The PATIENT-FRIENDLY PRACTICE: HOW TO INCREASE YOUR PATIENT-CENTEREDNESS
A new generation of primary care patients, thoroughly digital and used to getting things on their own terms, is on the horizon and promises to bring with them significant changes for practices and clinicians.

Generation Z, generally regarded as those born from 1995 to 2012, is the first truly digital generation, a group that has never known a world without the internet and whose phones have always been smart. Their digital fluency may well change how healthcare is delivered and consumed in the coming decades.

While medicine is becoming more digitized in many aspects, it can’t happen quickly enough for Gen Z. Though most members are probably still seeing pediatricians or their parents’ doctor, they will soon be choosing their own physicians and they will have definite preferences. And at roughly 80 million strong, the largest generation alive, Gen Z is too big to ignore for physicians who plan on being in business past the next ten years.

Of course, it’s easy to overgeneralize when assigning characteristics to an entire generation, but research indicates Gen Z will be different than those who came before them, even the millennials, which they most closely resemble.

**DIGITAL EVERYTHING**

Raised on Uber, Netflix, and Amazon Prime, Gen Z will expect healthcare delivery to be just as immediate and convenient, says Travis Schneider, founder of PatientPop Inc., which offers marketing services to independent practices.

“These patients really have moved to a new reality. They want everything online and they’re not going to accept any other way,” Schneider says. “It’s not a nice-to-have anymore; it’s absolutely critical.”

Gen Z patients will want to do everything digitally, he says: research physicians, make and confirm appointments, provide insurance information, receive information and test results, and ask follow-up questions. And they will expect it all to be seamlessly integrated and done on their smartphones.

“The last thing a Gen Z patient wants to do is play phone tag with a receptionist,” Schneider says.

Jonah Stillman is 18. He and his father, David, form the consulting firm Gen Z Guru and are co-authors of the book GenZ@Work. Efficiency and ease of interaction will be key to attracting Gen Z patients. Jonah says, “Efficiency is king in this day and age. Gen Z is going to be interested in finding ways to make everything more efficient and streamlined, including healthcare delivery.”

“We honestly don’t see the difference between an online appointment and an in-person visit. They’re the same,” he says, add-
“The physician will rather act as a health coach in the future. The doctor will interpret health data if something is not clear, give advice when results are not optimal while spotting and checking irregularities based on data as soon as possible.”

ing that “doc in a box” clinics in retailers and telehealth services are regarded by Gen Z as acceptable ways to access primary healthcare.

Practices should begin now to prepare for Gen Z, even if their arrival in significant numbers is years down the road, says David Gans, MSHA, FACMPE, senior fellow for industry affairs at Medical Group Management Association (MGMA).

“If you are a medical practice, you should be looking to design your practice more for Gen Z and millennials rather than the Gen X and baby boomers who make up the majority of your patients,” he says. “As they come into mainstream healthcare, wise organizations will learn to accommodate their different personality.”

That can mean offering digital features and conveniences, such as high-speed Wi-Fi and online scheduling that millennials and Gen Z want while still preserving the traditional ways of doing business that Gen X and baby boomers are more familiar with, Gans says. Because their smaller size allows them to change policies more easily, independent practices will be able to adjust more quickly than large multi-specialty groups and health-care systems, he says.

DOCTOR SHOPPING
Gen Z is going to comparison shop for its healthcare and prioritize patient reviews when deciding whom to see. “They view healthcare as a transaction and they don’t do any transactions without getting peer reviews and shopping online,” says Es Nash, MD, a population health expert at Deloitte Consulting.

That means physicians and practices must continue to carefully monitor and manage their online reputations on sites like Healthgrades, Vitals, RateMDs, and even Yelp. An inviting website and engaging social media presence also are important, Nash says.

PatientPop’s Schneider says a good site should be mobile-friendly, attractive, easy to navigate, easily found through search engines and integrated with common physician review sites.

PatientPop client Payal Bhandari, MD, a primary care physician in San Francisco, works with the firm to regularly tweak her website design and content to attract patients. She uses a second vendor to manage her blog and social media.

“I have to meet patients where they are,” she says. “If you’d told me 13 years ago that I’d have to pay this much attention to satisfying patients’ expectations, I wouldn’t have believed you, but that’s the new reality.”

