SPECIAL REPORT

A Summary of the American Society of Echocardiography Foundation Value-Based Healthcare: Summit 2014

The Role of Cardiovascular Ultrasound in the New Paradigm

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Dr Byrd was the Summit chair; the rest of the panelists are listed in alphabetical order.

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Abbreviations

ABIM = American Board of Internal Medicine

ACC = American College of Cardiology

ACO = Accountable care organization

AHA = American Heart Association

ASE = American Society of Echocardiography

AUC = Appropriate Use Criteria

CAD = Coronary artery disease

CMS = Center for Medicare and Medicaid Services

EACVI = European Association of Cardiovascular Imaging

LV = Left ventricular

MI = Myocardial infarction

TEE = Transesophageal echocardiography

TTE = Transthoracic echocardiography

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For the past decade, the healthcare system in the United States has been undergoing a seismic shift in models of care and payment paradigms. Until recently, nearly all medical care in the United States was reimbursed on a "fee-for-service" basis, as doctors and hospitals were paid separately for each test or procedure they performed. In 2006, Michael Porter and Elizabeth Teisberg introduced the value agenda in their seminal book *Redefining Health Care* and noted in a 2007 article[1] that physician leadership was essential to bringing about meaningful changes and improving value in healthcare. Since that time, both government and private payers have begun paying for care in a multitude of new ways, such as bundled payments, episode-of-care payments, and outcomes-dependent payment models. This shift from "volume to value" represents both a challenge and an opportunity for the field of cardiovascular ultrasound.

On September 12, 2014, the American Society of Echocardiography (ASE) Education and Research Foundation hosted Value-Based Healthcare: Summit 2014 in Washington, D.C. This event was organized around three main goals:

1. To create a dynamic forum for discussion of the evolving value-based healthcare environment and the important role of cardiovascular ultrasound in that environment.
2. To disseminate important information to a wider audience through publication of the Summit proceedings in the *Journal of the American Society of Echocardiography*.
3. To provide a "living resource" for clinicians, researchers, and administrators to use in advocating for the value of cardiovascular ultrasound.

This Summit featured speakers and panelists from across the healthcare spectrum, each offering a unique perspective on the transition to value-based healthcare, with a focus on the role of cardiovascular ultrasound. Clinicians, legislators, private and governmental payers, patient advocates, researchers, and industry representatives came together to discuss ways to deliver superior value in cardiovascular care in this rapidly changing healthcare environment.

The Summit was organized into panels offering a variety of perspectives on value-based healthcare and the role of cardiovascular ultrasound in both the current system and the new paradigm. The various panels focused on five key aspects of the discussion: value-based healthcare in the United States, the value choice in cardiac imaging, the value of echocardiography in clinical cardiology, payer perspectives on value, and the value of echocardiography in research. Finally, Summit attendees participated in three breakout groups to explore specific trends in healthcare and cardiac imaging. Participants discussed the role of cardiovascular ultrasound in the current landscape, as well as challenges and opportunities waiting in the future. The following sections summarize the key points of discussion, recommendations, and selected readings for further information.

VALUE-BASED HEALTHCARE IN THE UNITED STATES

Panelists: Representative James H. S. Cooper, JD (D-TN), Thomas R. Graf, MD, Benjamin F. Byrd III, MD, FACC, FASE, and Randolph P. Martin, MD, FACC, FASE, FESC

A Congressional Perspective

Representative Cooper opened the Summit by discussing the growth in healthcare expenditures in America and the challenges of addressing this issue through legislative action. He emphasized that today's healthcare system is in transition, characterized by rapid change in insurance regulation as well as healthcare delivery, the decline in private practice and a concomitant rise in hospital employment of physicians, and growing out-of-pocket health expenditures for consumers. Representative Cooper addressed three key questions regarding value-based healthcare: (1) What is value-based healthcare? (2) Who should determine value? and (3) Will value-based healthcare work?

From a practical standpoint, for the average patient, the simple definition of value-based healthcare is "getting your money's worth." Although Americans are excellent shoppers, Representative Cooper noted that they have never truly been allowed to shop for their healthcare until recently. The complex insurance system and widespread use of employer-sponsored healthcare tend to hide the true cost of care from the average patient, but that is changing with the advent of insurance exchanges and the shifting of costs from employers to individuals.

Representative Cooper strongly urged doctors and their professional associations, in conjunction with patients and patient groups, to take the initiative in defining value. Medical professionals are key to the decision-making process, because they have a deep understanding of the benefits of specific procedures. Patients want to make choices in their own best interest. Importantly, the medical profession must regulate itself continually to avoid waste and fraud, or the government may be forced to take the decision out of their hands.

Finally, the short answer is that value-based healthcare has to work; there is no real alternative, because the current level of expenditures is not sustainable, either by the government or by consumers. There has never been a greater moment for cardiology leadership to foster progressive efforts in lifestyle changes among the broader population, as well as to shape the future of healthcare delivery.

A Health System Perspective

Speaker Dr Thomas Graf offered a unique perspective as a family medicine physician who also oversees population health efforts at Geisinger Clinic, one of the more successful health systems in implementing new models of care such as accountable care organizations (ACOs). Dr Graf emphasized that the objective of tomorrow's healthcare delivery system should focus on the "Triple Aim plus." The Triple Aim is to achieve higher quality for populations, better patient experience of care, and lower costs.[2] In addition, however, Dr Graf also emphasized the need to achieve a better professional experience for healthcare providers.

Table 1 Summary impact of CAD imaging referral process at GHS

Group	Second test in 90 days	Test savings in 694 consecutive patients
GHP	20.1%	Baseline
GHS PCP	14.2%	−46 tests (5.9% reduction overall)
GHS PCP with CAD imaging	10.0%	−87 tests (11.1% reduction overall)

CPSL, Community practice service line; *GHP*, Geisinger Health Plan; *GHS*, Geisinger Health System; PCP, primary care physician.
Estimated on the basis of gross up to second tests from CPSL population to GHP population.
Reproduced with permission of GHS.

Dr Graf described in some detail the conceptual underpinnings of the ACO model. The ACO model combines the organizational structures of a health plan with those of a clinical enterprise, and it is critical that each organizational component do what it does best: that the health plan function primarily in the realms of population health analysis, finances, marketing, and alignment of reimbursement incentives, while the clinical enterprise focus on care delivery, best practices, quality improvement, and patient and family involvement. Overall, both components should focus on prevention and early intervention services to reduce the likelihood that manageable conditions will become chronic, the effective management of the nearly 50% of Americans with chronic conditions who are responsible for 84% of US healthcare expenditures,[3] and the elimination of fraud and waste. At least for now, effective ACO operation involves balancing a fee-for-service mind-set with ACO goals, which means reducing length of stay, readmissions, the use of postacute care, and inappropriate use of ancillary services, including imaging.

Dr Graf presented a new methodology for ensuring the appropriateness of cardiovascular imaging for coronary artery disease (CAD), which has been implemented at Geisinger and has proven highly effective. Under the new system, each CAD imaging referral is referred to a pool of CAD imaging referral nurses, who conduct a full chart review, which is tested against a test protocol, with cardiologist input. The cardiologist selects and signs the order for the optimal test: essentially, "precertification" is managed by the cardiology department. After the test is performed, the results are communicated to the ordering provider. Under this protocol, the percentage of patients who underwent second CAD imaging tests within 90 days dropped from 20% to 10%, and the protocol resulted in an 11.1% reduction in CAD tests overall (Table 1).

Dr Graf outlined several important lessons that Geisinger has learned over the years as it has transitioned to population health–based care. The first crucial lesson is that improving the reliability of the process of care is equally as important as knowing what treatment to provide; the system must enable delivery of the optimal treatment to every patient every time. Electronic tools such as electronic health records are successful only when implemented into a system of care that has been efficiently designed. Finally, compensation can help focus attention on a specific issue, but it is not sufficient to truly drive change.

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THE VALUE CHOICE IN CARDIAC IMAGING

Panelists: R. Parker Ward, MD, FACC, FASE, FASNC, Thomas J. Ryan, MD, FACC, FASE, and James D. Thomas, MD, FACC, FASE

This session of the Summit explored two aspects of cardiovascular ultrasound's place in the evolving economics of healthcare: first, how volume and costs of cardiovascular ultrasound have been controlled since 2008, and second, how echocardiography laboratories and physicians must change practices to thrive in a value-based system delivery system.

