# Integrated Communication and Networking Technologies for Healthcare

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**Abstract**
**Many healthcare facilities continue to use obsolete, disjointed information and communication systems. Although these systems provide basic support to healthcare operations, they are vulnerable to challenges such as delayed information exchange, lack of interoperability, challenges in coordinated care, increased risk of errors, administrative inefficiencies, high operational costs, and reduced patient engagement. Providers can avoid these limitations by migrating to integrated ICTs. This document expounds on the limitations of disintegrated healthcare systems and discusses technologies that can be used to implement integrated ICTs.**

**Index Terms: disintegrated healthcare systems, integrated healthcare systems, ICTs, technology.**

## Introduction

Communication and collaboration among healthcare providers and stakeholders has become essential. To provide high-quality and efficient care, all stakeholders in the healthcare sector must seamlessly exchange data, such as patient data and billing details. For instance, to facilitate flawless transfer of patients across providers, healthcare facilities' communication systems must be interconnected to allow receiving facilities to access previous diagnoses and treatment plans. Similarly, for efficient processing of billing codes, payers must have the means to access patients' journeys to certify services rendered. Although communication is an essential requirement for integrated care, healthcare facilities are unable to achieve flawless communication due to the use of disintegrated communication systems [1].

## Disintegrated communication systems

Disintegrated communication systems are techniques or technologies that facilitate communication and data flow within the facility. These systems do not support data sharing with external entities such as other healthcare providers and payers. Disintegrated communication systems can be based on paper techniques or legacy systems that run on local networking technologies. The key weaknesses of disintegrated communication systems include;

### *Delayed information exchange*

As aforementioned, fragmented communications systems make it difficult to share patient information promptly. This is especially problematic when patients transition between providers, such as from primary care to specialists or from hospitals to rehabilitation centers. Delayed information exchange can inhibit prompt decision-making, especially in emergencies, where timely information is essential for accurate treatment.

### *Lack of interoperability*

Fragmented healthcare systems lack interoperability. Facilities often use different electronic health record (EHR) systems or software that do not communicate well. This prevents seamless data exchange. Mandatory

interinstitutional data exchange, such as between providers and payers, must involve manual data entry, which is arduous and error-prone. Lack of interoperability also introduces the challenge of fragmented patient data in facilities, where patient data is scattered across different systems. This may prevent healthcare providers from seeing the entire picture of patients' treatment journeys, complicating effective treatment.

***Challenges in coordinated care***

Fragmented communication channels limit the ability of specialists, primary care providers, pharmacists, and other team members to streamline care delivery. This can lead to disjointed or contradictory treatment plans. Besides, disintegrated communication systems can cause delays in processing referrals or obtaining specialist consultations, affecting timely access to care.

***Increased risk of errors***

When healthcare providers rely on disjointed communication systems, there is a higher risk of misunderstandings and errors, particularly in verbal or handwritten communication, which can lead to mistakes in medication, dosages, or care instructions. Disjointed systems require operators of each system to feed data into their networks. This can lead to redundant or inconsistent data, potentially leading to inaccurate medical records and treatment decisions.

***Administrative inefficiencies and high operational costs***

Disjointed communication systems entails tasks such as manual data entry, information verification, and transferring records between systems. These tasks are time consuming and can increase operational costs. Besides, since the systems are disjointed, these tasks are repetitive, leading to duplication of efforts.

***Reduced patient engagement***

Disintegrated healthcare systems limit provider-patient engagement and block patients from accessing their health information, such as treatment plans. These systems also restrict the deployment of programs such as telemedicine. Also, they do not support communication of vital information, such as treatment reminders and follow-up communication.

These are the main issues resulting from using disjointed communication systems in healthcare. These issues can be addressed by healthcare providers switching to modern ICT systems that facilitate interorganizational data exchange. These systems come in various types, as described in the following section.

**Modern ICT systems for integrated care**

Integrated care can be attained by healthcare providers migrating to integrated ICT systems that support interoperability. Integrated ICT systems not only support the flow of information across healthcare providers but also connect the care system to other stakeholders, such as payers. These systems also support modern care programs such as telemedicine and mobile clinics. Some of the leading technologies that power integrated ICT systems include;

***Mobile apps***

Mobile applications is one of the leading technologies for developing integrated healthcare systems. ICT systems are designed as mobile applications and run on mobile devices such as tablets and smartphones. Although mobile applications are commonly used for implementing telehealth systems, the technology can also be used to develop typical healthcare systems, especially those that support remote data access.

***Web-based platforms***

Integrated ICT systems can also be implemented as web-based platforms that are accessed via browsers. Just like mobile apps, the technology permits remote access to data. Web-based platforms are commonly used to implement typical healthcare systems. However, the technology can also be used to implement telehealth systems.

