Mobile Devices in a Medical Setting:
Which Ones are Providing Real Value?

A Frost & Sullivan White Paper
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I. INTRODUCTION

The US healthcare sector continues to grapple with information technology. What to purchase? How best to implement? Who will be allowed to use the solutions? How will they be managed and secured?

Wireless technology is of particular interest, promising to enhance the quality of patient care, help providers control costs in creative ways, and lessen the pounding headache of regulatory compliance.

These wireless solutions all begin with the mobile device, and manufacturers are working diligently to tempt healthcare providers with a broad—and sometimes bewildering—portfolio of choices. The computer on wheels and the laptop with a mobile broadband card may still be as portable as some medical institutions and offices get; however, these laggards are falling further behind the technology curve and could be squandering the opportunity to dramatically improve patient outcomes by not giving serious consideration to additional wireless device types.

In today’s mobile industry, change is the constant with smartphones still growing in size and power; tablets providing crisp, portable displays; and now wearables further legitimizing remote patient monitoring. Even traditional push-to-talk devices are enhancing their value proposition by offering an expanded stable of models and manufacturers. Underlying all of these choices is the wireless network. Fast, powerful 4G networks enable today’s mobile devices and make it possible to connect patient, physician, and information in exciting new ways.

This paper provides an update on four major wireless device categories that should be especially relevant to healthcare providers. It also summarizes the current weaknesses and strengths of these device types, predicts best fit, and reminds the reader that there is more to selecting the right device than just running price comparisons.

II. CARE, COSTS, AND COMPLIANCE

Healthcare is a fiercely competitive sector being buffeted by multiple forces, including:

• Continued regulatory compliance pressures from government departments;

• A still-lukewarm economy, making healthcare services more of a financial burden in certain patient segments;

• Consumers becoming more educated and choosier about treatment and caregiver alternatives;

• Alignment among multiple care team participants—including physicians, clinics, and hospitals—which remains a work in progress;

• Ongoing profitability pressures; and

• Aging patient populations, with a corresponding rise in chronic conditions.

Whether it’s in a hospital, the doctor’s office, or a patient’s home, today’s healthcare practitioners face the same basic set of challenges: 1) Expanding the availability and quality of patient care, 2) controlling costs, and 3) complying with government and industry regulations.
**Patient Care:**

Delivering high-quality, easily accessible patient care — on both an in-patient and out-patient basis — is an ongoing balancing act. Consumers are looking for quality and value. They have done their homework, think they know the answers, and are frustrated when insurance plans impose limits on their access to providers and care. In the face of this educated customer, the healthcare industry has to compete and survive by demonstrating real value-add.

Today’s healthcare value proposition to patients is equal parts high-quality medicine, affordability and convenient accessibility. Multiple expert providers are expected to work together to deliver seamless, coordinated medical services. And those services can more often be provided right in the patient’s home or in a nearby satellite facility.

**Controlling Costs:**

Unpredictable funding, downgraded bond issues and increased competition all expose the ongoing need to keep expenses actively managed. Fixed expenses and labor costs continue to soar. At the same time, ROI (return on investment) remains a somewhat ephemeral metric in the healthcare sector.

Technology’s tangible benefits are easy to predict, but can be difficult to actually quantify. CIOs can find it challenging to put a hard, concrete number on staff productivity improvements, increased patient safety, cost-savings, faster response times, improved outcomes, more satisfied and involved patients, reduced medication errors, etc.

In the face of cost increases and ongoing margin pressures, providers must manage expenses by constantly evaluating alternatives and improving efficiency across departments and groups.

**Regulatory Compliance:**

Compliance is always a major priority, keeping healthcare executives and IT departments constantly on the alert. The Affordable Care Act, HIPAA regulations, adoption of ICD-10 (International Classification of Diseases), and electronic health records (EHR) requirements are just a few of the industry- and government-imposed mandates that must be satisfied. These requirements cost money and can disrupt work flow, and may even negatively impact patient care if not deployed properly.