Dr Parker Ward observed that over the past two decades, US healthcare spending on medical imaging in general, and cardiovascular imaging in particular, has far outpaced healthcare spending on all other medical services. Although echocardiography did not grow as fast as other cardiac imaging modalities during this time period,[1] echocardiography nonetheless remained a contributor as the highest volume cardiac imaging test. This growth rate was perceived as unsustainable, and "uncontrolled imaging" continues to be cited as a primary target in ongoing efforts to curb healthcare spending. However, in recent years, the facts have changed. Since 2008, medical imaging utilization, including that of echocardiography, has been declining. According to a 2015 Medicare Payment Advisory Commission report to Congress, the volume of imaging procedures under the Physician Fee Schedule declined by approximately 7% from 2009 to 2013 (after increasing by 85% from 2000 to 2009).[2] Echocardiographic procedures billed to Medicare under the Physician Fee Schedule fell by 1.8%, 3.7%, 5.1%, and 7.3% annually from 2009 to 2013 on a per beneficiary basis.[2-5] The reasons for this decline are multiple and incompletely understood. Certainly there has been a reduction in payment for cardiovascular ultrasound services, particularly in the office setting, while some insurance companies have restricted access to cardiovascular ultrasound, sometimes to the detriment of patients.

Beyond these reasons, however, there has been a clear commitment by the medical community to address issues of imaging utilization. The ASE and the American College of Cardiology, along with other specialty societies, have collaborated to publish appropriate use criteria (AUC), which provide guidance for physicians, payers, and patients in the best use of imaging procedures in optimal patient care. AUC are available for a variety of imaging modalities, including transthoracic echocardiography (TTE), stress echocardiography, and transesophageal echocardiography (TEE). The AUC for echocardiography are easily accessible, including a free mobile application from ASE that quickly provides the appropriateness level (appropriate, may be appropriate, and rarely appropriate) for hundreds of clinical scenarios. Several intensive education efforts regarding echocardiography AUC at Massachusetts General Hospital resulted in steep reductions in inappropriate ordering; from 13% to 5% in an inpatient setting, and from 34% to 13% in an outpatient setting.[6,7] The AUC also allow the identification of potential "missed opportunities," in which an imaging test that is not performed may have contributed

to suboptimal patient care. In a study of inpatients who did not undergo echocardiography during their stays, 16% presented with clinical conditions for which the test would have been appropriate, suggesting that underutilization as well as overutilization of cardiovascular ultrasound should be addressed.[8]

One of the challenges in defining the value of cardiovascular ultrasound is the indirect manner in which any diagnostic test result may affect outcomes. The value of a positive test result that leads directly to a therapeutic intervention and an improved outcome is obvious. However, frequently test results are negative, eliminating a suspected diagnosis or cause of symptoms. This scenario also provides great value by reassuring the patient or caregiver or by prompting additional diagnostic inquiry that may lead to diagnosis and improved outcome. This value is more "indirect" and thus not frequently considered when assessing the value of an imaging test. A recent study from Dr Ward's medical center found that over a 2-year period, 82% of appropriate echocardiographic examinations had demonstrable clinical impact, which was "indirect" in half.[9]

Panelist Dr Tom Ryan brought the unique perspective of a cardiovascular ultrasound expert who, as chair of the cardiovascular program at The Ohio State University, is charged with the responsibility of ensuring that all cardiovascular imaging modalities are used appropriately in patients' best interests, without bias favoring one modality over another. As one who must decide where to invest resources to maximize patient outcomes, Dr Ryan made these key points: (1) The way physicians are paid will continue to evolve, (2) growth will no longer be the key to job security, and (3) physicians will not get paid for poor-quality work. Of particular importance is the Bundled Payments for Care Improvement initiative that incentivizes providers to deliver more coordinated care, by placing providers at risk for providing all services associated with predefined episodes of care.[10]

There are a few key maxims for survival in this changing world: (1) Behave as if you are part of a large organization (because you are or will be); (2) do just enough cardiovascular ultrasound, and do it really well; (3) coordinate imaging across modalities, so that you do the best test first; (4) standardize your protocols, adhering to best practice standards; (5) implement AUC so you target the right population; and (6) stratify your service options, so that you use the appropriate level of sophistication to answer the clinical question (e.g., you don't need three-dimensional strain imaging to rule out a pericardial effusion). The role of hand-carried ultrasound is rapidly evolving; one function will likely be to serve as a triage agent to ensure that an echocardiography laboratory does only the highest yield studies. For echocardiography laboratories, quality will be king, with an emphasis on quantification, reduction in interreader variability, and delivering the best product for the lowest cost in resources. Fortunately, with low fixed and variable costs and the ongoing innovation evident in the field, cardiovascular ultrasound is well suited to compete in the future, whether in a fee-for-service system or one in which providers assume risk for providing value-based care.

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ECHOCARDIOGRAPHY'S VALUE IN CLINICAL CARE

One may examine the role of cardiovascular ultrasound in value-based models of healthcare from the standpoint of (1) specific patient populations (2) specific diseases, or (3) how patients themselves perceive value. During the Summit, all three approaches were explored.

SPECIFIC PATIENT POPULATIONS

Panelists: Randolph P. Martin, MD, FACC, FASE, FESC, Jack Rychik, MD, Steven A. Goldstein, MD, and Michael H. Picard, MD, FACC, FASE, FAHA

Patients Undergoing Cancer Treatments

Advances in the diagnosis and treatment of cancer have markedly improved survival. The US National Cancer Institute estimates that 13.7 million cancer survivors were alive in 2012 and that this number will approach 18 million by 2022.[1] Some cancer treatments can be complicated by side effects on the cardiovascular system. For example, anthracyclines, trastuzumab, and some tyrosine kinase inhibitors have detrimental effects on myocardial function, and radiation therapy to the thorax can damage heart valves, coronary arteries, and the pericardium.[2-4] Thus, many survivors are at potential risk for cardiac disability from their cancer treatments. In addition, as successfully treated cancer patients age, they are subject to the same common cardiac diseases as the general population.

There are several roles for cardiovascular ultrasound during potentially cardiotoxic cancer treatment regimens. First, before potentially cardiotoxic chemotherapy, echocardiography can ensure that patients do not already have impaired cardiac function. Second, during chemotherapy, cardiovascular ultrasound can monitor ventricular function for deterioration. Last, during follow-up treatment, cardiovascular ultrasound can determine if new symptoms are potentially due to cardiac disease. Early detection of decreased ventricular function allows modification in the regimen, either by increasing the interval between doses or reducing the total cumulative dose of a potentially toxic agent. There is current enthusiasm for using new

echocardiographic parameters such as myocardial deformation or strain imaging to detect subclinical perturbations in ventricular function earlier and more reliably than can be identified by traditional measurements such as left ventricular (LV) ejection fraction.[5,6] These techniques are being studied to determine if such early detection can result in treatment modifications that maintain high cure rates but prevent the development of clinically important effects on LV function and later cardiac disability.

Reducing LV dysfunction as a sequela of cancer treatment results in less disability, higher quality of life, fewer future cardiac complications, and lower subsequent costs for care. When specific, low-cost echocardiographic imaging protocols are integrated into complex cancer care, the value equation strongly favors cardiovascular ultrasound.

Congenital Heart Disease in the Fetus

In the United States, approximately 30,000 to 40,000 children are born each year with congenital heart lesions, making congenital heart disease the most common birth defect. Ultrasound evaluation during pregnancy with echocardiography is the only means to identify defects of the heart before birth.[7]

Accurate identification of important structural heart defects before birth provides a number of benefits. It allows the development of a plan for pregnancy and for delivery at an expert site that can manage the hypoxia and hemodynamic compromise that may accompany a defect. This strategy allows the implementation of treatment as soon as the infant is delivered and results in the best outcomes, because it can prevent the development of high-risk sequelae such as hypotension, shock, and end-organ damage, including neurologic impairment. Later postnatal diagnosis leads to delayed identification, neonatal instability, long-term complications, and higher mortality. In such cases, there is often a higher lifelong cost of treating these impaired survivors, such as the costs associated with the management of cerebral palsy.

