



Improving Communication Between Doctors and Patients in Medical Clinics by Using Modern Communication Technologies

¹ Almahmde, Abdullah Mana, ² Al Sharmah, Shalwan Ali, ³ Almuhamidhi, Ali Mana, ⁴ Al Khamsan, Mana Rashed, ⁵ Almurdif, Abdulrahman Hamad

¹Ministry of Health, Saudi Arabia, Aalmhmade@moh.gov.sa

²Ministry Health, Saudi Arabia, Saalsharmah@moh.gov.sa

³Ministry of Health, Saudi Arabia, aalmuhmidhi@moh.gov.sa

⁴Ministry of Health, Saudi Arabia, Mralkhomsan@moh.gov.as

⁵Ministry of Health, Saudi Arabia, ahalmurdif@moh.gov.sa

Received Date: September 14, 2022 Accepted Date: October 18, 2022 Published Date: November 07, 2022

ABSTRACT

Effective communication between doctors and patients is crucial for delivering quality healthcare and ensuring patient satisfaction. With the advancement of modern communication technologies, there is an opportunity to enhance communication channels in medical clinics. This article explores the utilization of modern communication technologies to enhance communication in medical clinics. The study aims to assess the effectiveness of these technologies, explore their benefits and challenges, and identify strategies for their successful implementation. The advancements discussed include telemedicine and virtual consultations, secure messaging and patient portals, remote monitoring and wearable devices, electronic health records (EHRs), patient education and information dissemination, as well as online appointment scheduling systems and automated reminders. By leveraging these technologies, medical clinics can improve efficiency, accessibility, and patient satisfaction, ultimately leading to better healthcare outcomes.

Key words: doctor-patient communication, modern communication technologies, medical clinics, telemedicine, patient portals, healthcare communication.

1- INTRODUCTION

Effective communication between doctors and patients is a cornerstone of successful healthcare delivery. It facilitates accurate diagnosis, proper treatment, and patient satisfaction [1]. In recent years, modern communication technologies have emerged as powerful tools that can significantly enhance communication between doctors and patients in medical clinics. This article aims to explore the benefits and possibilities of utilizing these technologies to improve doctor-patient interactions.

Traditional face-to-face consultations have long been the standard method of communication in medical clinics. However, advancements in communication technologies offer innovative approaches to bridge the gap between doctors and patients, particularly in situations where physical presence is not required or convenient [2]. By leveraging these modern communication technologies, medical clinics can overcome barriers such as geographical distance, limited accessibility, and time constraints, leading to improved healthcare outcomes and patient experiences.

The utilization of telemedicine and virtual consultations has revolutionized the way doctors and patients interact. Through video calls, audio calls, or secure messaging platforms, doctors can provide remote medical advice, discuss treatment plans, and address patient concerns [3]. This approach enhances accessibility, eliminates travel time and costs, and offers convenience for patients who may have limited mobility or live in remote areas.

Secure messaging and patient portals provide an efficient and confidential means of communication. Patients can ask non-urgent questions, request prescription refills, and receive test results through secure messaging platforms[4]. Doctors can respond at their convenience, reducing the need for unnecessary in-person appointments and optimizing communication efficiency. This not only saves time for both parties but also promotes patient engagement and satisfaction. Remote monitoring and wearable devices have transformed healthcare by enabling real-time tracking of patient health data. Doctors can remotely monitor vital signs, sleep patterns, physical activity, and other relevant parameters[5]. This data empowers doctors to personalize treatment plans and intervene promptly when necessary. Patients can report concerns or abnormalities in real-time, fostering ongoing communication and ensuring timely medical attention.

Electronic health records (EHRs) serve as centralized repositories of patient information. Accessible to doctors and patients alike, EHRs facilitate seamless communication and improve continuity of care. Doctors can access patient records,

review medical history, and make informed decisions. Patients can actively participate in their healthcare journey, access their own records, and ask relevant questions during consultations, leading to better-informed decision-making and improved patient satisfaction[6].

Modern communication technologies also provide opportunities for patient education and information dissemination. Doctors can share educational videos, interactive modules, and informative articles through digital platforms. Patients can access these resources at their convenience, empowering them to understand their conditions, make informed decisions, and actively engage in their own healthcare management.