The patient-friendly approach is working, she says, adding that the number of younger patients she attracts has been increasing year to year and that her online and survey reviews have improved. “I am convinced my model is the model for the future,” she says. “It is consistently working in regards to patient and physician satisfaction, sustainability and efficiency.”
“We’ve built practices for the physician experience, but we’re turning that upside down and asking if that’s good for patient services. It always seems like medicine is 10 to 20 years behind. It has to catch up or we’re not going to provide these patients the services they want.”

In addition to patient reviews and ratings, Gen Z will have greater access to outcomes and Medicare data on individual doctors, Nash says. Gen Z will not hesitate to switch doctors if they’re unhappy or inconvenienced, she adds, a move that will be easier when EHRs become truly interoperable.

“Customer satisfaction is as important as clinical outcomes,” she says, adding that smart practices will heed patient suggestions and criticisms and adjust their operations accordingly.

That will require doctors to be more solicitous of, and responsive to, patient complaints, says Schneider, who predicts practices will use more surveys and other means to gauge patient satisfaction. “It’s really putting pressure on the physicians to improve their game,” he says.

MENTAL HEALTH AND WELLNESS
For a number of reasons ranging from growing up around world events like 9/11 to peer issues, Gen Z is stressed. Members report a lot of problems with stress, depression, and other mental health issues.

A 2015 survey by the Hartman Group, a marketing research firm, found that 46 percent of teens are actively treating or preventing anxiety or stress and 30 percent are actively treating or preventing depression.

Jean Twenge, Ph.D., a professor of psychology at San Diego State University, in 2015 examined four surveys of younger Americans and found that high school students in the 2010s reported more somatic symptoms (e.g. trouble sleeping, thinking and remembering, shortness of breath) and were twice as likely to have seen a professional for mental issues compared with students in the 1980s. College student health centers also report an increase in demand for mental health services.

What does that mean for primary care providers beginning to see Gen Z patients? They should be aware that their young patients could already be under the care of a mental health professional, and know how mental illness can cause or exacerbate physical conditions.

Gen Z has grown up in a culture of wellness and realizes the importance of integrating physical, mental, and emotional health, according to the Hartman Group report, which also found them more aware of the importance of nutrition. Stillman predicts Gen Z patients will prefer doctors who incorporate, or at least respect, alternative and Eastern medicine.

CUSTOMIZED MEDICINE
Over the past ten years, doctors, sometimes grudgingly, have learned to deal with patients doing their own research through websites such as Google or WebMD; Gen Z will not only have their own research, but their own data.
Affordable genomic testing, wearable monitors, fitness trackers, and other devices are more likely to be adopted by younger patients and will provide users more raw information about their health. That will require physicians to incorporate patient-generated data into their own findings, says Bertalan Mesko, MD, Ph.D., director of the Medical Futurist Institute, which studies trends in medicine. Doctors will be responsible for helping patients understand and act upon their data, he says.

“The physician will rather act as a health coach in the future,” he says. “The doctor will interpret health data if something is not clear, give advice when results are not optimal while spotting and checking irregularities based on data as soon as possible.”

Gans predicts physicians will share tools and information more with Gen Z than previous generations, partly because the patients will demand it.

Rather than rolling their eyes, doctors should welcome Gen Z patients engaged enough to do their own research, Stillman says. Though he concedes that physicians will be more knowledgeable than patients, he adds, “We live in a time when anyone can become an expert through [online] research.”

**PATIENT POWER**
The balance of power in the patient-physician relationship, already tilting toward the patient, will shift even more with Gen Z, says Gans, adding that patients will expect physicians to deliver care the way they want or they will go elsewhere. “I think the doctors are going to have to learn to work extra hard to maintain the relationship with a patient,” Schneider says.

Students at Missouri State University don’t have the provider choices they will later in life, but the school still caters to their digital preferences, says Frederick Muegge, MD, an internist and university director of Health and Wellness Services. The university’s new health center offers online appointments and prescription refills, counseling, a portal for sharing lab results and text alerts for pharmacy pick-ups.

Muegge describes his young patients as curious and collaborative: “They are often engaged with their medical care and interested in understanding the pathophysiology of the illness. Often, many have done primary internet research,” he says.