Thus, the value of cardiovascular ultrasound in the assessment of congenital heart defects in the fetus is clear. Its use allows early diagnosis and leads to better outcomes, lower mortality, and a reduction in lifelong healthcare costs.

Patients with Complex Myocardial Infarction (MI)

In the various phases of treatment of MI, time is of the essence. Numerous studies have shown that delays in the treatment of acute MI result in lower event-free survival rates. In patients with confusing presentation, echocardiography combined with biomarkers can improve the accuracy of diagnosis, and in particular, echocardiography can show the location and size of an MI.

In patients presenting with hemodynamic compromise after MI, early diagnosis of the cause of the problem is critical to expedite lifesaving treatment. Studies of patients with cardiogenic shock have shown that there is often a significant time delay in determining the cause of shock,[8] and clinical experience suggests that bedside imaging with echocardiography (both TTE and TEE) can reduce that time delay and thus reduce sequelae such as end-organ damage.

Last, echocardiographic assessment of LV systolic and diastolic function after MI provides prognostic value and assists in personalizing post-MI care.[9-11] For example, eligibility for certain post-MI treatments, such as the use of implantable cardiac defibrillators, may vary on the basis of the LV ejection fraction measured by echocardiography.

Although many cardiac imaging modalities can provide similar information, cardiovascular ultrasound has advantages and favorable value in MI care because of its ability to image at the bedside and its relatively low cost, wide availability, and rapid information turnaround. Of note, the use of echocardiographic contrast agents is of particular value in MI care, because it improves the accuracy and reproducibility of regional wall motion assessment when image quality is technically limited.

SPECIFIC CARDIAC DISEASES

Panelists: Theodore P. Abraham, MD, FACC, FASE, Linda D. Gillam, MD, MPH, FASE, Pamela S. Douglas, MD, MACC, FASE, FAHA, and Michael H. Picard, MD, FACC, FASE, FAHA

Valvular Heart Disease

Valvular heart disease is common, and its prevalence will continue to increase as the population continues to age. For those aged 18 to 44 years, the prevalence is 0.7%, but for those >75 years of age, the prevalence is 13.3%.[12] Treatment options for the various valvular diseases continue to expand, in terms of both surgical repair and transcatheter techniques. Thus, patient selection is critical, and cardiovascular ultrasound is the foundation of this process. Optimizing clinical management in these patients involves determining both the severity of the valve dysfunction and the mechanism underlying the dysfunction. Cardiovascular ultrasound is comparable and in some situations superior to other imaging modalities in assisting the management of valvular heart disease. In addition to its relatively low cost, wide accessibility, and lack of ionizing radiation, cardiovascular ultrasound provides a comprehensive, real-time assessment of valve anatomy and function, as well as secondary changes in ventricular function, atrial function, and pulmonary artery pressures. Further testimony to its value in this set of diseases is demonstrated by the important place of echocardiography in the current ACC/AHA valvular heart disease guidelines.[13]

Heart Failure

Heart failure places a significant financial burden on our society. There are >5 million cases in the United States, and an estimated 825,000 new cases are diagnosed each year.[14] It is one of the most common discharge diagnoses in the elderly. Cardiovascular ultrasound provides value on many levels in these patients, ranging from those with early symptoms to those with advanced end-stage heart failure. It has multiple important uses: diagnosis through quantitation of systolic and diastolic ventricular function, classification of etiology, assessment of response to therapy, and guidance of advanced treatments. Moreover, as healthcare models move from pay-for-procedure to pay-for-performance, cardiovascular ultrasound maintains its value, because it is relatively low cost, and it is more portable and more widely available than other noninvasive imaging technologies[15] (Table 2). In addition, in contrast to other modalities, it is a scalable technology (with scalable costs) that can be tailored to the patient's needs, be it a complete diagnostic assessment with a fully equipped machine or a quick check of LV ejection fraction with a handheld device. For example, cardiovascular ultrasound can assist in appropriate triage of patients with heart failure to medical therapy, cardiac resynchronization therapy, or mechanical circulatory assist device therapy, helping ensure that these expensive technologies are used

Table 2 Comparison of imaging modalities

Characteristic	Echocardiography	CMR	CT	Nuclear scintigraphy
Availability	++++	++	++	+++
Portability	++++	—	—	—
Cost (relative value units)*	9.11†	22.51‡	14.39§	13.59‖
Radiation risk	—	—	++++	++++

CMR, Cardiovascular magnetic resonance; *CPT*, Current Procedural Terminology; *CT*, computed tomography.
*From the Centers for Medicare and Medicaid Services, National Physician Fee Schedule (http://www.cms.hhs.gov/PFSlookup/)3_PFS_Document.asp).
†Sum of relative value units for CPT codes 93303, 93323, and 93320.
‡CPT code 75562.
§CPT code 71275.
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appropriately. Clearly, because of its role in optimizing care and outcomes at an affordable cost, cardiovascular ultrasound is highly valuable in heart failure. It has an important role in determining whom to treat, how to treat, and when to treat.

CAD Detection

The clinical and economic burden of diagnostic testing to detect suspected CAD is large, with >20 million stress tests performed each year in the United States.[16] The decision making regarding testing begins with appropriateness; the decision to test is an important and necessary precursor to choosing the type of test.[17] It does not end with test performance, however, as the value of a test is only as good as the information it provides and only as good as how that information is incorporated into clinical care.

In her examination of the value of stress echocardiography for detection of CAD, Dr Pamela Douglas used the Triple Aim construct defined by the Institute for Healthcare Improvement. In assessing value, the Triple Aim approach focuses on an intervention's contribution to personal and population health, the patient experience of care, and per capita cost.[18]

In terms of population health, there are several important considerations: the accuracy of CAD detection by stress echocardiography equals or exceeds the accuracy of other forms of stress tests, stress echocardiography is equally accurate in men and women, and it can be performed whether or not a patient is able to exercise (through pharmacologic methods).[19] Perhaps equally important, stress echocardiography provides additional information regarding heart and valve function—information not provided using other methods—which may assist in identifying the cause of symptoms.

Stress echocardiography has a number of important advantages over other diagnostic tools in terms of the patient's experience of care; it does not use ionizing radiation, which is especially important for young women and for those requiring repeated testing. Also, echocardiography is incredibly efficient, and most stress echocardiographic examinations are completed in less time than other cardiovascular imaging tests in a single visit. Finally, in terms of accessibility, most cardiologists' offices and all hospitals have stress echocardiography capability and expertise. All of these features are important to the patient experience.

With regard to per capita cost, it is important to note that stress echocardiography is typically one of the least expensive among cardiac stress imaging tests, and it is superior to nonimaging stress tests. Finally, stress echocardiography can eliminate the need for two studies or test layering in some scenarios by providing information on ventricular and valve function, as well as inducible ischemia and myocardial viability. When image quality is suboptimal, the use of echocardiographic contrast adds considerable value to stress echocardiography.

Thus, when framed in the Triple Aim construct of population health dynamics, individual patient experience, and cost, it is easy to demonstrate the value of echocardiography for detection of CAD.

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THE PATIENT PERSPECTIVE

Panelists: Sarah Woodruff, BS, MS, William Wallace, MBA, Alexis Isenberg, PE, Randolph P. Martin, MD, FACC, FASE, FESC, and James D. Thomas, MD, FACC, FASE

Three remarkably articulate and intelligent patients generously shared their medical histories with the Summit and, most important, outlined the impact cardiovascular ultrasound had on their care. For each of these patients, cardiovascular ultrasound and the human factor associated with their echocardiographic examinations not only provided valuable diagnostic information but also helped direct their therapies.