**Integrated ICT Systems Classes**

Mobile applications and web-based platforms can be designed to integrate different healthcare operations. For example, telehealth systems are primarily used to link patients and providers, and billing systems integrate providers and payers. Based on function, ICT technologies can be described using the Rainbow Model of Integrated Care (RMIC) and the eHealth Enhanced Chronic Care Model (eCCM).

***Rainbow Model of Integrated Care (RMIC)***

The RMIC model describes different levels of operations integration in healthcare facilities. These levels include;

*Clinical level*: These are patient care systems that connect patients to care providers. These systems include patient portals to access information and telehealth applications.

*Professional Leve*l: Constitute systems for promoting teamwork and collaboration within the organization. They include patient data access platforms and videoconferencing applications.

*Organizational level*: These are systems that support patient care cooperation across providers. These systems include shared patient electronic medical records.

*System level*: These systems adhere to common rules, regulations, and policies to facilitate interoperability. Such systems include telehealth systems for providers that apply for reimbursements from payers.

*Formative level*: Typically, these are administrative systems with critical functions to support care integration. Management systems, information systems, and financial systems are interlinked.

*Normative Level*: These are industry systems guided by common values and goals. For example, during COVID-19, there were systems for coordinated management of COVID-19 response.

***eHealth Enhanced Chronic Care Model (eCCM)***

This model describes how information and communication technologies can be leveraged to support patients with chronic conditions. The critical elements of the eCCM model include the following;

*eCommunity resources*: These systems link patients with support community organizations and online health communities. These platforms include health-related social networks and web-based communities that facilitate care connections

*Health systems enhancements*: These platforms support patient engagement and self-management support. They include web-based health platforms and mobile health applications.

*Delivery system design enhancements*: These are technologies that enable teamwork. They include electronic health records (EHRs) and web-based health platforms that facilitate information sharing.

*Self-management support enhancements*: These are platforms that enable patients to actively manage their conditions. They include health apps and web-based resources.

*Clinical decision support enhancements*: These are platforms that enable patients and providers to provide evidence-based care. They include web-based platforms and EHRs for protocols and guidelines.

*Clinical information system enhancements*: systems for management of patient data. They include mobile health apps and web-based platforms that hold patients' data for easy accessibility.

**Impact of integrated communication and information systems in healthcare**

Integrated communication and information systems in healthcare create a unified, efficient, and secure means for providers, patients, and other stakeholders to communicate and share information. Consequently, the following benefits are realized.

***Efficient care coordination*:** Care teams can collaborate, share notes, and stay updated on treatment plans, reducing redundant tests or procedures and delivering cohesive, patient-centered care. Besides, integrated systems enable seamless communication when patients move between primary care physicians, specialists, hospitals, or other care facilities, ensuring continuity of care [2].

***Enhanced patient care and safety*:** Integrated systems allow for comprehensive patient data sharing across

providers, leading to better-informed diagnoses based on a full view of patient history, lab results, and imaging. Universal access to patient records minimizes errors related to incomplete or outdated information, helping prevent issues like adverse drug interactions and misdiagnoses.

***Improved patient engagement and satisfaction*:** Patient portals enable individuals to view test results, treatment plans, and medication instructions, empowering them to actively participate in their health care. Integrated systems create clear communication channels between patients and providers.

***Facilitate telehealth and remote care*:** modern healthcare programs such as telemedicine and remote care are only feasible in integrated systems.

***Improved productivity*:** Ease of access to patient data and reduced need for switching between different applications enhance healthcare workers' productivity. Reduced redundancy prevents the need for duplicate tests and procedures, reducing healthcare costs. These technologies also reduce administrative burdens like repeated data entry and data transfers, allowing care providers to focus on core healthcare functions.

| Comparison between disintegrated and integrated healthcare systems | |
|---|---|
| Disintegrated healthcare systems | Integrated healthcare systems |
| • Delayed information exchange.<br>• Lack of interoperability.<br>• Challenged in coordinated care.<br>• Increased risk of errors.<br>• Administrative inefficiencies and high operational costs<br>• Reduced patient engagement. | • Efficient care coordination.<br>• Enhanced patient care and safety.<br>• Improved patient engagement.<br>• Improved productivity.<br>• Facilitates telehealth and remote care technologies. |

## Conclusion

Legacy communication and information systems used in healthcare facilities are disjointed. Consequently, these systems are vulnerable to issues such as delayed information exchange, lack of interoperability, challenges in coordinated care, increased risk of errors, administrative inefficiencies, high operational costs, and reduced patient engagement. Modern integrated ICT technologies address these challenges. Integrated ICT systems in healthcare are implemented as mobile applications or web-based platforms. These platforms ensure efficient care coordination and enhanced patient care and safety, improve patient engagement and satisfaction, and facilitate telemedicine and remote care. Healthcare facilities can improve the quality of their care delivery and streamline their operations by implementing integrated ICTs.

## Resources

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