HEALTHCARE TECHNOLOGY CONSOLIDATION:
DEVICE CONVERGENCE BENEFITING PATIENT CARE & HOSPITAL EFFICIENCY

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EXECUTIVE SUMMARY

This paper looks at the opportunity for hospitals to strategically consolidate elements of their technology infrastructure by deploying a new breed of "converged" medical devices that mimic the miniaturization and multi-functionality of today's consumer electronics. The discussion justifies the consideration of such convergence, outlines the enabling factors and describes the expected benefits for clinicians, hospitals and patients. Broadly applicable evaluation criteria, which should apply to numerous categories of devices, are also detailed. Finally, Capsule's new SmartLinx Vitals Plus™ patient monitoring system is presented as prototypical of other converged devices that have yet to arrive on the healthcare technology landscape.

INTRODUCTION

Today your cell phone is an entertainment center, computer, game system and communication device. A pair of glasses can serve as your keyboard. Your watch is your personal trainer.

Multi-function, miniaturization and personalization are major trends across all technology—and medical devices are no exception. Functionality and features are expanding, while hardware platforms are converging and often incorporating IT solutions. In the coming years, we can expect to see a dramatic growth of medical devices with multiple personalities that cater to a variety of needs in the hospital, outpatient and home environments.

Many of the benefits of these converging multi-purpose devices are obvious — including convenience, space-saving footprints and cost economies. But not always so obvious are the design and decision-making that underlie the success of a converged medical device. From a vendor's standpoint, this calls for a strong understanding of clinical workflow across multiple hospital departments; expertise in particular types of medical devices; hardware design; software engineering; and IT connectivity.

Technology is tricky — especially in healthcare. Convergence must enhance patient care, streamline clinical workflows and cut costs. Convergence for its own sake is not helpful, and so not every vendor will get it right.

This paper examines the growing trend of healthcare technology consolidation at the bedside, its important benefits — including improved patient outcomes, what to expect today and in the future — as well as how to critically evaluate converged medical devices.

THE NEED

Breakthroughs that seemed unimaginable only a few years ago are now standard on the typical hospital floor. Technology is playing a greater role in patient care than ever before and is helping to guide therapies and improve outcomes. While all this is good news, it does come with significant challenges. Hospital rooms are often extremely crowded with bedside devices including physiological patient monitors, smart pumps, ventilators and PCs. All this technology may not be used to its full benefit simply because caregivers struggle to navigate a crowded patient room. Today, the average 200-bed hospital is equipped with hundreds of medical devices from a host of manufacturers. A typical operating room (OR) patient is connected to more than 10 of these simultaneously.

THE ENABLERS

Advances in engineering and the constantly evolving healthcare landscape both play significant roles in driving the trend toward device convergence. More powerful and compact technology enables multiple devices to be integrated into a single hardware and software platform with a compact and maneuverable form factor. Also powering this is the proliferation of "plug and play" technology. For example, while pulse oximetry measurements have traditionally been obtained from internal computer boards integrated into monolithic patient monitors, today freestanding SpO2 modules are available that connect to an industry-standard USB port. Such components make it possible to develop converged devices that are highly usable and modular while benefiting from PC economies of scale.

Additionally, healthcare reform has challenged hospitals to deliver care and cost efficiencies. This can be supported through technology consolidation, since a single multi-function device should cost less to purchase and maintain than multiple pieces of equipment. And if designed for upgradeability, it may have a longer useful life than the multiple devices it replaces. Reform also demands greater documentation and quality reporting, which renders many of today's standalone devices technologically obsolete. Fortunately, this need for enhanced IT functionality and network connectivity is being met in the new generation of converged medical devices, as once again necessity proves to be the mother of invention.

THE BENEFITS

When technology consolidation is well planned and designed, the benefits can cut across many hospital functions and departments. Most important for clinicians is that converged devices potentially diminish hours spent dealing with technology and expand the time available for patient care. In particular, consolidating multiple devices onto a single platform can mean less time spent on: 1) logging on to multiple systems; 2) powering up or recharging individual devices; 3) ensuring patient association with each device; and 4) managing multipledata transfer streams. Additionally, consolidation minimizes operational learning curves and reduces time spent walking around a unit or patient room to access multiple devices.

Consolidation also reduces device management complexity for clinical engineering. Clearly, the training, setup, maintenance, tracking and procurement for a converged device is simpler than for the multiple units it replaces. The same is true for IT departments managing network-connected devices. Instead of repeating many similar operational steps across multiple different device types — sometimes once per device — they can use one step to change the configuration of a group of converged devices located in a common care area.