Moreover, online appointment scheduling systems and automated reminders streamline the communication process between doctors and patients. Patients can easily book appointments through digital platforms, reducing administrative burdens and improving overall efficiency[7]. Automated reminders through SMS or email help patients stay organized and minimize the risk of missed appointments, ensuring better communication and timely care.

Finally, the utilization of modern communication technologies offers tremendous potential to enhance communication between doctors and patients in medical clinics. Telemedicine, secure messaging, remote monitoring, EHRs, patient education, and streamlined appointment systems all contribute to improved accessibility, efficiency, and patient satisfaction. By embracing these technologies, medical clinics can establish stronger doctor-patient relationships, deliver personalized care, and ultimately improve healthcare outcomes.

2- TELEMEDICINE AND VIRTUAL CONSULTATIONS

Telemedicine and virtual consultations have transformed the way doctors and patients communicate in medical clinics. These modern communication technologies offer numerous benefits for improving communication and enhancing the overall healthcare experience[8]. By utilizing telemedicine and virtual consultations, medical clinics can overcome barriers of distance, time, and accessibility, providing efficient and convenient healthcare services.

Telemedicine refers to the use of communication technologies to deliver remote healthcare services, allowing doctors and patients to connect virtually [3]. Virtual consultations, a key component of telemedicine, enable patients to receive medical advice and consultations without the need for in-person visits. The implementation of telemedicine and virtual consultations in medical clinics brings about various advantages:

- **Accessibility:** Telemedicine expands access to healthcare services, particularly for patients in remote or underserved areas [9]. It bridges the gap between patients and doctors, enabling them to connect regardless of geographical location.
- **Convenience and Flexibility:** Virtual consultations offer convenience and flexibility for both doctors and patients. Patients can schedule appointments at their convenience,

eliminating the need for travel and reducing waiting times [3]. Doctors can provide consultations outside regular clinic hours, accommodating patients' schedules and enhancing accessibility.

- **Time and Cost Savings:** Telemedicine reduces the time and costs associated with traveling to and from medical clinics. Patients can save on transportation expenses and minimize the time spent on commuting [10]. Additionally, virtual consultations can be more cost-effective compared to traditional in-person visits.
- **Continuity of Care:** Virtual consultations support ongoing healthcare management, allowing for follow-up appointments and monitoring of patients' conditions [9]. Doctors can review medical records and provide personalized care, ensuring continuity and consistency in treatment plans.
- **Timely Intervention:** Telemedicine enables prompt access to medical advice and intervention, particularly for urgent health concerns. Patients can connect with doctors quickly, leading to timely assessment and appropriate medical attention.
- **Efficient Communication:** Telemedicine platforms provide communication tools such as video calls, audio calls, and secure messaging [12]. These enable doctors and patients to communicate effectively, exchange medical information, and address patient queries in real-time.

Telemedicine and virtual consultations have revolutionized doctor-patient communication in medical clinics. By embracing these modern communication technologies, medical clinics can enhance accessibility, convenience, continuity of care, and communication efficiency. This ultimately leads to improved healthcare outcomes, patient satisfaction, and a patient-centered approach to healthcare delivery.

3- SECURE MESSAGING AND PATIENT PORTALS

Improving communication between doctors and patients is essential for effective healthcare delivery. Modern communication technologies can play a significant role in enhancing this communication while ensuring security and privacy. Two key technologies that can facilitate this process are secure messaging and patient portals [13].

Secure messaging allows doctors and patients to communicate directly through encrypted channels, ensuring that sensitive medical information remains confidential. It provides a secure platform for patients to ask questions, request prescription refills, or share updates on their health. Doctors can respond to these messages, provide advice, and address patient concerns in a timely manner [14]. By utilizing secure messaging, doctors and patients can engage in convenient and efficient

communication without the need for physical meetings or phone calls.

Patient portals are web-based platforms that give patients access to their medical records, test results, appointment schedules, and other relevant information. They also provide a space for patients to securely message their healthcare providers, access educational resources, and manage their healthcare preferences. Patient portals enable patients to take an active role in their healthcare by providing them with convenient access to their medical information and the ability to communicate with their doctors.