III. MOBILE DEVICES CAN SIGNIFICANTLY IMPROVE THE HEALTHCARE EXPERIENCE

For even the biggest technology laggards, wireless devices—along with powerful wireless broadband data networks and mobile software applications—have to be recognized as fundamental components in the quest to improve patient care, control costs and comply with government and industry mandates.

For a dwindling number of hospitals, the computer on wheels (COW) remains the sole definition of “mobility,” simply because no one has been motivated to search for better alternatives. Often, a lack of funding or expert technology personnel serves as a key barrier to expanding wireless access. Sometimes IT staffs are paralyzed at the thought of supporting more than one type of mobile device and therefore refuse to support anything. Data security and patient privacy are also concerns. However, whatever the objections to mobility have been in the past, they are falling away as everything wireless becomes more powerful, more affordable and more user-friendly.
Today’s home healthcare providers, physician offices and hospitals have an array of mobile devices to choose from. Smartphones, tablets, wireless laptops and push-to-talk devices are familiar to most. Remote patient monitoring devices are assuming a higher profile.

**Smartphones:**

**U.S. Tier 1 Mobile Subscriber Forecast (2010-2020)**

Smartphone penetration in North America is forecasted by Frost & Sullivan to continue surging, growing from 67.2% as of EOY 2013 to 94.6% by 2020. Clinicians are enthusiastic users.

These popular devices are equal parts handheld computer and mobile phone and come in four major flavors. Today’s major operating systems include Google Android™, Apple® iOS, BlackBerry®, and Microsoft Windows® Phone. Despite some differences in approach, each operating system (OS) sets the stage for intuitive, user-friendly devices and applications.

Touchscreens, powerful processing capacity, GPS location awareness, crisp graphics and animation, rapid Web browsers, and accelerometers are just a few smartphone capabilities that help deliver a convenient user experience to healthcare providers. Compared to pagers and voice badges, smartphones can offer high utility with their voice, texting, and software capabilities.

Smartphone-based mobile health applications range from drug and clinical references to imaging tools to real-time patient record-keeping. Specific examples that have found their home on the smartphone form factor include:

- **Medical reference libraries** – Caregivers can stay current on medical advances, advice and new updates by tapping into medical reference apps that provide drug guides, conversion tables, diagnostic and treatment information, etc.

- **Anatomy applications** – While technically a part of the medical reference category, anatomy-focused apps are extensive enough to deserve special mention. These solutions provide detailed visual diagrams of the human body.

- **Imaging solutions** – A patient’s clinical images can be accessed and viewed via these apps, including CT, MRI, and PET displays. Interactive, three-dimensional displays are available on selected software.
• **Patient monitoring tools** – Patient vitals (for recovering patients or those with chronic conditions) can be monitored long distance using a combination of smartphones and sensors. Remote consults can take place with rural or distant patients and colleagues.

• **Patient record access** – Electronic health records can be accessed via smartphone, allowing caregivers to diagnose and communicate virtually anywhere, anytime, including at the point of care. Home healthcare providers can enter patient data once onsite.

• **Worker monitoring** – Home healthcare aide location and workflow can be monitored via GPS to ensure timely arrivals and departures, and optimal productivity.

As smartphone display screens have increased in size (now commonly 5 to 6 inches), these devices have become even more user-friendly and valuable to healthcare providers. Smartphones present a number of strengths; however, there are also potential weaknesses:

### Device Category: Smartphones

<table>
<thead>
<tr>
<th>PRO</th>
<th>CON</th>
<th>BEST FIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Inexpensive</td>
<td>• Limited displays and lower processing power can result in incomplete or unclear information, time-consuming paging through multiple screens</td>
<td>Hospitals</td>
</tr>
<tr>
<td>• Easy to carry in lab coat pocket</td>
<td>• Security vulnerabilities</td>
<td>Physician’s Office</td>
</tr>
<tr>
<td>• Generous 5”-6” display screens</td>
<td>• Easy to lose</td>
<td>Home Healthcare</td>
</tr>
<tr>
<td>• Location awareness (with GPS)</td>
<td>• Battery life can be less than 10-12 hours (a full shift)</td>
<td></td>
</tr>
<tr>
<td>• Large portfolio of medical applications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Can be ruggedized with third-party casing</td>
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</table>

### Tablets:

Ruggedized, special-purpose, tablet-type computers have been around since the 1980s; however, the lighter, less-expensive, more feature-packed consumer tablets have now become firmly entrenched in the healthcare sector.

