Low-Dose Imaging
Developing Radiation Management Programs
Advances in imaging technology have had a profound impact on patient morbidity and mortality. Without question, imaging saves lives. However, high doses of radiation can result in long-term risk to patients. Radiation dose-management programs enable the prudent application of imaging technology to ensure that patients receive the right procedure at the right time at the right dose.

To explore the ongoing development of comprehensive dose-management programs, Health Forum convened a panel of industry experts Aug. 23 in Chicago for a roundtable discussion. Health Forum would like to thank all of the participants for their open and candid discussion, as well as GE Healthcare for sponsoring this event.
MODERATOR (Bob Kehoe, Health Forum): Let’s start by getting some perspective on where you see the profession today in terms of the evolution of dose management programs in hospitals. What are some of the challenges you’re seeing in the field today? What’s your overall assessment of what’s going on in your institution?

KEITH HENTEL, M.D. (New York-Presbyterian Hospital–Weill Cornell Medical Center): Radiation was ignored for years, but now it’s important that we all pay attention to it. It’s important for patient safety. And patients are aware of the issue. They want to know about the doses they’re receiving.

ELLA KAZEROONI, M.D. (University of Michigan Health System): Radiation dose management is probably the single most important public health contribution that radiology can make in terms of quality and safety. It’s both a combination of public awareness, as Keith mentioned, as well as the growing science behind it.

For decades, we’ve been driven by image quality, a pursuit of a prettier picture. What we’re seeing now is the pursuit of a picture that is good enough to be of diagnostic quality for the question being asked for that patient. So, rather than a protocol-based approach that is related to a body part, we’re seeing more medical efficacy-type protocols being developed to help determine what’s right on an individual patient basis. We’re trying to tailor the quality of what we do by providing a minimal amount of radiation to answer the clinical question at hand.

MARK JARRET, M.D. (North Shore–Long Island Jewish Health System): This really represents a shift in thinking toward a big-picture view. In the past, we were more concerned with efficiency, getting people through the system and making a diagnosis, and less concerned about the impact on the patient. We never thought much about balancing safety and quality.

JEFF HERSH, M.D. (GE Healthcare): Radiation dose management is consistent with the trend in medicine to be patient-centered. It’s about maximizing the benefit for individual patients and minimizing risk. Imaging saves lives, minimizing morbidity and mortality. It’s huge. We don’t want to underestimate the huge, potential benefit. But we certainly don’t want to minimize the risk. And that’s something that needs to be done on the individual patient level.

HENTEL: I would take it even a step further. I would say not only on a patient-by-patient level, but really on an exam-by-exam level. There’s a great deal of talk about cumulative dose and tracking cumulative dose. I don’t really know what that means. To me, each study is either needed or it’s not needed. So I think that we really need to focus on imaging one exam at a time. We should have the same concern with the first exam as we do with the 10th exam. Either you need to do an exam to obtain diagnostic information or you don’t. The job of the radiologist should be to help determine whether or not the study is indicated. The best way to reduce radiation dosage is by not performing unnecessary imaging procedures.

KAZEROONI: Once it’s determined that a test is indicated, the next step is to determine what the right test is based on the patient’s needs. Would the patient be served best by an X-ray, a computed tomography scan or an interventional procedure?
Is there another test that would provide a higher degree of accuracy for the specific clinical patient? Once the decision has been made for a CT scan or that interventional radiography with fluoroscopy is appropriate, how can the dose be minimized for that individual? The answer will be very different for a cancer patient with a three-year life expectancy versus a 22-year-old with no pre-existing medical conditions. There is a trade-off at the individual level.

**JAMES DWYER, D.O.** (Virtua): From a system perspective, outside of the field of radiology, I think there is a growing awareness of dose management, as has been mentioned. But I don’t think the level of awareness is as intense as it is in the radiology field. The real challenge will be getting the message out not only to the public, but also to the clinics and all the physicians ordering the tests to ensure they are aware of the implications of the tests they’ve prescribed, and assist them with creating a more effective culture of safety. That’s a big challenge. Protocols are great but, until we can get everyone on board, all of the other stuff goes by the wayside.

**RISHI SIKKA, M.D.** (Advocate Health Care): One of the disconnects I see is that the risk is always expressed on a population level and the rubber hits the road on an individual patient level. It’s hard for a clinician to contextualize that. There are several areas that need to be taken into consideration. Is the exam indicated? Are the appropriate protocols in place alongside the best technology? Are the images performed by knowledgeable radiologic technologists?