Bill Wallace

Mr Bill Wallace was a very healthy and successful business executive in late 2004, when his wife heard some unusual vibrations in his upper chest and neck. This led to cardiovascular evaluation and TTE, which showed severe aortic regurgitation that was believed to be due to leaflet prolapse or possibly leaflet fenestration. As fate would have it, Mr Wallace's college roommate at Harvard was Dr James D. Thomas, a cardiovascular imaging specialist at Cleveland Clinic. Hence, Mr Wallace went to Cleveland Clinic, where Dr Thomas performed TEE, which clearly showed fenestrations of his aortic leaflets, which led to a flail noncoronary cusp, creating severe aortic regurgitation (Figure 1). On the basis of the findings on TEE, Mr Wallace underwent successful replacement of his aortic valve at Cleveland Clinic, where intraoperative TEE also aided in assessing the successful implantation of the aortic prosthesis. Mr Wallace is now back to a vigorous lifestyle; TTE made the diagnosis of significant aortic valvular abnormalities rapidly, TEE clearly defined the valve pathology, and the use of TEE in the operating room was critical to successful valve replacement.

Sarah Woodruff

Ms Sarah Woodruff was born in 1978 with Shone's syndrome, in her case consisting of aortic coarctation, a bicuspid aortic valve, dilation of her thoracic aorta, and mitral regurgitation due to abnormalities of the mitral complex. Interestingly, this condition was not diagnosed until she had a fall as a 4-year-old and went to an emergency department for evaluation of a concussion. At that visit, she and her parents were told about her "heart condition," something that was totally unexpected. Four days later, she was seen at Children's National Medical Center, in Washington, D.C., where an exact diagnosis was made by TTE, and she soon thereafter had her aortic coarctation surgically repaired. She did well with that surgery and had regular follow-up echocardiographic examinations. In the spring of 2010, TEE showed that her thoracic aorta was dilated to the point at which valve-sparing aortic root replacement was necessary. That surgery was performed, and currently, Ms Woodruff is doing very well. She articulately explained the great value of undergoing cardiovascular ultrasound examinations as the core of follow-up evaluations throughout her life because "they are such an excellent, inexpensive, clearly noninvasive way to get such good structural data." One of the most important facts Ms Woodruff emphasized was the human touch factor while she was undergoing her echocardiographic examinations. She particularly highlighted the role sonographers played, stating, "The imaging people that I've worked with over the years have been marvelous; I had a wonderful experience as a child." She also credits cardiovascular ultrasound with being able to follow her thoracic aortic size, allowing optimal timing for surgery before she became symptomatic. Finally, she is also a strong advocate of fetal echocardiography for appropriate patients because of the reassurance it can give parents about the condition of their children's hearts.

Alexis Isenberg

Ms Alexis Isenberg is a cum laude graduate of Bucknell University and licensed professional engineer, as well as the principal and owner of The Lexis Group, LLC. Ms Isenberg is a very vibrant, articulate woman who has been through the trials and tribulations of dealing with a very aggressive, stage III, invasive breast cancer, first diagnosed in April 2010, when she was 38 years old. She has subsequently undergone a double mastectomy, 2 years of chemotherapy, 8 weeks of radiation, two breast reconstructions, and a total hysterectomy. In an effort to continue her incredible battle against breast cancer, Ms Isenberg participated in an 8-month-long clinical trial at Johns Hopkins Medical Center for HERS-2-positive breast cancer, which required her to commute between her home in central Pennsylvania and Baltimore, often 7 days a week. She shared how cardiovascular ultrasound was critical to evaluating her cardiac function throughout her chemotherapy and vaccine trial. Unfortunately, as Ms Isenberg had a strong desire to continue the vaccine trial, her

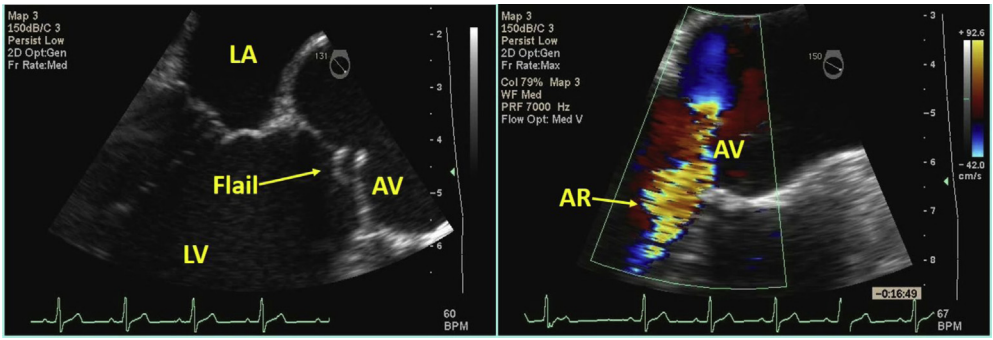

Figure 1 TEE showing the structure (*left*) and color Doppler (*right*) of Mr Wallace's flail aortic valve. The arrow on the left points to the flail component of the noncoronary cusp. *AR*, Aortic regurgitation; *AV*, aortic valve; *LA*, left atrium.

echocardiographic examinations found that trastuzumab (Herceptin) had caused subclinical damage to her LV function, a finding that forced her to stop participating in the vaccine trial (an example from a similar patient is shown in Figure 2). She was grateful for the fact that cardiovascular ultrasound provided valuable information and stated, "I'm not sure what would have happened if that wasn't detected and I had just kept taking Herceptin." Ms Isenberg's story clearly shows the value of cardiovascular ultrasound in helping individuals with certain types of cancer undergo proper therapies without sustaining major damage to their hearts.

PAYER PERSPECTIVES ON VALUE-BASED HEALTHCARE

Panelists: John C. Pilotte, MHS, Amol Navathe, MD, PhD, Anthony V. Coletta, MD, MBA, Susan Nedza, MD, MBA, FACEP, David H. Wiener, MD, FACC, FAHA, FASE

The US healthcare system is evolving toward an emphasis on high-value care, with value defined as patient health outcomes achieved per dollar spent.[1] Government and commercial insurers are designing payment models that attempt to measure quality as well as costs. Physicians and groups that demonstrate high quality and low cost will be rewarded, and those exhibiting the opposite will be penalized. The Centers for Medicare and Medicaid Services (CMS) states that groups at the extremes will be rewarded or penalized only if their differences from the mean are statistically significant. All models contain mechanisms for risk adjustment, although these models at present incorporate only claims data and not clinical information. CMS has begun to roll out programs that are based on familiar quality metrics, such as Physician Quality Reporting System reporting and 30 day readmissions.

Payers are moving away from traditional fee-for-service medicine toward bundled payments or episodes of care. The latter aggregate all costs (professional, technical, facility, and in some cases pharmacy and other costs) associated with a particular treatment for a specific illness, condition, or medical event over a defined period of time. A lump sum payment is made to a health system or other entity for the total cost of care. The goal of the changes in healthcare delivery is to achieve the Institute for Healthcare Improvement's Triple Aim: improving the patient experience of care (including quality and satisfaction), improving the health of populations, and reducing the per capita cost of healthcare.[2]

Some observers express the belief that the private practice of medicine is obsolete. Novel models of practice have been proposed in response to this drive to value, which is coupled with downward pressure on costs. At one extreme is the assumption of full risk, which has typically been taken by insurance companies, by entities such as ACOs or by novel business arrangements such as joint ventures between a commercial payer and a medical service organization and its member physicians. An intermediate step is participation in a clinically integrated network of providers and institutions, one that would have the scale to assess and accept limited degrees of risk while permitting sharing of savings. These rapidly evolving models of shared risk and benefit explain in part the increasing percentage of US cardiologists employed by hospitals and health systems.

Implications for Cardiology

Cardiologists can respond to these challenges by understanding these new models for delivery of and payment for healthcare. Physicians can use data analytics to define the efficiency of the care they render, namely, the highest quality across the spectrum of care at the lowest cost, at an individual physician or a physician group level. Some payers indicate a willingness to share data with participating physicians. Mechanisms to coordinate care between primary care physicians and specialists are needed, allowing them to perform under contracts from an outcomes perspective as well as a cost perspective.

Cardiologists will need to participate actively in discussions of how care bundles or episodes are designed and how costs are attributed in each bundle. These steps allow physicians to argue for the fair value of their cognitive work, whether in chronic care bundles such as heart failure management or in discrete surgical episodes such as perioperative management. Cardiologists will need to understand the limits of risk adjustment mechanisms and to argue where necessary for more accurate risk adjustment and for exclusion of outliers, realizing that payers are limited in their ability to incorporate clinical data into models that are based on claims information or to match up cost and quality using their legacy data systems.