Bhandari says doctors should regard Gen Z’s challenges, not as a threat, but as a way to improve. “We’ve built practices for the physician experience, but we’re turning that upside down and asking if that’s good for patient services,” she says. “It always seems like medicine is 10 to 20 years behind. It has to catch up or we’re not going to provide these patients the services they want.”

**Facts About Gen Z**
- It’s huge. Gen Z is 26 percent of the U.S. population, trailed by the baby boomers (24 percent), millennials (22 percent), Gen X (20 percent) and Post-War (9 percent). *(U.S. Census)*
- It’s the most diverse generation in U.S. history: 49 percent of children 15 and under are minorities. *(U.S. Census)*
- It’s tired. One in three is actively treating or preventing fatigue and they list getting enough sleep as a top health concern. *(Hartman Group)*
- Dermatological problems (26 percent) and anxiety, aches and pains and asthma (11 percent each) were the most prevalent conditions cited by Gen Z members. *(Hartman Group)*
It’s no surprise that patients who take an active role and interest in their healthcare have better health outcomes and lower costs. It’s also no surprise that patients haven’t been connecting with practices or using traditional patient engagement solutions, as those tools don’t offer different options for how patients want to connect.

Healthcare consumers now expect more from providers. Patients want tools that are flexible and easy to use to help them meet their health needs, according to a recent report by Deloitte.

To meet this demand, physicians’ offices, specialty clinics, community pharmacies, and the like have adopted technology solutions from multiple vendors for appointment reminders and patient portals. In addition, most providers offer these services through a patchwork of technology or single-point solutions that often lack interoperability and can overwhelm staff with added administrative complexities and increasing frustration.

The answer to this problem is not less technology—it’s technology that does more. Providers need to adopt new, cutting-edge solutions that offer multiple channels to connect with patients, based on their preference and convenience, as well as a single place for staff to manage communications.

RETHINKING PATIENT ENGAGEMENT
The challenge of using technology to connect with patients poses the opportunity to think about patient engagement in new ways. Healthcare consumerism has changed the way we want or expect businesses to communicate with us. Today, it’s crucial for providers to think of patients as customers and engage with them via the same channels that other businesses use to nurture those valuable relationships.

New communication options, such as cell phones and wearables, have shifted the way we providers and consumers communicate with each other. Indeed, mobile is already a primary means of communication for many consumers, with a survey by Flurry Analytics finding that the average U.S. consumer now spends up to five hours per day on their mobile devices.

For providers, tasks such as phone calls for lab results, reminders and scheduling that previously required hours of manual administrative work within the practice can now be easily automated. Through technology, patients can complete pre-intake forms, take pictures of insurance cards or medicine bottles, fill out surveys, and even make payments—all with less active interaction needed from providers.

Just as businesses in other industries like retail, banking and insurance are using tech-
nology to better communicate with patients, it’s time the healthcare industry caught up. The 2018 *Future of Health: Digital Health report* from EY noted that nearly 70 percent of physicians believe digital health technology will reduce costs and help reduce the burden on doctors and nurses. “Engagement with digital technology for health is gaining momentum, driven by a desire to improve wellness and underpinned by convenience. Technology is seen as one of the key enablers of seeing health as a lifelong journey,” the report notes.

Technology has the opportunity to fundamentally change the way both doctors and consumers approach healthcare. It can enable new outcomes and give patients greater flexibility and choice. But it can also create added frustrations, and for technology to do more, we need to understand the ways it lacks efficiency.

**COLLABORATION PLATFORMS OFFER EFFICIENCY AND ENGAGEMENT**

While many providers are already using some sort of digital engagement via patient portals and appointment reminders, it’s often with a makeshift system of single-point solutions that only solve specific functions. A provider may use one vendor for billing, another for appointment scheduling, and still another for text reminders. In many cases, providers are often unable to communicate with one another behind the scenes, and patients must use separate systems to message their physicians, view their medical records, or pay bills.

It’s not only an expensive and inefficient way to run the back office, but it can diminish patient engagement and the quality of care.

Often, single-point solutions were added to a provider’s workflow over the years as new technologies and trends came to market. This multi-vendor approach has left office personnel juggling multiple browser tabs and apps with no way of exploring the overall patient communications history in a single dashboard. This makes errors more common and can leave staff frustrated and burned out by working on laborious, administrative activities that end up stealing too much of their time.