By implementing secure messaging and patient portals in medical clinics, several benefits can be realized[15]:

1. **Enhanced Communication:** Secure messaging enables timely and convenient communication between doctors and patients, promoting better care coordination and patient engagement. Patients can ask questions, seek clarifications, and provide updates, while doctors can respond promptly, resulting in improved overall communication.
2. **Convenience and Accessibility:** Secure messaging and patient portals eliminate the need for in-person visits or phone calls for routine inquiries. Patients can access their medical information, request prescription refills, or discuss non-urgent matters conveniently from their homes or workplaces, saving time and effort [16].
3. **Efficient Workflow:** Secure messaging allows doctors to efficiently manage patient inquiries, prioritize urgent matters, and allocate appropriate resources. It streamlines the communication process, reducing administrative burdens and freeing up valuable time for healthcare providers.
4. **Continuity of Care:** Secure messaging and patient portals facilitate continuous communication, ensuring that patients receive ongoing support and follow-up care. Doctors can monitor patient progress, provide guidance, and address concerns, leading to improved patient outcomes and satisfaction.
5. **Privacy and Security:** By utilizing secure communication channels and encryption protocols, the confidentiality of patient information is maintained. Patient portals often incorporate robust security measures to protect sensitive data, adhering to regulatory requirements and industry standards [17].

To implement secure messaging and patient portals effectively, medical clinics should consider factors such as user-friendly interfaces, integration with electronic health record systems, secure authentication mechanisms, and adherence to privacy regulations. Additionally, healthcare providers should educate patients about these technologies, their benefits, and how to use them appropriately.

By leveraging modern communication technologies like secure messaging and patient portals, medical clinics can bridge the communication gap between doctors and patients, resulting in improved patient care, increased engagement, and enhanced overall healthcare outcomes.

4- REMOTE MONITORING AND WEARABLE DEVICES

Improving communication between doctors and patients is crucial for effective healthcare, and modern communication technologies can greatly facilitate this process. One such technology that has gained significant traction is remote monitoring through wearable devices [18]. This approach enables doctors to gather real-time health data from patients, fostering continuous communication without the need for frequent physical visits or specific communication points.

Remote monitoring involves the use of wearable devices, such as smartwatches, fitness trackers, or medical sensors, which collect various health metrics and transmit the data to healthcare providers [18]. This technology allows doctors to monitor patients' vital signs, activity levels, sleep patterns, and other relevant health data remotely. By leveraging this continuous stream of information, doctors can proactively detect any abnormalities, track progress, and provide timely interventions when necessary.

By utilizing remote monitoring and wearable devices, the communication between doctors and patients can be improved in the following ways:

1. **Real-Time Data Sharing:** Patients wearing wearable devices can have their health data continuously transmitted to their doctors. This real-time data sharing enables doctors to have access to up-to-date information, providing a more accurate assessment of patients' health conditions.
2. **Proactive Interventions:** With remote monitoring, doctors can identify any concerning trends or deviations from normal health parameters promptly [5]. This allows for early intervention and preventive measures, potentially reducing the risk of complications and hospitalizations.
3. **Improved Patient Engagement:** Patients who actively participate in remote monitoring become more engaged in managing their own health [19]. The ability to track their progress and visualize their health data empowers patients and encourages them to take ownership of their well-being.
4. **Efficient Resource Allocation:** Remote monitoring reduces the need for frequent physical visits, which can be time-consuming and inconvenient for patients [19]. By leveraging wearable devices and remote communication, doctors can allocate their resources more efficiently, focusing on patients who require immediate attention while still monitoring others remotely.

5. **Enhanced Care Coordination:** Remote monitoring facilitates seamless communication and collaboration among healthcare providers. Different specialists involved in a patient's care can access and share relevant health data, leading to better care coordination and comprehensive treatment plans [19].

To implement remote monitoring effectively, medical clinics need to consider the following factors:

- **Selection of Appropriate Wearable Devices:** Choosing reliable and accurate wearable devices is crucial. The devices should be capable of capturing relevant health data, have good connectivity, and be user-friendly for patients.
- **Secure Data Transmission:** It is essential to ensure that the transmission of health data from wearable devices to healthcare providers occurs through secure and encrypted channels. Privacy and security measures should be in place to protect patients' sensitive information.
- **Integration with Health Information Systems:** The remote monitoring system should be seamlessly integrated with the clinic's health information systems, allowing doctors to access and analyze patient data efficiently [20]. Integration can streamline workflows and ensure data continuity.
- **Patient Education and Support:** Patients need to be educated about the proper use of wearable devices, data interpretation, and when to seek further medical assistance. Clear instructions and ongoing support should be provided to maximize the benefits of remote monitoring.