Frost & Sullivan predicts rapid growth in world units shipped—from 146 million in 2014 to over 434 million in 2018.

Tablets can satisfy the clinician’s growing demand for extensive information and professional-quality graphics right at the point of care. Weighing around 1 pound, less than half-an-inch thick, and typically offering 7- to 10-inch touchscreen displays, these devices are eminently portable, with the 7-inch models being compact enough to tote around in a lab coat pocket. With multiple core processors, they deliver the speed and performance that are absolutely crucial for medical applications. And high-resolution displays can provide clear, crisp views of medical images (X-rays, CT scans, etc.).

Dual cameras (front and back) make these devices even more productive in three important ways: 1) By allowing caregivers to supplement patient records with valuable images of the current medical condition, 2) by providing an image that the caregiver can quickly share with his or her colleagues for feedback and collaboration purposes, and 3) by allowing videoconferencing—virtual consultations—with patients and other healthcare providers.
Mobile Devices in a Medical Setting: Which Ones are Providing Real Value?

Tablets also allow caregivers to share images and data directly with the patient, resulting in more interaction and engagement and—hopefully—a more satisfied healthcare customer. In fact, a growing number of point-of-care patient education apps are becoming available for tablets.

Not surprisingly, given their generous display screens, tablet applications focus on providing diagnostic imaging and video, quick access to educational and reference resources, and on-the-spot viewing of electronic patient records. In addition to the capabilities discussed, software vendors are challenged to leverage additional tablet features such as pen input, GPS, accelerometer, gyroscope and multiple network connectivity options. Both custom and prepackaged applications are common.

Examples of apps developed for tablets include MRI viewers, mobile film readers and mobile medical calculators. Tablets are also large enough for the easy addition of a biometric reader, which can single-handedly trump the need for other security protocols, thereby saving valuable clinician time and effort.

While there are distinct advantages to the tablet form factor, there also remain vulnerabilities—at least for the time being:

### Device Category: Tablets

<table>
<thead>
<tr>
<th>PRO</th>
<th>CON</th>
<th>BEST FIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Highly portable – 7” models are pocket-size</td>
<td>• Potential security vulnerabilities</td>
<td>• Hospitals</td>
</tr>
<tr>
<td>• Large, bright, sharp screens and images</td>
<td>• Battery life can be less than 10-12 hours (a full shift)</td>
<td>• Physician’s Office</td>
</tr>
<tr>
<td>• Rapid Web browsing</td>
<td>• Water resistance is insufficient to withstand disinfectant wipe-downs</td>
<td>• Home Healthcare</td>
</tr>
<tr>
<td>• Digital pen for notes</td>
<td>• Requires after-market casing to protect from drops</td>
<td></td>
</tr>
<tr>
<td>• Price point that encourages laptop computer replacement</td>
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</tbody>
</table>

*Source: Frost & Sullivan*

**Push-to-Talk:**

Push-to-talk communication devices are often described as “walkie-talkies on mobile phones.” Nextel Communications introduced mobile push-to-talk service on its iDEN network back in the 1990s. Push-to-talk provides instant communications, usually taking less than a second to connect the caller with the targeted recipient(s).

This service remains fairly utilitarian, enabling instant, short, focused voice calls. With half-duplex communications, only one person at a time can transmit. Communications can be one to one or with predefined groups.

