

Advancing Connected Care in a Rapidly Evolving Healthcare Landscape

Introduction

There are many challenges in healthcare today; staff shortages, reduced time for care, complicated workflows, rising costs, and an increasing demand for more complex care. The concept of “connected care” with digital technologies has been put forward as one way to help address these challenges. But all too often the focus is on connectivity alone; for example, accessing an electronic patient record or linking wireless medical devices. But connected care should be just that, “connected” and “care”. Baxter is continuously exploring new possibilities for connectivity that leverage integration, technology and customer partnerships and focus on enhancing care, lowering costs and increasing workflow efficiency. Seamless integration of new technology into a hospital’s existing infrastructure should deliver vital information and clinical insights directly to clinicians when and where they need it, including at the patient bedside, and support the communication and collaboration needed to use that information and insights to drive improvement in outcomes.

The healthcare data explosion

According to RBC Capital Markets, approximately 30% of all the world’s data volume is now being generated by the healthcare industry, and by 2025 the compound annual growth rate for health data will be 36%. This growth rate is substantially faster than for other industries such as manufacturing, financial services, and media and entertainment.¹ The average patient generates at least 80 megabytes of clinical data each year, encompassing sensor readings, clinical notes, lab tests, medical images, and medication lists.² Each patient in an intensive care unit generates thousands of data-points per day.³

The growth in the use of digital technology is furthering the capability to acquire ever more clinical patient data: from periodic, continuous, and remote patient monitoring; to precision diagnostics; to wearables and the Internet-of-Things. According to research from security company Zingbox, in a typical hospital in the USA there are already an average of 10 to 15 connected medical devices per patient bed.⁴ This is understandable and justifiable, since, despite already capturing significant amounts of patient data, we may have only just scratched the surface; it has been estimated that, from brain activity to muscle performance, the human body produces two terabytes worth of data on a given day.⁵ To help make sense of this sometimes overwhelming data, guidance and decision-support from early warning scores to cutting edge artificial intelligence also continue to be the focus of investigation and innovation. However, there is emerging evidence that the human element, the clinical workflows and the way in which clinicians and hospital staff communicate and collaborate in executing these workflows, is critical to turn this data and guidance into coordinated care that improves patient outcomes.

Vital signs, early warning scores, and patient deterioration

As an example, it has been estimated that patient monitors represent 19% of connected medical devices in today’s hospitals in the USA.⁶ These are used to collect some of the most routine clinical data in a hospital, but at the same time some of the most important, a patient’s vital signs (pulse rate, respiration rate, systolic blood pressure, temperature). According to NICE Clinical Guideline CG50, vital signs are fundamental to clinical assessment, risk evaluation, and prevention of patient deterioration. Patients who are, or become, acutely unwell in hospital may receive suboptimal care. This may be because their

deterioration is not recognised, or because, despite indications of clinical deterioration, it is not appreciated, or not acted upon sufficiently rapidly. Communication and documentation are often poor, experience might be lacking and provision of critical care expertise, including admission to critical care areas, delayed.⁷ Periodic monitoring of patient vital signs is the backbone of “track and trigger systems” such as the NEWS2 (National Early Warning Score), which use multiple-parameter or aggregate weighted scoring systems, allowing for a graded response. These systems work as a continuous loop that starts with measuring the patient’s vital signs, documenting them in the patient record, possibly an electronic patient record, and potentially communicating alerts or alarms triggering further actions by clinicians such as increasing the frequency of observations, ordering additional tests, urgent response, or emergency response. Each of these further actions themselves require communication and collaboration in a time-constrained manner.



A patient’s vital signs are some of the most important clinical data in a hospital

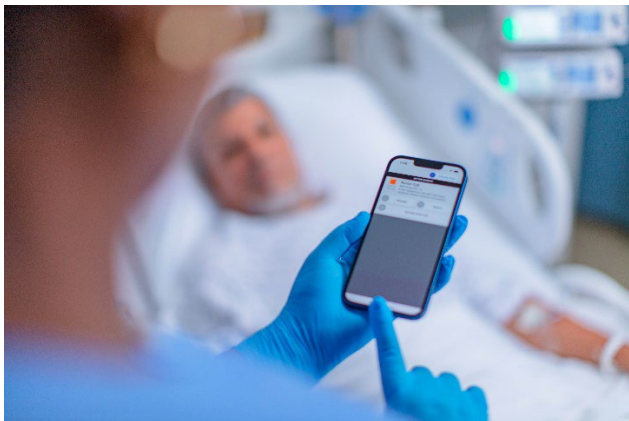
Consistent execution of this process is challenging at each step. Measuring a patient’s vital signs contributes significantly to routine nursing workload on general hospital wards,⁸ when healthcare is facing one of the biggest staff shortages we have ever experienced.⁹ When staffing is lower, more observations are missed.¹⁰ Methods known to reduce the time taken to document vital signs in the patient’s record (e.g., mobile devices) might be expected to free up clinical time, making it possible for staff to document more observations.^{8,11,12} The Imperial College Healthcare NHS Trust deployed a connected vital signs monitor device to connect wirelessly to their electronic patient record system. The monitoring devices capture and record patient vital signs seamlessly at the bedside, whilst also providing caregivers with NEWS2 early warnings scores and escalation instructions automatically on screen.¹³ The mean time to take and record vitals was reduced from 2 minutes 35 seconds to 1 minute 12 seconds with the digital solution. By using bedside devices, 600 hours of nursing time was released from routine documentation and that time could be used in direct patient care. A saving of 30 hours per month of audit time was also achieved. Together, this was projected as 323,500 hours a year across the Trust.¹⁴