By leveraging modern communication technologies like remote monitoring and wearable devices, medical clinics can establish continuous communication channels with their patients. This approach enables doctors to monitor patient health remotely, intervene proactively, and improve overall healthcare outcomes while reducing the burden on both patients and healthcare providers.

5- ELECTRONIC HEALTH RECORDS (EHRs)

Effective communication between doctors and patients is essential for better healthcare outcomes. Electronic health records (EHRs) are a crucial component of modern communication technologies in medical clinics. However, the use of EHRs can also complicate interprofessional teamwork and coordination of patient care [21]. Physicians are concerned that EHRs negatively affect communication with patients [22]. Despite these challenges, EHRs hold great promise in enabling more efficient and effective healthcare service delivery [2].

Here are some ways that EHRs can be used to improve communication between doctors and patients in medical clinics:

1. **Facilitate patient-physician communication via electronic messaging:** The use of EHRs has the potential to facilitate patient-physician communication via electronic messaging [23]. This can enable patients to communicate with their doctors more easily and efficiently.
2. **Facilitate patient access to personal health information:** EHRs can also facilitate patient access to personal health information [23]. This can enable patients to be more informed about their health and to take a more active role in their healthcare.
3. **Use of EHRs in the examination room:** One way to enhance patient-centered communication and collaboration is by using EHRs in the examination room [23]. This can facilitate communication and data sharing between clinicians and patients, leading to better healthcare outcomes.
4. **Patient portals for EHRs:** Patient portals for EHRs can enable patients to communicate about health needs electronically, which is of great importance to both the patient and the clinician [22]. This can enable patients to communicate with their doctors more easily and efficiently.
5. **Multidisciplinary research:** Multidisciplinary research can help to enhance electronic communication between medical staff [21]. This can enable medical teams to use EHRs more effectively and efficiently.

To implement these technologies effectively and ensure seamless communication:

- **User-Friendly Interfaces:** Design intuitive and user-friendly interfaces for patient portals, secure messaging platforms, telehealth applications, and mobile applications. This promotes ease of use and encourages patient engagement.
- **Privacy and Security:** Implement robust security measures to protect patient data and ensure compliance with privacy regulations. Use encryption and authentication protocols to secure communication and maintain patient confidentiality.
- **Interoperability:** Foster interoperability between different systems to enable the exchange of health information seamlessly. This ensures that doctors have access to complete patient records, regardless of the EHR system or communication technology being used.
- **Education and Support:** Provide patients with educational resources and guidance on how to use the communication technologies effectively. Offer training to doctors and staff to optimize their use of EHRs and associated communication tools.

In conclusion, EHRs are a crucial component of modern communication technologies in medical clinics. While they can complicate interprofessional teamwork and coordination of patient care, they hold great promise in enabling more efficient and effective healthcare service delivery. By facilitating patient-physician communication via electronic

messaging, facilitating patient access to personal health information, using EHRs in the examination room, patient portals for EHRs, and multidisciplinary research, patient-physician communication and collaboration can be enhanced, leading to better healthcare outcomes.

6- PATIENT EDUCATION AND INFORMATION

Improving communication between doctors and patients in medical clinics can be greatly enhanced by leveraging modern communication technologies to provide patient education and information. These technologies create valuable opportunities to bridge the communication gap and empower patients with the knowledge they need to make informed decisions about their health.

One effective way to facilitate patient education is through the use of online platforms and patient portals. These platforms, integrated with electronic health record (EHR) systems, provide patients with easy access to their health information and educational resources [14]. Patients can explore articles, videos, and interactive tools that cover various medical topics, treatment options, preventive care, and lifestyle modifications. By accessing these resources, patients can better understand their conditions and actively engage in their healthcare.

Mobile applications dedicated to patient education also play a crucial role in enhancing communication. These applications provide patients with on-the-go access to health information, personalized health tips, medication reminders, and reliable sources of medical knowledge [3]. Patients can track their progress, receive guidance, and stay informed about their health in a convenient and accessible manner.

Secure messaging and communication platforms integrated with EHRs enable direct and secure communication between doctors and patients [24]. Through these platforms, doctors can share educational materials, explain treatment plans, and provide important health information. Patients can ask questions, seek clarification, and receive guidance from their healthcare providers, fostering a continuous and convenient line of communication.