A variety of mobile handset types can be used as push-to-talk devices, including ruggedized devices, everyday smartphones, flip phones, etc. Additional push-to-talk service capabilities can include:

- Touchscreen controls
- Call alerts
- Repeating text with alerts
Remote Patient Monitoring (RPM) Devices:

Remote patient monitoring solutions (combining specialized hardware and software) monitor and manage patients by collecting relevant medical data and then wirelessly transmitting this information for review and action by the patient’s healthcare provider. These devices fall into a larger technology category called “machine to machine” or M2M.

RPM usage is being driven by a number of factors, including the Affordable Care Act (ACA) and its Hospital Readmissions Reduction Program (Section 3025). The goal of this legislation is improved healthcare, with reduced payments made to hospitals with excessive readmissions.¹ RPM devices are viewed by a growing number of healthcare advocates as an effective way to identify problems or issues early enough to prevent the need for readmission.
Other developments that have increased interest in RPM devices include a continued uptick in chronic medical conditions, a shortage of on-site healthcare professionals, and concurrent advancements in mobile technology. Even today’s popular fitness trackers (wearables such as bracelets, smartwatches, etc.) are helping to legitimize this RPM category and are expected to result in increased patient comfort with more sophisticated medical monitoring devices.

Using a Personal Area Network (PAN) interface/gateway such as Wi-Fi, BlueTooth® or ZigBee, these devices can help wirelessly capture and communicate biometric data to the patient’s healthcare provider(s). This enables health professionals to intervene early should abnormal data appear. It also allows the information to be added to the patient’s electronic medical record.

These remote monitoring devices currently fall into four general use categories:

• **Chronic disease management** – Managing chronic conditions (such as diabetes, sleep apnea, cardiac disease, asthma) by wirelessly transmitting a variety of data (e.g., blood pressure, glucose levels, weight, heart rate, oxygen level) to the patient’s care team.

• **Acute and post-acute care** – Monitoring many of these same medical conditions after a hospital stay, including tracking physical therapy and rehab activity.

• **Personal wellness** – Typically focused on gathering data on a person’s fitness, nutrition and general well-being.

• **Assisted living** – Helping the elderly or at-risk individual to live independently by monitoring their condition and safety. This includes real-time location awareness of Alzheimer’s patients.

Given that many prospects for these types of solutions are older, infirm or just fragile, the user interface on these devices must be very simple and easy to use. Fortunately, vendors realize this and are making their monitoring devices even smaller and simpler. They currently include glucose meters, pulse and blood pressure monitors, spirometers, body weight scales, fingertip pulse oximeters, etc.

By monitoring patients at home, physicians and hospitals can better manage their patient load; patients do not need to travel; and measurements are constant and less prone to error. In elder care situations, these monitors allow healthcare providers to better track the patient’s physical condition and gives family members (who can live far away) additional peace of mind.

In the case of chronic condition monitoring, vendors are finding that the enhanced level of disease management and patient participation can produce a reduction in:

• The number of physicians’ office visits;

• Hospitalization risk;

• Patient mortality; and

• The length and quantity of hospital stays.
As a newer technology, healthcare’s remote patient monitoring solutions offer both risk and reward:

### Device Category: Remote Patient Monitoring Devices

<table>
<thead>
<tr>
<th>PRO</th>
<th>CON</th>
<th>BEST FIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cost-savings from early diagnosis/treatment, shorter hospital stays, and reduced physician time and office visits</td>
<td>• Resistance on part of prospective patients</td>
<td>Hospitals</td>
</tr>
<tr>
<td>• Increased patient compliance with self-care behaviors</td>
<td>• Insurance may not cover cost</td>
<td>Physician’s Office</td>
</tr>
<tr>
<td>• Enhanced patient safety, convenience, independence</td>
<td>• Unclear FDA approval requirements possibly slowing new product introductions</td>
<td>Home Healthcare</td>
</tr>
<tr>
<td>• Better disease management</td>
<td>• Data security concerns</td>
<td></td>
</tr>
<tr>
<td>• Increased data accuracy and record-keeping</td>
<td>• Little standardization among devices</td>
<td></td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

## IV. CRITERIA FOR CHOOSING THE RIGHT MOBILE DEVICE(S)

Let’s agree upfront that larger healthcare entities (including hospitals and physicians’ offices) will have to support a diverse array of wireless devices. Today, it is unreasonable to expect a completely homogeneous environment in which one type of device is universally accepted by all medical staff. First, different types of workers have different communications needs. One size definitely does not fit all. Second, an increasing number of doctors expect to be able to use their own personal devices as needed, typically smartphones from a variety of vendors and operating on a variety of platforms.