Implications for Cardiovascular Ultrasound

Payers recognize that imaging of all types contributes to potentially avoidable costs. Cardiovascular ultrasound is believed by payers to be well positioned relative to other forms of imaging. Many payers see cardiovascular ultrasound as lower in cost compared with other cardiac imaging modalities and inherently containing a significant amount of value. However, the profession must develop criteria that define quality and cost around core aspects of its contribution to patient care, in order to define that value. Payers believe that cardiology is well ahead of many other specialties in this regard.

Central concepts in defining the value of an imaging study are whether the study helped the clinician make a diagnosis, whether it

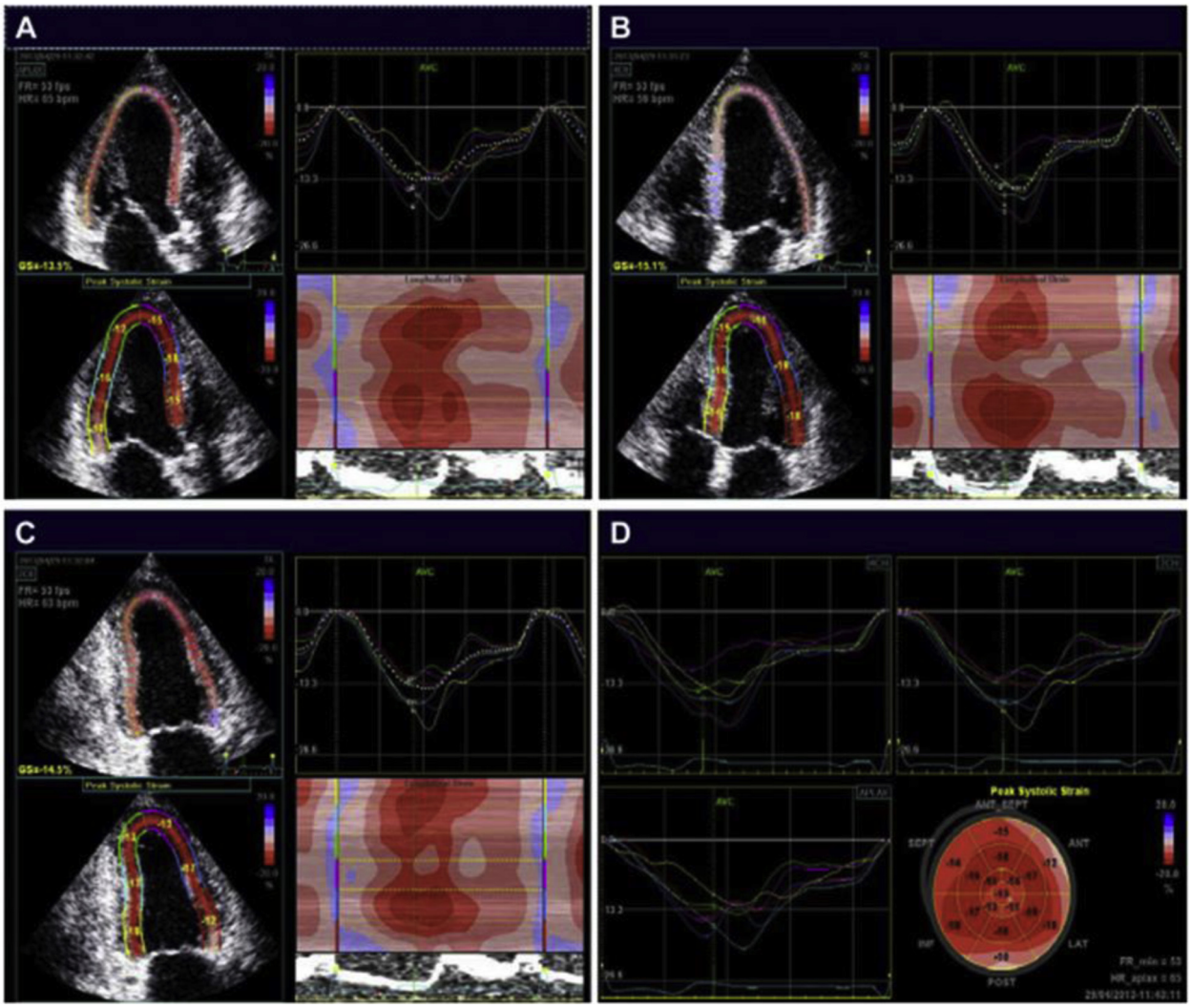

Figure 2 Speckle-tracking echocardiographic images illustrating global longitudinal strain obtained from the apical long-axis view **(A)**, four-chamber view **(B)**, and two-chamber view **(C)** and strain curves and bull's-eye plot in a patient with breast cancer who developed chemotherapy-related cardiotoxicity after receiving doxorubicin followed by trastuzumab. Each segment has a numeric and color-coded strain value. The cardiac dysfunction appears to be regional, with some segments more involved than others. Reproduced from Plana JC, Galderisi M, Barac M, Ewer MS, Ky B, Scherrer-Crosbie M, et al. Expert consensus for multimodality imaging evaluation of adult patients during and after cancer therapy: a report from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. J Am Soc Echocardiogr 2014;27:911–39.

influenced decision making, and whether it affected the patient's outcome. A further key question is benefits versus costs at the societal level.[3] A combination of population and epidemiologic data can provide measurements of the value of an imaging modality. Examples might be population-level epidemiologic studies (e.g., examining rates of morbidity) to demonstrate how imaging can lead to reduced spending, morbidity, or mortality.

Among the greatest challenges for echocardiographers is establishing the value of imaging within an episode of care. Ultrasound is being bundled into various procedures, and this model will be adopted increasingly by government and private payers. Physicians need to ensure that the nontechnical components of cardiovascular ultrasound (the portion reflected in the cardiologist's training, experience, use, and interpretation of the imaging data), along with the technical portions, continue to be valued. Highest quality at least cost, not quality alone, will win. This commoditization of care will have to be faced by private groups and by academic centers. Analyses that help establish the value of imaging within an episode of care are critical to practitioners of cardiovascular ultrasound for ensuring payment for services when bundles are being discussed or payment apportioned.

Challenges to the ASE

Payer representatives emphasize that ASE and its sister cardiology professional societies are respected and looked to as leaders. An important role for ASE is promoting research to establish the value of cardiovascular ultrasound. Potential approaches include population-level outcomes studies making use of data analytics. Some payer representatives express eagerness to share data with ASE, for example, data based on the experiences of their radiology benefits manager arms having to do with prior authorization, and to partner with ASE in research. Payers challenge the ASE to look at

the frequency of follow-up studies. Research is needed to hone guidelines for follow-up studies, as most current recommendations are consensus based rather than data driven. Payers state that they would rather use professional societies' criteria than adopt their own.

Preauthorization by radiology benefits managers will evolve. Payers are mandated under the Patient Protection and Affordable Care Act to decrease expenditures not directly related to patient care (the "medical loss ratio"), so the costly practice of insurance preauthorization may decrease. Still, the need to control costs and promote high value will remain under any payment scheme. Studies that go beyond appropriateness to demonstrate the actual value of an imaging technique will be of great interest to any entity assuming full or partial risk and to physicians and groups participating in payment bundles. Most echocardiographic studies are ordered by noncardiologists,[4] but the cost of cardiac imaging in an episode may be attributed to the participating cardiac specialist. Therefore, further research into systems to inform and coordinate with ordering physicians who are not cardiac imaging experts will be required.

