي.

النتائج :أظهرت الطب عن بعد تحسنًا ملحوظًا في إدارة السكتات الدماغية واحتشاء عضلة القلب، حيث قلل من أوقات العلاج الحرجة ومعدلات الوفيات. وفي النقل الجوي الطبي، قللت الطب عن بعد من النقلات غير الضرورية، مما أسهم في توفير التكاليف وتعزيز السلامة. كما أثبتت نماذج الطب المجتمعي والعلاج في الموقع فعاليتها في توجيه المرضى نحو الرعاية المناسبة، مما قلل من العبء على سيارات الإسعاف وأقسام الطوارئ. علاوة على ذلك، عززت المراقبة والتعليم عن بعد خدمات الطوارئ من خلال تمكين نقل البيانات في الوقت الفعلي، والحفاظ على المهارات، والتدريب على الإجراءات المعقدة.

الخلاصة :يقدم دمج الطب عن بعد في خدمات الطوارئ الطبية إمكانات تحولية تشمل خفض التكاليف الصحية، وتحسين نتائج المرضى، ومعالجة نقص الكوادر، وحل المشكلات التشغيلية. ومع ذلك، تظل هناك تحديات مثل خصوصية البيانات، وقابلية التشغيل البيني، والحاجة إلى بروتوكولات موحدة.

الكلمات المفتاحية :الطب عن بعد، خدمات الطوارئ الطبية، الرعاية قبل دخول المستشفى، المسعفون، المراقبة عن بعد، التعليم عن بعد، الاستشارات عن بعد.