The correct wireless device is the cornerstone to creating an effective and successful mobility strategy no matter what the healthcare environment — hospital, physicians’ office or home care. Criteria to consider when selecting a device should include:

**Functionality** — From quick, basic voice communications to sophisticated data software applications, there’s a wireless device that can meet your needs. The challenge is to clearly define your mobile communications requirements, projecting out over the next 3-5 years if possible. This is not an isolated exercise, but one that necessitates involvement and analysis from IT staff and all impacted user groups. Their inputs will dictate the optimal mix of capabilities and features, including requirements around screen size, touch navigation, battery life, processing power, sensors and various forms of information capture and display (writing/signature, photo, video, barcode, Flash animation, etc.).

**Usability** — The device can provide all the functionality you need; however, if your care providers and staff (and, in the case of RPM, your patients) don’t find it easy and natural to use, the device has no value. Consider the simplicity of push-to-talk, the pocket size portability and light weight of smartphones and 7-inch tablets, or the automatic capture and communication capabilities of small, compact remote monitoring devices. Ergonomics done well result in devices that even your most technophobic personnel will find acceptable and—dare we hope—desirable.

**Security** — Government and industry regulations concerning the privacy and security of patient information dictate enterprise-level security mechanisms. Centralized device management should be possible, along with
over-the-air lock/wipe and robust data encryption and authentication capabilities. Devices that can be easily integrated with an existing enterprise IT infrastructure are ideal.

**Network Connectivity** – Define the type of wireless networks your users will have available to them. What type of network connectivity must the wireless device be able to provide—cellular, Wi-Fi, Bluetooth, mobile broadband? 4G networks have become ubiquitous and can provide the speed and power necessary to present and process the data that increasingly undergirds high-quality care. Whatever connectivity type is selected, test the device across a wide range of locations and signal strengths in order to identify any vulnerabilities.

**Durability** – It is a fact of life: In healthcare environments, devices are going to inevitably be dropped, are going to fall off surfaces, and are going to be regularly disinfected. If your wireless device is not already ruggedized, an aftermarket casing can protect it from drops, dust and shock. However, include the incremental cost in your TCO (total cost of ownership) calculations. And check carefully to identify any device mechanisms, buttons, camera lens, etc., that may be blocked by the additional casing. Water resistance is another necessity in hospital settings (while not as applicable in individual doctors’ offices or in patients’ homes) Devices at the point of care are going to be wiped down with strong disinfectants on a frequent basis. Can your device withstand this treatment over time?

**Applications Availability** – If there are few prepackaged software applications available for a particular form factor or operating system, or an inordinate amount of approval barriers through which in-house developers must jump, you will not be able to optimize the value of your device. Worst case, the mobile device may end up being prematurely discontinued for lack of viability. Healthcare apps remain a work in progress, so one must become familiar with the operating systems and their level of application development friendliness. Certain OS systems are closed and tightly controlled, erecting various approval gateways. The objective is to ensure a high level of quality; however, this can also slow down and limit the availability of high-value, healthcare-specific solutions. Other OS are decidedly open source, allowing anyone to build applications, but also inject a higher level of risk regarding quality, security, etc.

**Price** – Cost can be a major barrier to implementation. Often, however, the purchaser of a wireless device can obtain a better price by signing up for a long-term service contract. Actual device price points are only one input to the solution purchase analysis, which should include a detailed definition of all hard and soft costs (including user training, application software, data plans, upgrades, device management services, etc.).