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THE VALUE OF ECHOCARDIOGRAPHY IN RESEARCH

Panelists: Denis B. Buxton, PhD, Pamela S. Douglas, MD, MACC, FASE, FAHA, Neil J. Weissman, MD, FACC, FASE, and Patricia A. Pellikka, MD, FACC, FACP, FAHA, FASE

Because of its widespread availability, well-developed standards for performance and interpretation, and relatively low cost, echocardiography is widely utilized in research. A text-search survey of NIH RePORTER showed that the National Heart, Lung, and Blood Institute currently supports 211 grants and network grants that utilize echocardiography. There are a significant number of funding sources for echocardiographic research; the largest number of awards were RO1 grants, but 20 mechanisms and various types were included, including RPG, PPG, K Award for younger faculty, Fellowship, and U10/UM1 networks (Figure 3). Nearly half of the studies involved animal research, and among these, mouse and rat models were most common. Most of the human studies involve adults, but pediatric populations and fetuses are also being studied. About 40% of the human studies are clinical trials, 25% are cohort studies with longitudinal follow-up of subjects, and the remainder involve technology development and other noninterventional patient studies. The largest percentage of studies focus on basic structure and function, but screening, assessment of complex structure and function, three-dimensional valve imaging, diagnostics, and method development are also the focus of significant research (Figure 4). Two thirds of the studies involve serial imaging of subjects. Thus, echocardiography, a relatively inexpensive imaging modality, plays a critical role as a cost-effective tool for serial assessment of cardiac function in basic and clinical research.

There are diverse uses for echocardiography in clinical trials research (Table 3). One of these is improving echocardiography as an imaging test. This encompasses development of technology, understanding the diagnostic capabilities of new software, and test performance relative to a gold standard; it also includes development of new scanning systems and procedures, such as three- and four-dimensional and deformation imaging, as well as novel applications of contrast agents. A second use involves improving the application of echocardiography and development of diagnostic strategies. An example of diagnostic strategy research is the Prospective Multicenter Imaging Study for Evaluation of Chest Pain, in which 10,000 patients with chest pain were randomized to either functional testing or computed tomographic angiography; major adverse cardiac events are the primary end point and cost is the secondary end point.[1] A third use involves harnessing the power of echocardiography to delineate disease pathophysiology or to understand a therapeutic mechanism of action. For example, quantitation of ventricular reverse remodeling in heart failure trials by echocardiography demonstrates how the heart adapts to disease and the relationship of these changes to cardiovascular events.[2] Fourth, the information derived from echocardiography may be used as a primary or secondary end point for safety or efficacy of a new therapeutic drug or device. Examples of this might involve using echocardiography to evaluate LV size and function, aortic regurgitation, and prosthesis function in patients who have undergone transcatheter aortic valve replacement.[3]

In clinical trials, echocardiography can serve many roles, including efficacy, effectiveness, utility, efficiency, mechanistic, exploratory, and/or safety end points. For randomized controlled trials involving echocardiography, the echocardiographer should be involved in trial design to optimize these assessments. Expertise is required for development of study design (end points, assessments, timing, and sample size calculations), trial structure (site vs core laboratories), imaging (acquisition, transmission, archiving, and analysis), and analysis and interpretation of results. ASE has published standards documents for the use of echocardiography in clinical research that have been endorsed by other relevant groups.[4,5]

Echocardiography offers many important advantages: the ability to assess cardiac structure, function, and hemodynamics; noninvasiveness; feasibility for longitudinal assessments; and safety. It is widely available and routinely used at most centers that perform research, and it is relatively inexpensive and involves no ionizing radiation. For these reasons and because no sedation is required, it is the preferred modality for studying pediatric patients. Echocardiography is desirable for studies that involve serial measurements; it is well tolerated by patients, there is broad investigator experience, and there are robust national practice standards in place.

Disadvantages of echocardiography in clinical trials include the requirement for high-quality data, which demands strict attention to quality at all sites, including the core laboratory. As with other testing, there is a requirement for supportive trial leadership in operations. Variable reproducibility and the precision of image measurements can be a limitation, as quantitation is required in most research. Regulatory compliance can be time consuming and costly.

Echocardiography will remain important in research. The technology will continue to evolve and improve. In the current era of cost constraints, our need to understand and provide evidence to support the role of echocardiography in clinical care algorithms is increasing. Additionally, there is an increasing importance of translational research and quality improvement. An increasing incorporation of echocardiography end points in clinical trials involving diagnostic strategies, new drugs, and devices is expected, as now more than ever

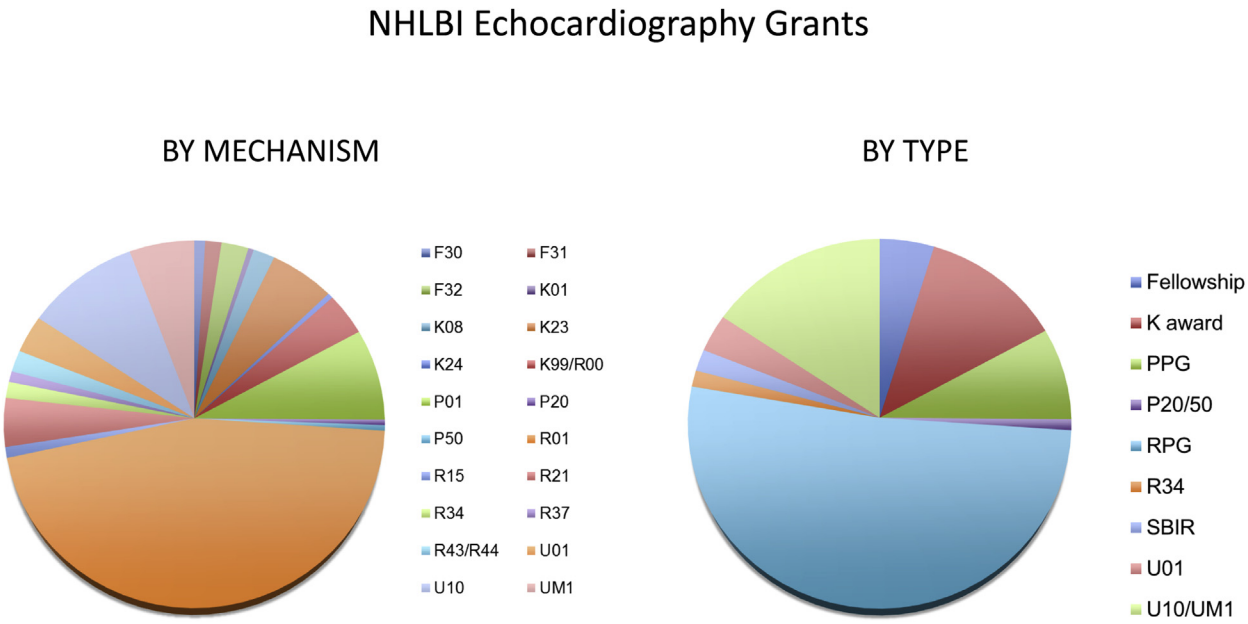

Figure 3 National Heart, Lung, and Blood Institute (NHLBI) echocardiography grants, compiled via text search of NIH RePORTER, grouped by mechanism and type. Reproduced with permission of the National Institutes of Health.

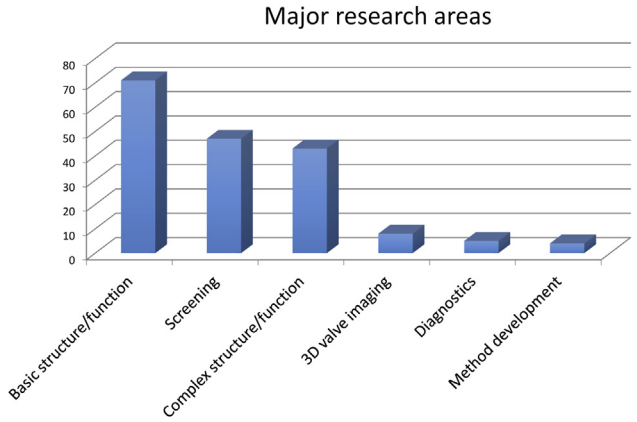

Figure 4 National Heart, Lung, and Blood Institute (NHLBI) echocardiography grants, compiled via text search of NIH RePORTER, grouped by major research areas involved. Reproduced with permission of the National Institutes of Health.

before, there is increased emphasis on safety signals in the development of drugs and devices.[6] Finally, the research infrastructure continues to improve, with multiple groups, including the ASE, American College of Cardiology, and American Heart Association, working to develop standard definitions for transthoracic echocardiographic data elements intended for clinical care and research reporting. The ASE supports ongoing initiatives to improve echocardiography's reproducibility, methodology, and practice.