Improving the efficiency of vital sign measurement has significant operational value for the hospital; however, recent studies have shown that this first step of “track and trigger” – tracking and storing vital signs data in an electronic system – may not in itself be enough to ensure early intervention and

improve patient outcomes. Early warning score may not be as important as the clinical workflow and to whom the warning alerts are directed.¹⁵ It may be that not enough attention has been paid to how clinicians communicate and collaborate once a warning alert has been sent.¹⁶ Studies have documented the challenges when trying to escalate care in response to early warning scores, with nurses commenting on their frustration, be it in accessing a doctor on the phone or in them attending to review the patient.¹⁷ “You are often ringing and ringing them to come up.... The other day I spent an hour trying to get a doctor to review a patient because of their early warning score,”¹⁸ reported one nurse at a large regional hospital in Ireland.

One way to address this could be interoperability between connected vital signs monitors, clinical surveillance software (which receives data from disparate systems and creates meaningful alerts to drive proactive interventions), and a unified clinical care communication system that connects care teams to improve care coordination and keep caregivers informed.

The Gartner technology market research firm defines unified clinical care communication systems as IT systems deployed by healthcare providers, and used by clinicians and support staff, to communicate and collaborate on patient-related activities. They are used to share patient information, alarms and notifications, and optimize care transitions and patient throughput.¹⁹ It has been estimated that ~35% of USA hospitals have some form of unified clinical care communication solution.²⁰ The relative market shares of unified clinical communication technology suggest that in Europe, the deployment of such solutions has so far been less extensive than in the USA.²¹



Unified clinical care communication systems

According to CWD, a leading multi-brand provider of information technology solutions, key features of unified clinical care communications include:²²

DYNAMIC DIRECTORY: Dynamic directory, or dynamic call routing, is essential for clinical collaboration. This feature uses answering rules to automatically direct a call to the correct care provider for a specific patient, based on on-call scheduling, answering service hours or other factors.

ROLE-BASED CALLING: This capability aligns with the shift-based nature of healthcare work by directing communications to the correct caregiver based on roles rather than individuals. Users no longer need to look at a list of names and scroll through to find the correct person to handle a specific need at a specific moment.

ACTIVE RESPONSE: In emergency situations, unified clinical care communication systems can send alerts directly to recipients, eliminating the need for overhead paging. This alternative reduces noise and stress in the already hectic care environment.

In addition to patient vital signs from a connected vital signs monitor, clinical surveillance software can also receive and alert to pathology lab data, organ function data such as kidneys and liver. This data can provide insights about patient risk of deterioration. As this data is repeatedly captured over time, trends might emerge to give further insight to caregivers. A recent publication from Dorset County Hospital NHS Foundation Trust summarized the benefits of clinical surveillance software:²³

- using real-time data from various clinical information systems across a facility, such as patient administration systems (PAS) and laboratory information management systems (LIMS) and applies advanced analytics to provide meaningful information to the users for clinical decision-making
- user-defined alerts bring immediate attention to lab results, patient exposures and infection clusters, allowing for early intervention
- up-to-the-minute data and alerts via mobile devices

While still in its infancy, the integration of vital sign monitors with early warning scores, electronic patient record systems, and unified clinical care communication systems is already showing some results. For example, Maimonides Medical Center, a 700-bed hospital in New York, did just that using an integrated technological approach to patient deterioration. In the first year, they achieved a 30% reduction in “failure to rescue” patients (the failure to prevent a clinically important deterioration, such as death or permanent disability, from a complication of an underlying illness or a complication of medical care).²⁴

Conclusion

While the drive for healthcare systems to make better use of digital technology had already started to take centre stage before Covid-19, the pandemic exacerbated existing challenges as well as created new ones, and as a result has driven unprecedented change in the way healthcare services are delivered.²⁵ Medical devices are being enhanced and integrated into connected environments through interoperable common platforms, and viable solutions are starting to provide seamless patient management and delivery of care, with the potential to tackle some of the many challenges in healthcare today. Connected care and its realization call for collective action where industry and healthcare providers jointly understand the healthcare workflow and make connected care an integral part of the clinical workflow. What was once a vision of connected care in the acute hospital care setting is now not very far from becoming a reality.

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⁴ <https://www.fiercehealthcare.com/tech/82-healthcare-organizations-have-experienced-iot-focused-cyber-attack-survey-finds> Accessed 22 March 2023

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