For improved patient experiences and more engaged consumers, healthcare providers need to consider how their various tools work together. After all, technology should simplify tasks, not make them more complicated.

A comprehensive collaboration or customer relationship management (CRM) platform that combines patient engagement with provider communications and internal productivity solutions offer practices more effective options to reach patients in ways that they could never do previously. Advanced solutions, like HIPAA-compliant secure text, let physicians use pictures and videos to capture patient symptoms, send educational materials or lab results, file patient conversations for future reference, and alert patients when follow-up care is required.

Thankfully, cloud-based products can now combine many applications within a single, fully-integrated platform. Moving to a comprehensive collaboration platform enables providers to reduce administrative complexities and boost engagement by offering patients everything they need in one location. By doing so, practices will be able to better connect with their patients, ultimately resulting in better outcomes and lower healthcare costs.

The era of single-point solutions is over. A more comprehensive collaboration platform has arrived.

*Michael Morgan is the CEO of Updox*
Introducing the first ECG with **Mortara** smarts and **Welch Allyn** heart

When it comes to your patients’ heart health, an ECG may be the most important thing you do today.

The Welch Allyn Connex® Cardio ECG provides results you can trust in an easy-to-understand format designed with your workflow in mind. **Powered by trusted Mortara technology** and backed by **Welch Allyn expertise**, it redefines what ECG acquisition should be.
Patients are more likely today than in the past to seek care from multiple sources: their primary care physician, the local urgent care center, retail clinics, and even online. They’re also generating more healthcare data on their own, through fitness trackers or at-home devices like glucometers and blood pressure cuffs.

As a result, patients want technology that consolidates all that information and allows them to access and share what they need, when they need it. Patients will look for physicians who provide them with the online experiences that they’re used to and expect in other aspects of their lives.

“Over time, the customer is going to gravitate to providers based on convenience,” says Don Rucker, MD, national coordinator for health IT with the Office of the National Coordinator (ONC) for Health Information Technology.

Patient portals—intended to provide that improved engagement and outcomes—have yet to deliver on the promise. But that’s expected to change within the coming decade as portals become more patient-centered.

In the years ahead, experts expect portals will move beyond the limited functionality they have today and transform into a user-friendly technology that puts a patient’s whole health history into one easy-to-navigate online portal.

“We’re going to see a highly personalized portal, one that aggregates data from multiple sources, that can contextualize the data, run analytics on it, and that can empower patients as they navigate their health journey,” says Mark Gilbert, MBA, director of research at Gartner Inc., a Stamford, Connecticut-based IT research and advisory firm. “And I think ten years out, we’ll find these tools will become a critically important part of a precision health model.”

A FRICTIONLESS EXPERIENCE

Even though today’s portals typically have limited functionality, physicians still say they see them as the primary tool for engaging patients, says Adam Cherrington, MBA, research director of patient engagement at KLAS Research in Orem, Utah.

“[Physicians] call it the highway to the patient,” he says, “but they also tell us that adoption is still low. It’s still a challenge to get patients to log in.”

Cherrington says that the vast majority of healthcare providers (both systems and individual practices) have implemented patient portals, yet studies show less than 20 percent of patients on average log in and use them. And those patients who do use portals generally do so only to check appointment times, send or receive messages, or check lab results and healthcare records—even though some portals already offer more advanced functions such as online scheduling and even telemedicine options.

Health IT leaders point to a poor user experience as a significant reason for the low rates of use by patients.
“It’s a pain point we hear a lot from patients,” says Margeaux Akazawa, a public health analyst at ONC. “We can see patient portals as a success in getting patients access to their data, but they’re very limited. Not only are they very static, but they’re not designed with the user in mind.”

Cherrington predicts technology vendors will develop portals that are easier for patients and physicians to use, which he says should spur higher levels of adoption.

Similarly, health IT experts say technology vendors will increasingly optimize portals for mobile device use, because studies show people overwhelmingly use smartphones and tablets to access online information.

“What we know is mobile is the dominant platform for consumers today, so that has to be the predominant platform for portals,” says Walter Jin, CEO of Pager, a New York City-based company that sells a mobile app to insurance companies to help guide their members through the healthcare system.