As Jim noted, we have to elevate radiation dose management to the entire health care community to enhance engagement and understanding. That’s something we are working on at Advocate Health Care. We have a dashboard for health outcomes: starting next year all of our sites will be participating in the American College of Radiology Dose Index Registry. The results of CT dosing will be reported on our dashboard in accordance with the new National Quality Forum CT radiation dose patient safety measure. This is a great example of taking something that was a little bit of a concerted focus within radiology and elevating it across our broader organization.

**MODERATOR:** How do we ensure that physicians are up-to-speed on this issue?
port tools at the point of care when a physician is ordering. We can debate on just what the status of that technology is, but we probably all agree that the technology is evolving rapidly. If you focus on population health and/or accountable care, having tools to support your imaging decisions can contribute to patient safety and reduce unnecessary utilization. That’s really the true value.

HENTEL: We use clinical decision support. It’s up and running at our organization. It’s really just a part of the puzzle. Basically, it comes down to expertise. In our system, we don’t take the position that every physician who orders an imaging study needs to have the expertise. It’s really leveraging the expertise of the radiologist. A radiologist should review every case before it gets done and recommend alternatives, if possible. Part of the education is making sure that those who refer the studies are also open to suggestions and don’t provide a lot of
pushback. It’s important that you leverage the expertise of people who are truly expert.

MODERATOR: What are some of the barriers to establishing radiation dose management programs?

HERSH: Leadership is important here. We need to get the message out. We need the right test for the right purpose. We need to answer some important questions. Is there an alternative test? Is the right test? Is it clinically indicated? Have we done a complete history and physical to make sure we’re going to get the most return for the patient?

The public, for the most part, still believes that more medicine is better medicine. We know that better medicine is better medicine. So, we need to get that message across. The benefits are huge, but the benefit-to-risk ratio is even better if you can ensure that you’re always getting the maximum benefit and that we minimize the risk.

Dwyer: The level of awareness is very implicit. There is a growing awareness among the public about radiation exposure. But there’s still a large segment of the population that will question the order of an X-ray instead of a CT scan or magnetic resonance imaging. That places some pressure on clinicians, irrespective of their knowledge of radiation exposure.

On the emergency side, for example, physicians are charged with the responsibility of getting to an answer as quickly as possible. The ED is probably the most acute example, but it’s also true in primary care practices and pediatricians’ offices. These physicians often seek the procedure that will provide the quickest answer so they can implement effective treatment. The challenge is to create a level of awareness among physicians to understand how serious this is and get them to consider the risk vs. benefit of a test prior to ordering one.

SHUMAN: The biggest challenge is cultural change and the biggest cultural change is accepting standardized best practices. Physicians don’t think in those terms. What we have to do is define best practices in radiology and then insist that we only practice that way. That is a huge cultural change for the practice of medicine. Defining best practices, standardizing, treating and executing the cultural change — those are the big challenges.

MODERATOR: Will things like the dose index registry help get us there?

SHUMAN: Sure, it helps. Keith is being a little modest in his description of his organization’s use of clinical decision support for imaging. His organization is leading the way in defining best practices in radiology. We’re closely watching what they are doing; they’re about two years ahead of the rest of us, but we’re going down that pathway. We’re going to see radiology as a profession leading the concept of computerized decision support in a way that the rest of the practice of medicine will follow our example.

Sikka: This is a question to the radiologists in the room. How much of a barrier is the relationship between the radiologist and the non-radiologic physician? Has that relationship changed in recent years? My background is in emergency medicine and looking back at my early career, I had a close relationship with the radiologists. It was partly because I had to get the films and look at them. Now, I have a workstation from which I can view reports and I have less interaction with the radiologists. The relationship isn’t as strong, but that relationship is essential for the requisite education to take place. Does anyone else see this as a potential barrier?

Kazerouni: Technology has changed things. The radiologist is separated from where the intensivists are practicing, and it takes a great deal of effort to maintain that relationship. The relationship probably started to fray because of distance. Over the last three to five years, the radiology community started to realize how important it is to maintain a relationship with the referring practitioner. And it’s not just about ordering a test and getting it done efficiently when the patient or the provider wants it. It’s about getting the right test. It’s about communication. It’s about providing value to the referring physicians and having a partnership with them to help them understand the role of imaging. They’ll keep sending you patients because you have established a relationship.