As a part of its support of research in cardiovascular ultrasound, the ASE has previously hosted strategic planning summits that have brought together leading echocardiographers, scientists, ultrasound physicists, and engineers to craft a research roadmap for cardiovascular ultrasound technology development and clinical research, as well as necessary research infrastructure.[7] The ASE also supports research with its flagship journal, the *Journal of the American Society of Echocardiography*, which publishes clinical and basic research studies involving cardiovascular ultrasound. Finally, the ASE Foundation provides research grants to support research in cardiovascular ultrasound.

The research future for cardiovascular ultrasound looks bright. Challenges with reproducibility will be lessened, as studies are under way to reduce this variability, and with the expanding uses of cardiovascular ultrasound and the technique's inherent safety, it seems clear that it is poised to grow in importance in research in the years to come.

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Table 3 Uses of echocardiography in clinical trials research

Use	Description	Example(s)
Improving echocardiography as a test	Technology development, diagnostic capabilities, and test performance	New scanners, contrast agents
Improving application of echocardiography	Diagnostic strategies	PROMISE trial of stable chest pain evaluation: 2,000-patient subset randomized to stress echocardiography vs CTA
Harnessing the power of echocardiography	Delineate disease pathophysiology or therapeutic mechanism of action	Reverse remodeling in HF trials
Evaluating therapies with echocardiography	Use information derived from echocardiography as an end point for efficacy or safety of a new therapeutic	TAVR trials: PARTNER, CoreValve

CTA, Computed tomographic angiography; *HF*, heart failure; *PARTNER*, Placement of Aortic Transcatheter Valves; *PROMISE*, Prospective Multicenter Imaging Study for Evaluation of Chest Pain; *TAVR*, transcatheter aortic valve replacement.
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BREAKOUT SESSIONS

New Technologies in Echocardiography

Moderator: Allan L. Klein, MD, FRCP(C), FACC, FAHA, FASE

Mobile Health. Mobile health, or M-health, is increasingly making its mark on healthcare in the United States and has been carefully noted by all the stakeholders in healthcare: patients, clinicians, industry, insurance companies, and the government.[1,2] It is part of the ever-changing landscape of value-based healthcare and will ultimately improve patient welfare.[3] What exactly is M-health? It is commonly defined as the use of mobile telecommunication for the delivery of better healthcare and wellness.[1] There are many external forces at play in the current healthcare debate: (1) spending on healthcare in the United States is rapidly increasing and completely unsustainable; (2) cell phone use and wireless technology are exploding, with >3 billion users having access to these devices; and (3) consumer interest in personalized medicine is growing as well, marked by the recent increase in wearable monitoring devices.[4,5] Dr Eric Topol[6] of the Scripps Clinic, in his recent book *The Creative Destruction of Medicine*, suggested that traditional medicine as we know it will end and will be replaced by a digital revolution derived from both innovation and democratization of healthcare by consumers. There are numerous healthcare–related application solutions for acute and chronic conditions using smart phones, including electrocardiographic monitoring for palpitations, oxygen saturation recordings for shortness of breath, and home testing for urinary tract infections.[1]

To illustrate the potential impact of M-health, consider a 45-year-old woman with atrial fibrillation and heart failure who could be diagnosed and managed using M-health in the near future. This patient could be outfitted with a commercially available wearable "smart watch" device with built-in biosensors, along with her wireless smart phone, which is linked to countless medical applications for measuring heart rate, blood pressure, and oxygen saturation. She would also have an internal left atrial pressure sensor recording her left atrial pressure, which could be used to determine the appropriate dose of diuretics to prescribe.[7] In addition, with the development of miniaturized ultrasound transducers and handheld ultrasound machines, she could be sending wireless images of her beating heart. Thus, she could be sending online electrocardiographic strips, oxygen saturation readings, blood pressure recordings, left atrial pressure recordings, and images of her beating heart to her cardiologist. There have been many new advances in accessing and interpreting these large data sets in the digital era.[8] This patient encounter is not far in the future, as there are 30,000 to 90,000 medical applications that have been developed for smart phones and tablets,[1] and the wireless technology to transmit images is currently available. The left atrial pressure recording has been used in clinical trials for monitoring and treatment of heart failure.[9]

What are some the strengths and weaknesses of M-health? M-health may be beneficial for both consumers and clinicians in the early detection and treatment of acute and chronic conditions, such as pneumonia and hypertension.[1,10] It may lower the number of inappropriate visits to the doctor and lower overall costs to the healthcare system. On the other hand, with the aging population, patients and clinicians must develop a certain baseline literacy of how to use and send the wireless recordings. A major concern is the accuracy and reliability of all these recordings, as the US Food and Drug Administration currently regulates only 100 of these medical applications. Patient security (Health Insurance Portability and Accountability Act compliance) will be a concern for all companies sending data to the cloud. There will also be issues of unreasonable "spamming" of physicians with countless digital recordings of heart rates and blood pressures. Checks and balances, processes, and reimbursement will have to be in place for M-health to succeed. Wireless technology will be rapidly changing, and the platforms to read these images will be in flux. What will be an acceptable quality of wireless ultrasound images, and how much compression will they have? All these issues will have to be addressed to take this digital revolution and M-health to the next level.[11,12] In this breakout session, 100% of participants agreed that M-health, medical applications, and wearable devices ultimately will be useful for both the patient and the clinician.

Smart Echocardiographic Measurements. In clinical practice, a plethora of measurements are performed on a daily basis that are placed into structured echocardiography reports. These reports have a huge number of variables, and there may be a lack of consistency in reporting by echocardiographers. The question is whether clinicians can make more accurate measurements with improved diagnostic utility when using smart echocardiographic measurements with computer decision support. This new technology may improve the quality of interpretations of cardiovascular ultrasound studies, with better outcomes and reduced costs. For example, an echocardiographic study is performed on a 60-year-old hypertensive patient with heart failure, a preserved ejection fraction, and grade 2 diastolic dysfunction.[13] The left atrial volume index is measured at 27 mL/m^2, which is still within the normal

range. With a smart echocardiographic measurement system, the computer decision support function would remark that this measurement is inconsistent with the clinical interpretation of grade 2 diastolic dysfunction and that another measurement should be made. This support will allow the clinician to make an accurate interpretation and provide the necessary treatment. In addition, these smart echocardiography applications may provide links to evidence-based articles, such as on the link between left atrial volume index and outcomes. Also, clinicians already have many applications on their mobile devices, including those for appropriateness criteria (Echo AUC), quick echocardiography calculations (iASE), and pocket guidelines (ASE pocket guidelines). The major limitation of smart measurements and applications is the need for a "smarter" clinician who knows how to interpret the clinical data. Furthermore, most echocardiography laboratories already have their own protocols and algorithms in place, and it is not clear where smart echocardiographic reporting will fit into the existing echocardiography laboratory structure. At this breakout session, 100% of participants agreed that smart devices and intelligent platforms will allow clinicians to make more accurate measurements.

Strain Imaging. Myocardial deformation (strain) studies have increasingly been used in clinical conditions, including CAD and cardiomyopathies, pericardial diseases, valvular heart disease, and cardio-oncology.[14-18] Deformation studies have been shown to provide important incremental value to standard echocardiographic measurements. An example of how strain imaging could be used is a 45-year-old woman with breast cancer who was treated with trastuzumab and underwent a follow-up echo study with deformation imaging to assess the effect of the chemotherapy on the heart. The global longitudinal strain of the left ventricle dropped by >15% (from 20% to 17.5%) compared with the baseline study; however, the ejection fraction has remained at 57%. How does one interpret these divergent data? Is the strain detecting sub-clinical disease in this patient and should she be evaluated by a cardiologist? There is concern about standardization of strain measurements among vendors[19] and the variability of measurements as well as limited training programs for performing and interpreting these studies in the community.[18] It is well known that strain measurements can be influenced by the aging process (decreasing with age) as well as gender (higher strain values in women). There have been important new consensus documents on the standardization of 2D speckle tracking echocardiography from the EACVI/ASE/Industry Initiative to Standardize Deformation Imaging as well as the uses of strain imaging in cardio-oncology.[18] These documents will aid clinicians in the use of strain for diagnosis and monitoring of different clinical conditions. Sixty percent of the audience in this breakout session agreed that strain imaging was "ready for prime time."