The rise of telehealth technologies has also revolutionized patient education. Virtual consultations enable doctors and patients to interact remotely, allowing for direct communication and educational exchanges [3]. Doctors can discuss medical conditions, explain treatment options, and address patient questions or concerns in real-time. Visual aids and shared screens can be utilized to enhance patient understanding, making the educational experience more engaging and informative.

Furthermore, social media platforms and online communities serve as additional channels for patient education and information sharing. Medical clinics can leverage these platforms to share health tips, educational videos, and reliable medical information with a wider audience [25]. Patients can actively engage, participate in discussions, and benefit from a community-driven approach to learning and information sharing.

By utilizing modern communication technologies for patient education and information, medical clinics can bridge the communication gap, empower patients with knowledge, and

promote active involvement in their healthcare journey. This approach fosters informed decision-making, enhances patient understanding, and ultimately leads to better healthcare outcomes.

7- APPOINTMENT SCHEDULING AND REMINDERS

Appointment scheduling and reminders are crucial components of effective communication between doctors and patients in medical clinics [26]. These technologies streamline the process, minimize miscommunication, and enhance patient engagement.

One way to optimize appointment scheduling is through online platforms and patient portals. Integrated with electronic health record (EHR) systems, these platforms allow patients to schedule appointments conveniently. Patients can access real-time availability, choose preferred dates and times, and book appointments without the need for phone calls or relying on specific communication points [27]. This simplifies the process for patients and improves the efficiency of clinic operations.

Moreover, automated appointment reminders can be sent to patients using various communication channels. Modern communication technologies, such as SMS text messages, emails, or push notifications through mobile applications, can be utilized to deliver these reminders. Patients receive timely notifications about upcoming appointments, reducing the risk of missed appointments and improving patient adherence [28]. Furthermore, two-way communication technologies enable patients to easily reschedule or cancel appointments. Through secure messaging platforms or dedicated appointment management features within patient portals, patients can communicate their scheduling preferences and make necessary changes. This direct communication reduces administrative burdens on the clinic and enhances patient satisfaction by providing flexibility and convenience.

Integration of appointment scheduling with telehealth technologies offers additional benefits. Virtual appointments can be seamlessly scheduled and managed through the same communication channels. Patients can choose virtual consultation options, receive confirmation, and access necessary links or instructions for their virtual visits [28]. These technologies enable the provision of healthcare services without the constraints of physical locations, making it more accessible for patients.

In conclusion, modern communication technologies can be used to improve appointment scheduling and reminders in medical clinics. By using the appointment scheduling function, follow-up text messages, medical software solutions, electronic communication, EHRs in the examination room, and multidisciplinary research, appointment scheduling and reminders can be enhanced, leading to better healthcare outcomes. This approach enhances communication, increases patient engagement, and contributes to effective healthcare delivery.

8- CHALLENGES OF USING MODERN COMMUNICATION TECHNOLOGIES

While modern communication technologies offer numerous benefits for improving communication between doctors and patients in medical clinics, there are also some challenges that need to be considered:

1. **Technical Barriers:** The adoption and integration of modern communication technologies may face technical challenges [3]. Medical clinics need to ensure that their infrastructure supports the implementation of these technologies, including reliable internet connectivity, secure networks, and compatible software systems. Technical issues such as system compatibility, software updates, and connectivity disruptions can hinder the seamless operation of these technologies.
2. **Privacy and Security Concerns:** Modern communication technologies involve the exchange of sensitive patient information. Ensuring data privacy and security is crucial to maintain patient confidentiality and comply with legal and regulatory requirements. Medical clinics must implement robust security measures, encryption protocols, and secure data storage to protect patient data from unauthorized access, hacking, or data breaches [29].
3. **Patient Adoption and Digital Literacy:** Not all patients may be comfortable or familiar with using modern communication technologies. Patient adoption rates can vary based on factors such as age, socioeconomic background, and technological literacy. Medical clinics should provide support and training to patients to help them navigate and utilize these technologies effectively [30]. It's essential to ensure that patient education and support are in place to address any barriers or challenges related to technology use.
4. **Communication Overload:** While modern communication technologies facilitate faster and more convenient communication, they can also lead to information overload for doctors and patients. Doctors may receive a high volume of messages, emails, or notifications, making it challenging to prioritize and respond promptly. Patients may also feel overwhelmed by the constant flow of information. Effective management and triage of communication are necessary to ensure that important messages are not missed or delayed [30].
5. **Interoperability and Standardization:** Ensuring interoperability between different systems and platforms is critical for effective communication [29]. Medical clinics often use multiple communication tools, EHR systems, and telehealth platforms, and it's important to establish seamless integration and data exchange among these systems. Standardization of communication protocols, data formats, and terminology can facilitate

interoperability and enhance the efficiency of communication.