Using these criteria to finalize device selection can result in choices that help address three of healthcare’s greatest challenges: controlling costs, delivering high-quality and easily accessible patient care, and complying with government and industry regulations.

V. HOW SPRINT CAN HELP

In a recent hospital CIO focus group conducted by Frost & Sullivan, the preference for end-to-end mobile solution providers was pronounced. The reasons given focused on ease of integration, sustainability, and lower cost of ownership. Sprint has done the due diligence and is working with top-tier vendors to offer a dependable network and a wide range of devices and solutions for healthcare providers:
Wireless Services:

Whether it is smartphones, tablets, push-to-talk-capable devices, or remote patient monitoring M2M solutions, Sprint offers a robust device portfolio that keeps expanding. The carrier’s current device lineup includes:

**Smartphones** – Sprint offers a broad smartphone line-up from top manufacturers. Mobile operating systems include Apple iOS, Android, BlackBerry, and Windows Phone. The carrier has built a portfolio of 4G LTE smartphones that are designed to take full advantage of its powerful and growing Sprint 4G LTE network (reaching over 260 million people).

**Tablets** – The Sprint tablet portfolio includes models from Apple and Samsung. Healthcare providers are offered a selection of sizes (7 inch and 10 inch), Sprint 3G and 4G LTE network capability, a variety of features (dual cameras, digital pen, video capture, GPS, accelerometer, retina display—depending upon the model selected) and robust development environments.

**Push-to-Talk Capabilities** – A pioneer in the push-to-talk field, Sprint offers Sprint Direct Connect® on its powerful Sprint network. In addition to supporting a selection of today’s consumer smartphones with its Sprint Direct Connect Now app, Sprint Direct Connect® is also available on a portfolio of rugged mobile devices with device features available to support push-to-talk capabilities, data access, high-resolution cameras and Bluetooth connectivity.

**Remote Patient Monitoring Devices** – Sprint is steadily building an array of business solutions that utilize its machine-to-machine (M2M) platform with the ability to transmit patient medical data from home to healthcare provider. The carrier has established relationships with a growing selection of RPM providers to leverage the Sprint 4G LTE network for quick and easy transmission of medical alerts and data to the appropriate clinician.

Networks:

The backbone for running any sort of wireless applications within a healthcare facility is the wireless network. Whether caregivers are trying to access patient data on a tablet, are monitoring remote meters, or just need a reliable voice capability, dependable wireless connectivity in any healthcare setting is mission critical.

The Sprint 3G network reaches over 282 million people, while the Sprint 4G LTE network reaches over 260 million people. In addition, Sprint in-building solutions unite multiple network capabilities (Wi-Fi, cellular, land-mobile radio, paging, etc.) into a cohesive solution to help enhance wireless coverage and capacity. Outsourced solutions are available to provide a thorough analysis of site requirements, custom network design, full equipment installation, and ongoing management and support.

Healthcare Software Application Solutions:

Sprint works with leading application developers to provide solutions that enable care team members to communicate and collaborate more efficiently in the delivery of patient care. For example, Sprint and Mobile Heartbeat™ work together to deploy the MH-Cure (Clinical Urgent Response) software platform. This solution transforms the care team members’ smartphones into rich mobile computing devices that allow secure access to the EMR/EHR infrastructure, send and receive HIPAA-compliant text messages, and receive push notifications for lab results.
Sprint is also working with leading application developers to furnish home healthcare providers with software solutions that track the time and travel of their mobile caregivers. These apps also include workflow software that pushes task lists to the caregiver’s tablet or smartphone and synchronizes with the home healthcare provider’s backend systems.

The powerful Sprint network and growing ecosystem of mobile devices and applications can help healthcare providers at nearly every level, delivering high-quality, accessible patient care; helping to control costs; and helping to streamline regulatory compliance.

To learn more about how Sprint mobility solutions can help get the job done, please visit sprint.com/healthcare.

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