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Patient-Centered Healthcare: A Call to Engage Patients in Their Healthcare Decisions

Moderators: Kenneth D. Horton, RCS, FASE, and Joseph Kreeger, RCCS, RDCS, FASE

As early as 1994, a book review in the *New England Journal of Medicine* noted a shift in the way healthcare was being delivered. The expansion of electronic-based methods of communication and data searches was allowing patients to take greater responsibility for their healthcare. Physicians were called upon to collaborate more closely with their patients and share the "responsibility of defining goals and problems, making decisions, and carrying out

treatment plans."[1] Today, as healthcare changes in this country continue to evolve rapidly, our patients are either being placed or choosing to place themselves more squarely in the center of decisions about their healthcare. Our patients are increasingly proactive regarding which diagnostic test is best for them, where to seek treatment for the best quality and value, and what the out-of-pocket costs for their healthcare will be: not only in terms of health insurance costs but also the costs of specific procedures.[2] This shift in the way we deliver healthcare is referred to as "patient-centered healthcare."

In defining patient-centered healthcare in terms of the delivery of cardiovascular ultrasound services, three elements stand out:

1. The *Choosing Wisely*® campaign as a springboard for opening a dialogue with our patients about their role in healthcare decisions.
2. Implementation of AUC for selecting the right test for the right patient has proved to be a useful patient education tool.
3. Patient-centered discussions about their diagnosis, treatment, and cost of their healthcare are now the norm.

Discussion of the *Choosing Wisely*® campaign was led by Leslie Tucker, vice president of policy at the ABIM Foundation. The *Choosing Wisely*® campaign was initiated by the foundation as a tool that can be used to promote a dialogue between physicians and patients about what tests and procedures are necessary, safe, nonduplicative, and supported by evidence for the most appropriate care on the basis of a patient's individual situation.[3]

One pillar of the *Choosing Wisely*® campaign is the AUC, which have been developed for a number of medical procedures and services, including echocardiography. Based on scientific evidence, AUC help guide providers in determining the appropriateness of a certain medical test in a number of clinical scenarios. Echocardiographic AUC were originally developed in 2005 and subsequently updated in 2011.[4] In the breakout session, the group identified AUC as a tool that can assist physicians not only in selecting appropriate care but also in educating patients about why certain tests may or may not be appropriate for them.

Another element of patient-centered healthcare is cost transparency.[2] With the move toward high-deductible insurance plans that result in higher out-of-pocket costs, patients are beginning to "shop around" for their healthcare, as they do for other commodities. Providers must be able to talk openly about the cost of a diagnostic test or therapeutic intervention. Physicians must be able to demonstrate to their patients the value of a high-quality echocardiographic examination, in terms of the clinically important information it can provide at a relatively low cost compared with other imaging modalities.

In practice, the provision of "patient-centered healthcare" may be complicated by a number of factors. The willingness of patients to participate in these decisions is widely variable; patients' desire to participate in making healthcare decisions still covers a wide spectrum. At one end of the spectrum are patients who implicitly trust their physicians and willingly undergo any diagnostic tests or therapeutic interventions the physicians recommend. At the other end of the spectrum are patients who extensively research their particular diseases and want to partner with their physicians in making all healthcare decisions. Physicians in the breakout session noted that the amount of time spent educating patients and detailing all their options can be great, and those discussions often go beyond the scope of the initial referral.

Although most of the attendees of the breakout session were aware of the *Choosing Wisely*® campaign, many believed that there was still work needed to further publicize the campaign and promote more widespread use. The participants felt that although most healthcare providers and facilities are aware of the campaign, patients are not.

Also, although knowledge and application of AUC are growing, the interpretation and implementation of the criteria vary greatly. The AUC were developed in part to prevent insurance payers from requiring preauthorization of diagnostic procedures, so predictably, many deny claims on the basis of orders that are not compliant with the AUC. It is becoming increasingly important for echocardiography laboratories to implement AUC-compliant ordering to minimize payment denials.

Finally, with so many different health insurance plans, each with varying levels of coverage and different copayments, cost transparency discussions with patients are difficult. Frontline care providers are not equipped to know the details of each insurance plan, what is covered, and what the patient's financial responsibility will be. With such variance in out-of-pocket costs, physicians in this breakout session did not believe that they should be involved in discussions about the cost of a procedure or what the patient's financial responsibility will be.

Several recommendations were made to enhance patient engagement in making healthcare decisions and to increase compliance with AUC. The development of electronic decision support tools has been shown to decrease the number of inappropriate orders.[5] Electronic decision support tools coupled with point-of-entry application of AUC were identified as methods to further ensure compliance with AUC.

Through a grant from the ABIM Foundation, supported by the Robert Wood Johnson Foundation, the ASE Foundation has developed a mobile application that can be used by physicians for guidance about when echocardiography is appropriate for initial diagnosis and post-treatment monitoring or follow-up of many cardiac disorders. This application is free and available to the public and includes speaking points physicians can use to open a dialogue with their patients about their care. This tool and others like it provide new avenues to increase application of the AUC and help patients and providers make shared decisions.

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Improving Quality of and Access to Echocardiography

Moderator: Partho P. Sengupta, MBBS, MD, DM, FASE

Quality in cardiovascular imaging has been challenging to define. The 2011 ASE recommendations for quality echocardiography laboratory operations used the "dimensions of care" framework for defining quality.[1] This document outlined quality in echocardiography under five specific domains: patient selection, image acquisition, image interpretation, results communication, and the incorporation of results into care. Although all five domains are integral for echocardiographic operations, the changes in our healthcare environment call into question whether one or more aspects of quality standards need more in-depth consideration. This breakout session, like the aforementioned sessions, was composed of a broad representation of stakeholders, including physicians, sonographers and allied healthcare workers, hospital administrators, and members of industry. The goal of this breakout session was to outline and address factors that are currently affecting quality standards in echocardiography. The group reached a consensus that quality should be more specifically defined in relation to the amount of information obtained from echocardiographic images (47% of votes) and how this information affects patient care (53% of votes). The areas of improvement suggested were (1) expanding the role of echocardiography as a diagnostic tool, integrating it into clinical care by emphasizing specific findings and statements that help guide therapeutic decisions (47% of votes), and (2) improving timely communication of findings to caregivers (33% of votes). Mechanisms for ensuring quality in image acquisition and interpretation as highlighted in the ASE guideline document, were felt to have received adequate attention from accreditation and regulatory bodies such as Intersocietal Accreditation Commission (80% of votes).

Session participants also discussed mechanisms for improving the practice of high-quality echocardiography. Suggestions included a larger effort to embrace and train newer users in all aspects of cardiovascular ultrasound, the potential use of telemedicine[2,3] and telerobotic technologies[4,5] for training and standardizing image acquisition protocols, and the strategic use of focused ultrasound for improving efficiency in clinical care. Although overutilization of cardiovascular ultrasound for inappropriate indications was of continued concern, many participants also commented that there is substantial underutilization of cardiovascular ultrasound for appropriate indications and that more studies are needed to delineate the loss of quality care to patients due to underutilization for appropriate indications.

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SUMMARY

Value-Based Healthcare: Summit 2014 clearly achieved the three goals set forth at the beginning of this document. First, the live event informed and educated attendees through a discussion of the evolving value-based healthcare environment, including a collaborative effort to define the important role of cardiovascular ultrasound in that environment. Second, publication of these Summit proceedings in the *Journal of the American Society of Echocardiography* will inform a wider audience of the important insights gathered. Third, moving forward, the ASE will continue to build a "living resource" on its website, http://www.asecho.org, for clinicians, researchers, and administrators to use in advocating for the value of cardiovascular ultrasound in the new value-based healthcare environment.

The ASE looks forward to incorporating many of the Summit recommendations as it works with its members, legislators, payers, hospital administrators, and researchers to demonstrate and increase the value of cardiovascular ultrasound. All Summit attendees shared in the infectious enthusiasm generated by this proactive approach to ensuring cardiovascular ultrasound's place as "The Value Choice" in cardiac imaging.