6. **Digital Divide:** Socioeconomic disparities and disparities in access to technology can create a digital divide, with some patients having limited access to modern communication technologies [31]. It's crucial to consider equitable access to these technologies and explore alternative communication methods for patients who may not have the necessary devices or internet connectivity.

Addressing these challenges requires careful planning, investment in technological infrastructure, staff training, patient education, and adherence to privacy and security protocols. By proactively addressing these challenges, medical clinics can harness the full potential of modern communication technologies and overcome barriers to effective communication.

9- CONCLUSION

Improving communication between doctors and patients in medical clinics can be significantly enhanced through the utilization of modern communication technologies. By leveraging these technologies, medical clinics can create seamless and efficient communication channels that foster better doctor-patient interactions, enhance patient engagement, and ultimately improve healthcare outcomes.

Technologies such as secure messaging platforms, patient portals integrated with electronic health records (EHRs), telehealth platforms, and mobile applications play a vital role in facilitating effective communication. These tools enable secure and direct communication between doctors and patients, providing opportunities for timely interactions, convenient access to health information, and personalized guidance.

Furthermore, modern communication technologies contribute to patient education and information sharing. Online platforms, patient portals, and mobile applications deliver educational resources, health tips, and reliable medical information to patients. These resources empower patients with knowledge, enhance health literacy, and support informed decision-making.

Appointment scheduling and reminders are streamlined through online platforms and automated notifications. Patients can easily schedule appointments, receive timely reminders, and even manage changes or cancellations through secure messaging platforms or appointment management features. The integration of telehealth technologies allows for the seamless scheduling and management of virtual appointments, expanding access to healthcare services.

By adopting modern communication technologies, medical clinics can bridge communication gaps, enhance patient-provider relationships, and create a patient-centric healthcare environment. These technologies optimize communication processes, improve efficiency, reduce administrative burdens, and empower patients to actively participate in their healthcare journeys.

In conclusion, the integration of modern communication technologies in medical clinics has the potential to revolutionize the way doctors and patients communicate. By embracing these technologies, clinics can enhance communication, foster patient engagement, and ultimately provide more efficient, personalized, and effective healthcare services.