Making the user experience smoother and optimizing it for mobile use are critical steps that will help increase adoption rates, experts say. However, those steps are just the start of the improvements in portal applications expected in coming years.

**FUTURE FUNCTIONS**

EHR vendors are not the only ones developing patient-centered technologies.

Software companies outside the healthcare industry are introducing portal-like products, too, with experts pointing to the January 2018 announcement from Apple Inc. about its Health Records app as an example.

As these software makers create new features, physicians and patients can expect future portals to:

**Deliver more information and support more interaction between patient and provider.**

Health IT leaders say portals will be the main tool physicians use to remind patients about upcoming visits, the protocols they need to follow between appointments, and other critical healthcare recommendations. Likewise, they see portals making it easier for patients to send emails, search information, schedule appointments online, and even securely exchange texts (the preferred method of communication for many younger patients). Experts note that portals typically have these functions now; however, they’re not widely used nor are they always easy for patients and physicians to navigate.

**Organize and summarize patient data from multiple EHRs and consumer devices such as fitness trackers.**

This will be done in a way that the average person can understand, and provide details and insights on what the patient’s healthcare data means for them. For example, portals will provide action plans from the patient’s physicians and links to appropriate guidelines or follow-up treatment guides. Portals will also use artificial intelligence-enabled self-management and self-diagnostic tools. “There is the potential for healthcare that’s happening in the doctor’s office to move back to the patient,” says Edward Yu, MD, a primary care physician and medical director of quality at Palo Alto Medical Foundation.

**Automate more actions.**

Patients will be able to initiate and conduct a virtual visit with a simple click from the portal. In turn, portals will make it easier for patients to provide relevant information in advance of both virtual and in-office visits via automated questionnaires contained within the portal, says Stephen Dart, MBA, senior director of product management with AdvancedMD, a South Jordan, Utah-based vendor of cloud software for independent medical practices.

**Offer more resources, including connections to support groups or communities focused on their specific health conditions or wellness concerns.**

“Portals will become richer as they’re able to incorporate other capabilities that patients
want,” says Peter Kilbridge, MD, senior director for research at The Advisory Board Co., a healthcare research and consulting firm headquartered in Washington, D.C. For example, physicians could use portals to connect patients to nutrition programs or deliver ongoing content that helps motivate patients with chronic conditions to stay on track with their care programs. Taken all together, “the future of the portal is about getting the right data to the patient in an understandable format to help them engage and improve their ability to follow a healthcare plan,” says Ripley Hollister, MD, a board member with the Physicians Foundation and a primary care practitioner in Colorado Springs, Colo.

CHALLENGES TO IMPLEMENTING BETTER PORTALS
Such a future state isn’t that far off, according to health IT experts. Some portals already have advanced capabilities, such as telemedicine functions, online scheduling options, and the ability to access physicians’ notes. But those are the exceptions. Moreover, the technologies that will enable future features already exist. Application programming interfaces, or APIs, and the Fast Healthcare Interoperable Resource (FHIR) standard already enable interoperability between systems. Artificial Intelligence (AI) is being used to help physicians make diagnoses and plan the best courses of care. And many patient portals can be accessed by smartphones, even if not all existing portals are yet optimized for mobile devices. Still, there are challenges to creating the more advanced features described above and achieving widespread adoption of them, health IT leaders say.

For starters, EHRs can’t yet easily share data with other EHRs. Similarly, many EHRs can’t readily accept or share data with patient-owned apps. Additionally, some providers don’t want to share all their notes directly with patients. Many others don’t want to open up their schedules for patients to set up appointments online without staff screening to determine the urgency of the patient’s needs.

Questions about how and how much physicians will be reimbursed for services offered via patient portals—such as telemedicine visits or text exchanges—could slow adoption of anticipated future features, Hollister says. “There’s a cost to this technology and the maintenance of it. Who will pay for those costs? Will the physician be reimbursed?” Hollister asks.

Physicians will also need time to incorporate the advanced patient portal capabilities into their practices, Hollister says, explaining that physicians will have to establish for themselves and their patients what types of information is appropriate to share via the enhanced portals of the future and what communication will remain best done via in-office visits.