A radiologist can’t operate out of a darkroom, removed from referring physicians. That relationship will fray. There will be a lack of understanding, and you’re really not providing a full service. The radiology profession has realized over the last several years the importance of being engaged with referring providers.
JARRETT: We all want what's best for the patient and that includes getting the right test in a timely fashion. One of the major barriers is on the outpatient side. If an ultrasound is the best option, is the patient able to receive one right away? Can he or she get the results right away? If a patient needs a CT scan, can that be done right away? We don't have a good infrastructure to bring people through the system in a quick, timely fashion.

HENTEL: We've been piloting a consultation service for radiology. Radiologists spend time rounding with the ICU teams to recommend and talk about what's going to be ordered. It's important that we get that expertise from the radiologist early in the process to control the use of radiation and make sure it's done in a timely fashion.

KAZEROONI: We published a study in the Journal of the American Medical Association about 15 years ago on inpatient radiology consultation. We anticipated a reduction in utilization, but that did not occur. Instead, ordering physicians were using us to get tests ordered more quickly, rather than to make sure they were ordering the right test. But the radiologists were able to do both. The service was well-received, but it's hard to maintain.

HENTEL: We're using midlevel providers to help with that.

SHUMAN: We are, too. In fact, a resident came to me recently to express concern about his role in the organization, because we hired two physician assistants to interpret chest films. I referred him to an editorial I co-wrote in JAMA, “The Radiologist as a Consultant.” The role of the radiologist first will be that of a consultant, not a film interpreter. That article was actually published in 1979.

Dwyer: A certain level of transparency will be needed to be able to garner attention. How often are protocols being broken? How often are radiologists going outside of the dosing guidelines for different procedures? How often are you giving doses that exceed the recommended level for individuals? That kind of transparency ultimately will drive the change.

DwYER: Dose management is important. But until we develop a way to provide meaningful measures, it's going to continue to be just under the surface. We need metrics that can be reported publicly. Unless and until that happens, it will remain where it is in terms of awareness and focus.

SIKKA: The focus will increase significantly in the next couple years. People are going to recognize
the strong connection between dose management and utilization. As that connection becomes better understood and established, and as more and more organizations move into an accountable care environment, that’s when this is going to take off. I don’t mean to be cynical, but the tipping point will be the connection between dose management and utilization and the connection of utilization to population health management in a total-cost-of-care environment.

**KAZEROONI:** You’re absolutely right because places that are focusing on utilization are also focusing on dose management. There is a connection between the two. We are still early in our understanding of radiation dosage and its impact on the patient. We can participate in registries, but there’s no benchmark. There isn’t an adjustment for case mix. A cancer center’s use would vary significantly from that of a pediatric hospital, for example. What’s the size of the patient population? Do you have a high percentage of obese patients? So we’re still in the infancy of using dose as a metric and having any sort of benchmark around it. We’re really in the early general stage of reporting a single-dose measurement for a case, not the appropriateness for the patient or the population in general.

**SHUMAN:** We have to focus on the patient safety component. The risk is real. We are morally obligated to drive out all the risk that we can from the system and this is a manageable risk. Dose is a barrier to appropriate utilization. Appropriate utilization results in decreased length of stay. It results in better health care and better outcomes.

**JARRETT:** Senior leaders are beginning to realize that there’s more to dose management than simply replacing imaging equipment. You can’t replace everything. It’s the programs and processes that truly make a difference. It’s appropriate utilization, training and measurement. That’s the key in the long run.

**HERSH:** This needs to be attacked with a three-pronged approach. First, focus on the people: the radiologists, the ordering physicians, patients and technologists. Second, there needs to be a process in place. Do you have the proper processes and protocols in place? Do you have pediatric protocols? Weight-based protocols? Disease-based protocols? Finally, are you using the technology to its best capability? Is there other technology that you can add that will make this even better? You have to focus on these three things to be effective.

**SIKKA:** For a CEO of an organization that either is or will be entering into an accountable care contract, clinical decision support for high-end imaging utilization management has to be a key tactic, because it gets at the triple aim of better safety, better cost and better population health management. As organizations move toward accountable care and as the payment models change into shared savings models, we will see this bubble up.

**HENTEL:** We have dose tracking software on our scanners that provide reports on our dose protocols. I honestly don’t know what to do with the data. The only thing I do with that data on a reliable basis--and this may reflect on my limitations--is circle areas that seem to be out of alignment. A lot of this comes back to the case-by-case basis.