REFERENCES

1. Medical Economics Staff. Advice on using technology to enhance patient–physician communication, march 2023 available from: <https://www.urologytimes.com/view/advice-on-using-technology-to-enhance-patient-physician-communication>
2. Akash Takyar. HOW TO IMPROVE COMMUNICATION IN HEALTHCARE WITH TECHNOLOGY?, available from: <https://www.leewayhertz.com/improve-communication-in-healthcare/>
3. Haleem A, Javaid M, Singh RP, Suman R. Telemedicine for healthcare: Capabilities, features, barriers, and applications. *Sens Int.* 2021;2:100117. doi: 10.1016/j.sintl.2021.100117. Epub 2021 Jul 24. PMID: 34806053; PMCID: PMC8590973.
4. Sieck CJ, Hefner JL, Schnierle J, Florian H, Agarwal A, Rundell K, McAlearney AS. The Rules of Engagement: Perspectives on Secure Messaging From Experienced Ambulatory Patient Portal Users. *JMIR Med Inform.* 2017 Jul 4;5(3):e13. doi: 10.2196/medinform.7516. PMID: 28676467; PMCID: PMC5516097.
5. Abdulmalek S, Nasir A, Jabbar WA, Almuahaya MAM, Bairagi AK, Khan MA, Kee SH. IoT-Based Healthcare-Monitoring System towards Improving Quality of Life: A Review. *Healthcare (Basel).* 2022 Oct 11;10(10):1993. doi: 10.3390/healthcare10101993. PMID: 36292441; PMCID: PMC9601552.
6. Evans RS. Electronic Health Records: Then, Now, and in the Future. *Yearb Med Inform.* 2016 May 20;Suppl 1(Suppl 1):S48-61. doi: 10.15265/IYS-2016-s006. PMID: 27199197; PMCID: PMC5171496.
7. Iqbal U, Prentice W, Lawler A. Digital health in Tasmania - improving patient access and outcomes. *BMJ Health Care Inform.* 2023 Jun;30(1):e100802. doi: 10.1136/bmjhci-2023-100802. PMID: 37316251; PMCID: PMC10277071.
8. Andreadis K, Muellers K, Ancker JS, Horowitz C, Kaushal R, Lin JJ. Telemedicine Impact on the Patient-Provider Relationship in Primary Care During the COVID-19 Pandemic. *Med Care.* 2023 Apr 1;61(Suppl 1):S83-S88. doi: 10.1097/MLR.0000000000001808. Epub 2023 Mar 9. PMID: 36893423; PMCID: PMC9994565.
9. Mubarak AA, Alrabie AD, Sibyani AK, Aljuaid RS, Bajaber AS, Mubarak MA. Advantages and disadvantages of telemedicine during the COVID-19 pandemic era among physicians in Taif, Saudi Arabia. *Saudi Med J.* 2021 Jan;42(1):110-115. doi: 10.15537/smj.2021.1.25610. PMID: 33399180; PMCID: PMC7989314.
10. Evers EC, Fritz SA, Colditz GA, Burnham JP. Perceptions of Telemedicine and Costs Incurred by a Visit to a General Infectious Diseases Clinic: A Survey. *Open Forum Infect Dis.* 2022 Jan 22;9(3):ofab661. doi: 10.1093/ofid/ofab661. PMID: 35187192; PMCID: PMC8852313.
11. Khanji MY, Gallagher AM, Rehill N, Archbold RA. Remote consultations: review of guiding themes for equitable and effective delivery. *Curr Probl Cardiol.* 2023 Aug;48(8):101736. doi: 10.1016/j.cpcardiol.2023.101736. Epub 2023 Apr 17. PMID: 37075908; PMCID: PMC10108552.
12. Manojlovich M, Adler-Milstein J, Harrod M, Sales A, Hofer TP, Saint S, Krein SL. The Effect of Health Information Technology on Health Care Provider Communication: A Mixed-Method Protocol. *JMIR Res Protoc.* 2015 Jun 11;4(2):e72. doi: 10.2196/resprot.4463. PMID: 26068442; PMCID: PMC4526935.
13. Cronin RM, Davis SE, Shenson JA, Chen Q, Rosenbloom ST, Jackson GP. Growth of Secure Messaging Through a Patient Portal as a Form of Outpatient Interaction across Clinical Specialties. *Appl Clin Inform.* 2015 Apr 29;6(2):288-304. doi: 10.4338/ACI-2014-12-RA-0117. PMID: 26171076; PMCID: PMC4493331.
14. Dendere R, Slade C, Burton-Jones A, Sullivan C, Staib A, Janda M. Patient Portals Facilitating Engagement With Inpatient Electronic Medical Records: A Systematic Review. *J Med Internet Res.* 2019 Apr 11;21(4):e12779. doi: 10.2196/12779. PMID: 30973347; PMCID: PMC6482406.
15. Walker D, Sieck C, Huerta T, Menser T. Information technology to support patient engagement: Where do we stand and where can we go?, April 2017, Journal of the American Medical Informatics Association, DOI:10.1093/jamia/ocx043
16. O'Shea AMJ, Batten A, Hu EY, Augustine MR, Hogan TP, Kaboli PJ. Association of Secure Messaging with Primary Care In-Person and Telephone Visits Among Veterans: a Matched Difference-in-Difference Analysis. *J Gen Intern Med.* 2021 Apr;36(4):946-951. doi: 10.1007/s11606-020-06541-3. Epub 2021 Feb 2. PMID: 33528777; PMCID: PMC8041942.
17. Alotaibi YK, Federico F. The impact of health information technology on patient safety. *Saudi Med J.* 2017 Dec;38(12):1173-1180. doi: 10.15537/smj.2017.12.20631. PMID: 29209664; PMCID: PMC5787626.
18. Busnatu ȘS, Niculescu AG, Bolocan A, Andronic O, Pantea Stoian AM, Scafa-Udriște A, Stănescu AMA, Păduraru DN, Nicolescu MI, Grumezescu AM, Jinga V.