Cherrington acknowledges that these challenges could stymie the patient portals of the future, with a lot of developments having to come together in order to see the high level of patient portal adoption that can then impact healthcare outcomes. However, he says, his research shows that optimism regarding future improvements is high in light of Apple’s entry into this market and other advancements.

Physicians and other healthcare providers see a future where this technology can help with interoperability by providing a conduit for sharing data as well as making data more accessible and thereby allowing patients to really take charge of their healthcare. “Providers want to not only have a vehicle to connect with their patients, but they want their patients to participate in their care by making it easier to navigate it,” Cherrington says.

And patients want this too, he adds, in the form of a tool that makes their experience smooth and easy when seeing their healthcare team. “That’s what has to happen, Cherrington says. “Whether we call it a portal or patient guidance tool or something different, I don’t know. But it’s going to have to be something significantly useful for the patient and as that happens the value alone will keep patients coming back to it.”
The best way to engage patients in their care
BY BETSY WEAVER, ED.D.

Studies have substantiated the efficacy of both email and text messaging in improving patient engagement and outcomes.

Yet few studies have shown statistical significance and clinical impact. Instead, they focused on how email and text messaging moved the needle. But today, it’s not solely about message type—be it text, email, mobile app, or web portal. It’s about smart, fresh, factual, multimedia content delivered in real-time at the right time. If it’s not relevant, easy—and yes—delightful, the patient is GONE! There are few second chances.
“It’s about smart, fresh, factual, multimedia content delivered in real-time at the right time. If it’s not relevant, easy—and yes—delightful, the patient is GONE! There are few second chances.”

In 2018, we conducted a quasi-experimental study with a four-hospital system in the Midwest. We examined the use of a two-way digital engagement program and its impact on outcomes for total joint replacement patients—a critical population because these surgeries represent a tsunami of healthcare costs for Americans. Email and text messages were delivered to patients before, during, and after their hospital stay. We looked at engagement with the educational messages and outcomes regarding day of surgery cancellation, length of stay (LOS), discharge destination, emergency department (ED) use, and 30-day readmission.

What we found:

- Significant cost-savings and efficiencies gained
  - 25 percent of a day reduction in LOS for hip patients; 13 percent for knee patients
  - 50 percent reduction in ED visits by hip patients who were highly engaged (opening ≥50 percent of the messages)

- Early identification of at-risk patients
  - High engagement correlated with lower risk, enabling hospitals to target more support to low engagers

- Equally high engagement across insurance types
  - 71 percent of patients were highly engaged
  - Results were unrelated to insurance type—i.e., public (Medicare/Medicaid) vs. private.

Replicating these kind of results requires diligence in examining the how, as well as the what of patient engagement initiatives.

1. **Focus on the VEHICLE** (the platform or technology) that best connects with those you’re targeting to create a sustained connection throughout the care episode.

2. **Make it EFFORTLESS.** Patients will not engage unless there are no barriers to set-up and use (no required sign-up, downloading, or passwords). Additionally, any time required of the care team to make it work is too much. So …

3. **AUTOMATE ENROLLMENT.** Make the connection opt-out and part of your standard of care.

4. **Use REAL-TIME DATA to evaluate efficacy.**

5. **Make content PERSONAL and AUTHENTIC.** For example, if a patient just had a baby and hasn’t been able to sleep or shower for days, receiving images of well-manicured women wearing makeup and holding a perfect, sleeping baby will not cut it. Authentic means “I see myself in your connections.”

These are the things that make a difference in patient engagement and create opportunities to statistically substantiate that digital connections, sustained over time, do in fact improve outcomes, increase capacity for hospitals, and save time and money.

**Betsy Weaver, Ed.D.,** is the co-founder, CEO and president of TPR Media LLC (d.b.a, UbiCare).
An ECG test may be the first thing you do if you suspect a patient has cardiac issues—and it may be the most important thing you do all day. If clinicians overlook the fundamentals in conducting proper ECGs, the resulting interpretations, diagnoses and patient treatment plans may be fundamentally impacted as well.

A number of factors impact the data captured by an ECG, with consequences for how that data is then used in diagnosis and treatment decisions. This white paper reviews three areas of concern and how they may impact ECG interpretation. Questions for consideration are presented, as well as steps that can be taken to help assure that these critical tests yield accurate data that can be trusted.