Not surprisingly, significant cost savings can be realized by consolidating multiple devices onto a single platform. For example, converged devices reduce the upfront purchase and ongoing costs of roll stands; input devices; software licenses; displays; back-end server infrastructure; rechargeable batteries; similar but duplicated disposables; vendor support contracts and more. Multiply these costs by a hospital's large inventory of bedside devices, and the savings are sizeable. And, of course, a single multi-function device makes the most out of ever more limited hospital space — offering direct benefits.

The most important impact of device convergence is on patient care. Everyone benefits. With fewer devices to manage and many operational complexities eliminated, clinicians have more time to spend with their patients. To these patients and their families, clinician interaction with them now may seem more of a priority than their interaction with machines. Cost savings realized through technology consolidation can be channeled into funding for clinical or patient service initiatives. With less cumbersome equipment, hospital rooms can become more open, inviting spaces that enhance the comfort and satisfaction of patients and their families.

EVALUATING CONVERGED MEDICAL DEVICES

Not every vendor will deliver equally on the promised benefits of multi-functional devices. Success is complex because it means addressing the specific challenges for each individual device type and optimizing the technologies to work together to meet varied user needs. It also means building into the device operational efficiency, simple and cost effective design, as well as simple maintenance and upgrade procedures.

The best multi-functional devices will be developed by vendors with deep experience in all of the functions incorporated into the new product platform.

Here's what to look for:

SIMPLE, INTUITIVE OPERATION BASED ON CLINICAL WORKFLOW

Multi-function devices should streamline workflow andconsolidate operations across equipment. Therefore, theymust be based on a clear understanding of all the clinicalworkflows involved.

For example, device components should be optimally placed for access at the bedside and for easy clinician manipulation both independently and together as a system. Mobile devices must be easily maneuverable in small spaces. LED interfaces and IT displays must be accessible from multiple angles and easy to read. If the device is attached to a network, it should have a single login for all functionalities and a minimal number of well-organized screens for patient-centric information display.

Overall, consistency is key. The user interface should be similar across all devices and operational steps should be consolidated for efficiency. Naturally, the user interface should be simple and intuitive to understand for rapid adoption across all clinicians. Experts agree that difficult-to-use devices with complex settings and features often are not leveraged to full advantage in a busy hospital environment. When a device is shared between different user types — say nurse techs, RNs and rapid response teams — the design must consider the workflows of each and their coordination points.

COMPACT FOOTPRINT

As noted, size matters in today's overcrowded hospitalenvironment. Thoughtful space-saving design isparamount. For example, an OR with equipment stackedon carts, mounted on walls and suspended from ceilingbooms requires lengthy set up time, restricts themovement and communication of the OR team duringsurgery. This creates well-acknowledged visual stress at atime when seconds count and concentration is key. Thesame complexities and crowding affect clinician workflowin the intensive care unit (ICU) and other high acuityenvironments. Simplifying the equipment landscape has major benefits.

Similarly, in a patient room, unobtrusive, streamlined technology creates a more relaxing environment, which is far more conducive to healing and positive interaction with family and friends.user types — say nurse techs, RNs and rapid response teams — the design must consider.

MODULAR DESIGN

A good multi-functional device should be based onmodular components that can be individually replaced inthe event of failure or for upgrades. Malfunction of ablood pressure module on a traditional physiologicalmonitor, for example, would require removing the entireunit for service and replacing it with a backup. Modulardevices, however, allow a quick and convenient swap outof the failing component—even right on the floor of thecare area.

Equally important, devices should allow for expansion with new vital signs technologies as they become available. A device with a well-planned upgrade path can take hospitals well into the future with the addition of new modules and without the need to replace monitors which have useful life remaining. The ability to control future costs helps justify expenditures today.

FLEXIBILITY

To make the most of an investment, devices mustalso deliver flexibility to support the needs of varioucare environments.

For example, a physiological patient monitor should be deployable across the emergency department (ED), med-surg, outpatient/ambulatory, and perioperative care areas. Whether mobile or wall-mounted, with a clinician-friendly user interface and a range of vital signs modules this device should be able to easily meet the monitoring needs of a particular patient, from spot check to continuous. Likewise, through a web-based console, IT should be able to easily configure default profiles for each department just as clinical engineering should able to customize hardware configurations and applied parts.