- A Review of Digital Health and Biotelemetry: Modern Approaches towards Personalized Medicine and Remote Health Assessment. *J Pers Med.* 2022 Oct 5;12(10):1656. doi: 10.3390/jpm12101656. PMID: 36294795; PMCID: PMC9604784.
19. Welkin, How Remote Monitoring of Patients Can Improve Health Outcomes, Dec 27, 2021, TELEHEALTH. Available from: <https://welkinhealth.com/remote-patient-monitoring-improves-health-outcomes/>
 20. Kang M, Park E, Cho BH, Lee KS. Recent Patient Health Monitoring Platforms Incorporating Internet of Things-Enabled Smart Devices. *Int Neurourol J.* 2018 Jul;22(Suppl 2):S76-82. doi: 10.5213/inj.1836144.072. Epub 2018 Jul 31. Erratum in: *Int Neurourol J.* 2018 Dec;22(4):313. PMID: 30068069; PMCID: PMC6077937.
 21. Jeff March. Improving electronic health communication. *CANCER CARE*, September 9, 2022. Available from: <https://health.ucdavis.edu/news/headlines/improving-electronic-health-communication/2022/09>
 22. Cheryl Rathert, Jessica N. Mittler, Sudeep Banerjee, Jennifer McDaniel, Patient-centered communication in the era of electronic health records: What does the evidence say?, *Patient Education and Counseling*, Volume 100, Issue 1, 2017, Pages 50-64, ISSN 0738-3991, <https://doi.org/10.1016/j.pec.2016.07.03>
 23. White A, Danis M. Enhancing patient-centered communication and collaboration by using the electronic health record in the examination room. *JAMA.* 2013 Jun 12;309(22):2327-8. doi: 10.1001/jama.2013.6030. PMID: 23757080; PMCID: PMC4849541.
 24. Nichols L, Guerrero D, Mannuru D, Basson MD, Sahmoun AE, Bande D. Integrated secure messaging to enhance medical education: a mixed methods study. *BMC Med Educ.* 2022 Jul 28;22(1):580. doi: 10.1186/s12909-022-03637-8. PMID: 35902846; PMCID: PMC9333068.
 25. Chen J, Wang Y. Social Media Use for Health Purposes: Systematic Review. *J Med Internet Res.* 2021 May 12;23(5):e17917. doi: 10.2196/17917. PMID: 33978589; PMCID: PMC8156131.
 26. Zhao P, Yoo I, Lavoie J, Lavoie BJ, Simoes E. Web-Based Medical Appointment Systems: A Systematic Review. *J Med Internet Res.* 2017 Apr 26;19(4):e134. doi: 10.2196/jmir.6747. PMID: 28446422; PMCID: PMC5425771.
 27. Lyles CR, Nelson EC, Frampton S, Dykes PC, Cembali AG, Sarkar U. Using Electronic Health Record Portals to Improve Patient Engagement: Research Priorities and Best Practices. *Ann Intern Med.* 2020 Jun 2;172(11 Suppl):S123-S129. doi: 10.7326/M19-0876. PMID: 32479176; PMCID: PMC7800164.
 28. Marbough D, Khaleel I, Al Shanqiti K, Al Tamimi M, Simsekler MCE, Ellahham S, Alibazoglu D, Alibazoglu H. Evaluating the Impact of Patient No-Shows on Service Quality. *Risk Manag Healthc Policy.* 2020 Jun 4;13:509-517. doi: 10.2147/RMHP.S232114. PMID: 32581613; PMCID: PMC7280239.
 29. Coiera E. Communication systems in healthcare. *Clin Biochem Rev.* 2006 May;27(2):89-98. PMID: 17077879; PMCID: PMC1579411.
 30. Corinne Bernstein. digital health (digital healthcare). Electronic health record systems. March 2021, available from: <https://www.techtarget.com/searchhealthit/definition/digital-health-digital-healthcare>
 31. Saeed SA, Masters RM. Disparities in Health Care and the Digital Divide. *Curr Psychiatry Rep.* 2021 Jul 23;23(9):61. doi: 10.1007/s11920-021-01274-4. PMID: 34297202; PMCID: PMC8300069.