**MODERATOR:** As the health care field transitions from a volume-based system to a value-based system, are there financial benefits to hospitals that effectively manage dose?

**SHUMAN:** Sure, there are economic benefits. The big driver is appropriateness because appropriateness has value built into it. Appropriate utilization impacts length of stay and length of stay is one of the biggest variables in inpatient cost now. But it impacts outpatient expenses as well, which, of course, we’ll all be paying for in a centralized way in the future. There’s a huge economic driver there to do the right thing vis-a-vis radiation.
KAZEROONI: Blue Cross Blue Shield of Michigan has a program called the Physician Group Incentive Program that benchmarks physician practices based on utilization of high-tech imaging, among other things. Physicians can see how they rank relative to all other physicians in the state in terms of imaging utilization. Blue Cross Blue Shield provides incentives to be on the lower end of utilization. There is a definite financial return for lower utilization in our patient population.

MODERATOR: I’d like to shift focus a bit and explore the structure of dose management programs. What needs to be in place to establish an effective dose management program? Who needs to be involved?

KAZEROONI: Engagement by senior leadership is a must. There needs to be a partnership among senior leaders, radiologists and other providers in the organization. Infrastructure is critical — what hardware and software tools are on hand to optimize dose? It requires a great deal of time on behalf of physicians to set up protocols. You want to make sure that you’re working with your technologist to establish best practices.

All imaging protocols must be reviewed on a regular basis. You need to know what value you’re willing to accept and what value you will not go beyond for each examination. Radiologists, the lead technologist and, perhaps, a CT physicist should be involved in the decision-making.

We review every CT protocol yearly; any changes to protocol must be signed off by the radiologist, the lead CT technologist and a CT physicist. That’s critical to make sure we’re thinking about all of the components and to ensure that everybody understands all of the different pieces that play into radiation dose. We have found that to be a good process.

HERSH: Do you have a radiation officer? Do you have somebody who’s accountable and do they have seats on your hospital safety committee? Hospitals should have somebody who’s going to look at your protocols and the reports, and oversee all of this.

KAZEROONI: Most of the technology being developed today includes built-in safeguards to prevent excessive dosage. It allows only a handful of people to override the dose. But it will take some time for clinicians to accept that we can get the necessary results with an image that provides lower radiation.

SIKKA: Dose management programs should be in sync with clinical integration programs, providing incentives and feedback to non-radiologists. We need to remember the role of the non-radiologic physician and build metrics into the program. It’s important to involve the end users from the start; otherwise, we won’t get the results we are seeking.

HENTEL: Hospital leaders need to acknowledge and empower people who have the expertise and are willing to put in the time to do this. Dose man-
Dose management programs do not require a significant financial investment; they do require the investment of enthusiastic people dedicated to lowering radiation exposure. That’s one of the roles of leadership — finding dedicated, enthusiastic people to lead the program and providing them with the time and resources they need to get it done.

My guess is if organizational leaders look, they’re going to find people who are interested in this, because there are a lot of people who are interested in this.

KAZEROONI: Senior leadership involvement is critical from the beginning. We have a wonderful partnership with our administrative hospital and health system leadership; but we need to make and present the case to our leaders to build support and understanding.

SHUMAN: It’s a challenging case to make. We have to demonstrate the value of dose management. It improves quality of care and can be a valuable marketing tool within the community for being a high-tech, high-touch organization. That can quickly get the attention of administration.

KAZEROONI: All of us come from engaged health systems with respect to this issue. Of course, there are hospitals and outpatient centers that have one or two CT scanners that are replaced every 10 to 15 years. They can’t afford the state-of-the-art scanners, but they can do things to reduce radiation exposure. Unfortunately, dose management often is perceived as a technology issue. That’s one obstacle we need to help administrators and radiologists overcome. There are things that organizations can do to reduce radiation exposure regardless of the technology in place. Another way to engage administration is by showing what the organization can accomplish with what is already in place.

MODERATOR: Your organizations are a bit further along this path than many across the country. What recommendations do you have for organizations that are not as far along in developing dose management programs?

HERSH: We tried to address some of the variance that exists across organizations. We visit hospitals and evaluate their systems and programs. And we’re not just looking at our products. We really want to raise awareness of the issue. We have developed a questionnaire to help hospitals assess where they are and to help identify the low-hanging fruit.