Some devices will provide even greater flexibility by providing medical device integration for ventilators, dialysis machines, infusion pumps, etc. This level of multi-function will enable clinicians to rely upon the monitor for authentication, patient association, charting and data transfer—including data both from the directly measured vital signs and all the attached devices.

IT INTEGRATION

To be truly useful in today's hospital environment,converged medical devices must be truly integrated intothe back-end IT infrastructure. From a technology perspective they need to support the latest networkingstandards with secure, encrypted communications. Andfrom a user perspective, clinicians will require this fromthe device if they are to easily authenticate themselves — one time instead of repeatedly — with all their roles andprivileges. This will go hand-in-handwith the ability to securely associate the patient to thedevice. So seamless integration from the device toauthentication, ADT, and perhaps lab, imaging,medication and staffing systems will be essential for astreamlined clinician workflow.

In today's digital healthcare age we appreciate that medical device data is rich, varied, and valuable. It's no longer just about getting the data to the electronic medical record (EMR), but instead this data — often continuous streams of it — can play a role in a wide range of downstream systems, including alarms and alerts, patience surveillance, clinical decision support, and asset tracking. Therefore, devices should be able to supply data to all these systems simultaneously particular to the needs of each via a dedicated medical device information system.

CONSOLIDATION CASE IN POINT: CAPSULE'S VITALS PLUS™

Capsule's Vitals Plus™ patient monitoring system exemplifies a well-conceived approach to consolidation. It combines a state-of-the-art monitoring app with modular packaging of the vital signs modules (blood pressure, pulse oximetry and temperature) typically found inside a monolithic monitor. The result? True convergence in the sense of combining the functions of mobile clinical computer and a vital signs monitor into a single device. With Vitals Plus, the clinical computer becomes a biomedical device.

Evolved from Capsule's deep experience in clinical documentation and IT integration, Vitals Plus was conceived to offer clinicians an intuitive patient-centric workflow with features such as single sign-on; authentication; patient association to a specific visit/account; measurement of vital signs; configurable charting of eight vital signs modifiers and seven custom vital signs; calculation of an early warning score; and submission of validated patient data—all from a single screen at the bedside. Adding to clinician convenience, the system includes an ergonomic and maneuverable roll stand with accessory tray and cord management.

At the heart of this solution is the Neuron™ 2 mobile clinical computer. When combined with the SmartLinx Chart Xpress™ application, hospitals can add connectivity and clinical documentation to existing vital signs monitors as a first step toward technology consolidation. This approach, which works well in situations where the monitors have remaining life, still streamlines clinical workflow by elimination data transcription between a vital signs monitor and separately located clinical computer (a.k.a. WOW—Workstation on Wheels) and likewise reduces the combined footprint of monitors and WOWs.

Designed for flexibility and upgradeability, Vitals Plus at first release will able to meet monitoring and documentation needs for med-surg, ED and outpatient/ambulatory care areas with mobile or fixed mounting. Subsequent upgrades supporting continuous monitoring, additional vital signs modules and connectivity to other medical devices should broaden its deploy-ability to perioperative and other mixed/mid acuity care areas. Finally, as a monitoring system uniquely integrated into Capsule's Medical Device Information System™, Vitals Plus will not require additional IT infrastructure in terms of management tools and connectivity to EHRs and other downstream systems.

CONCLUSION

Technological advances in medical devices and healthcare IT systems have certainly advanced modern medicine. However, hospitals are often not able to fully benefit from the systems they've deployed due a lack of integration or interoperability between point solutions, duplicated workflow steps, space constraints and perhaps what is best described as "over distraction" of the clinician by all the technology demanding their attention. But just as with consumer devices, miniaturization and multi-functionality, promise to offer new capabilities and improve the situation in healthcare.

Specifically, manufacturers with combined medical device and IT competencies (and a flair for design) are in the best position to offer new devices that fuse the capabilities of what were once multiple devices into one that in many ways is also an IT device. These systems should offer the following benefits: 1) help clinicians avoid duplicative and non-value add workflow steps resulting more time to care for patients—certainly their preference vs. caring for technology; 2) reduce cost structures by eliminating duplicated infrastructure and ongoing purchasing costs; and 3) improve patient satisfaction through increased clinician attention and by opening up more space to increase comfort.

Capsule's Vitals Plus™ patient monitoring system will likely be one among many medical devices that will help hospitals consolidate technology with benefits for all. Nonetheless, as vital signs device, it creates a product category of its own by addressing the workflow, footprint, modularity, flexibility, and IT integration criteria presented here for evaluation of converged medical devices.

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