### Prep and Placement

High-quality ECG waveforms require good practices when prepping the patient and placing electrodes. If proper techniques have not been followed, ECG interpretation may be compromised even before it begins.

Capturing the electrical activity of the heart via electrodes is impacted by the fact that skin can be a poor conductor of electricity. For example, hair prevents electrode contact, dead skin does not conduct well, and oils, lotions and gels can leave a film. All of these sources of poor conductivity can lead to artifacts.

Good prep, therefore, consists of:
- Clearing away hair
- Removing lotions, powders and oils
- Drying the skin for better electrode attachment
- Abrading skin to remove dead skin cells

Apply electrodes to the prepped skin using lead placement diagram as a guide.
This approach to prepping patients may be met with some resistance from clinicians, due to longstanding processes or perceived limitations. To overcome such objections, consider the important implications:

- Patients may have an ECG at any number of facilities at any time, so comparing new to previous ECGs requires consistency in prep practices.
- Artifact has the potential to affect, or even misdirect, clinical decisions.
- Most sources of artifact are preventable—addressing them can avoid the need for retesting.
- Taking a few extra moments for patient prep can lead to higher quality exams the first time.

Proper electrode placement is also critical. In fact, when it comes to ECG inaccuracy, the top factor cited is precordial electrode misplacement. According to the ACC and AHA, 5% of all ECGs performed are done with a lead reversal. Some lead reversals can be difficult to discern as an error and may lead to physicians incorrectly identifying arrhythmia where there is none.

**Filtering**

ECG filtering removes noise from ECG recordings. In so doing, it’s intended to help physicians see waveform data more clearly, making ECGs easier to read and to interpret. While filtering can yield a clean-looking ECG, too much filtering can distort or remove authentic waveform data. The problem with overly filtered ECGs is that physicians may not know what they’re missing.

Filtering is beneficial if the filters are set to an appropriate threshold, and if the interpretive algorithm still looks at the original versus the processed waveform. Governing bodies like the ACC, AHA and HRS publish adult and pediatric guidelines providing guidance to:

- Limit filtering so not to sacrifice potentially lifesaving waveform data
- Clearly disclose filtering so physicians can more easily identify original vs. processed waveform data

All major ECG manufacturers offer filtering to reduce noise and provide clear ECG recordings, and most also offer interpretive algorithms to aid in decision support. Physicians need to be aware, however, of the filtering that takes place on any given ECG, and its potential impact on the interpretation.

Questions to ask include:

- Are the filters set to the right threshold per ACC, AHA and HRS recommendations?
- How can I tell what is original vs. processed waveform data?
- Does the interpretation look at the original or the processed waveform?
Sampling

An ECG is a visual representation of the electrical activity of the heart. The electrical stimulus of the heart occurs continuously, and in a repeated pattern to make the heart beat. To accurately represent this activity in digital form, a resting electrocardiograph is tasked with collecting enough data points to reproduce the analog signal as close to the original as possible.

The rate at which data points are sampled can have a significant impact with ECG waveforms that have fast-moving or high-frequency components. Examples of high-frequency information include:

- Pacemaker spikes
- High-frequency notches in the QRS complex
- Notches in Left Bundle Branch Block ECGs

Therefore, it’s important to consider the following questions:

- Does the sampling rate support a frequency response that is aligned with the published guidelines?
- Is there any user intervention needed to enhance the pacemaker detection or display?

Conclusion

In addition to the skill of the practitioner reading the data, ECG interpretation depends on the quality of the data captured. Factors that have a critical impact on that data capture include filtering, sampling, patient prep and electrode placement. With a better understanding of these factors and their implications, steps can be taken to achieve results that can be trusted for diagnosis and treatment.

About the Welch Allyn Connex® Cardio ECG

Using the interpretation algorithm trusted by the FDA in new drug trials, the Connex® Cardio ECG is designed to help you interpret a diagnostic-quality ECG based off of authentic waveform data. Using “best 10” technology, it captures 10 seconds of data with the least amount of noise to help reduce the need for repeat tests. With its combination of operational and clinical excellence, it can help alleviate some of the issues known to negatively impact ECG interpretation.

Learn more at www.welchallyn.com/connexcardio.