JARRETT: It’s not necessary to re-invent the wheel. Organizations that wish to adopt dose management programs should seek out organizations with existing programs and get a jump-start on it. Obviously, the program will have to be modified to fit an organization’s needs. We need more of that type of information sharing.

MODERATOR: How do you train and educate physicians and other staff on these issues? What types of things do you discuss with them? Is it formalized? Is there some sort of continuous education process that takes place?

HENTEL: All clinicians know that too much radiation is a bad thing. But the issue is much more complex. All patients are different; there’s no one-size-fits-all solution. One solution may be to start with something like cardiac imaging that has a great deal of supporting evidence in regard to dosing. After that is up and running, add a few more areas of focus. Once you’ve established dosing protocols in those areas and educated everyone involved, it’s time to move on to other areas.

SIKKA: We’ve created a competency assessment for all of the CT technologists across the health system. We target our educational program based on the results of the assessment. We aren’t providing broad-based education; it’s very targeted. It ties in to their professional development goals so they have incentives to build this competency.

HENTEL: It’s important to include the technologists as part of the program, too. You have to get buy-in. Technologists should be able to speak up if they feel something is off. They should be able to approach physicians to have an open discussion.

DWYER: Radiologists and radiology technologists have a pretty good understanding of the importance of dose management. My biggest concern is with those outside of radiology. What is the level of awareness outside of radiology? We need to get a sense of their understanding to build a case for how to develop an effective system of education.

MODERATOR: What metrics are needed to properly measure performance improvement in this area?
**HENTEL**: There really isn’t any good measurement that you can make. You have to choose a metric and just be consistent with that. Of course, you have to look at your protocols and you have to look at image quality and set a range of where the organization should be. Dose registries are important, but their main value right now is just setting the range.

**HERSH**: Looking at variance is key. Look at variance among technologists, radiologists and ordering physicians. If you don’t track it, you can’t change it.

**KAZEROONI**: One of the nice things about the American College of Radiology’s CT accreditation program is that there are standards for each of the groups that is involved in CT operations. There are image quality and radiation dose criteria for technologists, physicists and radiologists. Organizations that participate in the program get a good sense of what is going on in their organization in terms of dose management. It’s a big commitment but it sets a pretty high standard.

**MODERATOR**: What other metrics are commonly in place today? Body mass index is frequently cited. How do you track these types of measures?

**SHUMAN**: First, you need to set up certain key parameters and then track your ability to meet them every time. Here’s an example. Joel Platt, M.D., University of Michigan, did a wonderful experiment win which he off-centered patients and measured the change in radiation dose. He found that if a patient were 4 centimeters off center, the radiation dose increased 40 percent. That raised the question as to whether all technologists bring up the lateral scout, put up the cross hairs, and determine whether the patient is dead center every time. It has to be 100 percent. We struggled to reach the 100 percent goal, but we did achieve it, and it’s ingrained in the culture. It’s not just a matter of saying, “Yes, we do it.” It’s a matter of tracking compliance, as well.

**KAZEROONI**: In the past, our ability to do those sorts of things has been limited by technology, because what we really would have to do is look at the parameters scan by scan, put them in a spreadsheet, and then analyze them. Now we have improved software tools that will extract the information from our medical devices and create a database to help with that.

**HENTEL**: What’s been really important for us is being able to get the data in an automated way without dedicating too many man-hours to do it. That actually pushed us to go ahead with the ACR registry because we have a streamlined, efficient way to collect the data.

**MODERATOR**: Will the data eventually reside in the patient’s electronic health record? What are you doing with it?

**HENTEL**: The only utility we have for it right now is quality control. That’s what we’re using it for. We don’t put any cumulative dose into the patient’s medical record because, quite frankly, we aren’t sure exactly what it means.

**SHUMAN**: We recently started putting the dose length product in every patient report. The tech has to enter it manually, so it’s not automated yet. We did it mainly for educational purposes to help build awareness. I can understand the ambivalence about it. But when you put a number in a report, it creates awareness and also a database that you can search across populations.

**HENTEL**: In my opinion, we shouldn’t be focusing on cumulative dose. We should really focus on each individual exam, making sure it’s the right exam and then using the lowest dose possible. Again, we don’t know what cumulative dose means. And there’s really nothing we can do about cumulative dose.
Health Forum would like to thank the panelists for taking part in “Low-Dose Imaging: Developing Radiation Management Programs,” with special thanks to our sponsor: GE Healthcare and the GE Blueprint for Low Dose program.