

Relationship Between Appropriateness and Outcomes: It Is Complicated

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Optimizing healthcare quality means providing the right care at the right time. Cardiovascular health care currently focuses on 2 main domains of quality: appropriateness and outcomes. Appropriateness incorporates current evidence and expert opinion to determine optimal use of cardiovascular procedures for patient benefit.¹ Outcomes include risk-adjusted metrics of quality, such as 30-day mortality and readmission after hospitalization for acute cardiovascular conditions.² Healthcare quality, as measured by appropriateness and clinical outcomes, can vary greatly because they measure different aspects of healthcare delivery. For example, a patient hospitalized with ST-segment-elevation myocardial infarction may receive a percutaneous coronary intervention and a transthoracic echocardiogram (TTE) during his/her hospitalization, both highly appropriate in this clinical scenario. If the TTE shows reduced left ventricular ejection fraction, a cascade of care, such as initiation and up titration of evidence-based medications (eg, β blockers and angiotensin-converting enzyme inhibitors), is likely to be initiated. However, despite the fact that the TTE was highly appropriate and led directly to the use of evidence-based therapies, the TTE is unlikely to impact outcomes, such as 30-day mortality, because the benefits from evidence-based therapies may not be seen for several years.³ Conversely, if there is a major procedural complication during the percutaneous coronary intervention, the percutaneous coronary intervention may worsen 30-day mortality, despite the fact that it was highly appropriate. Therefore, appropriateness of

procedures and clinical outcomes may not always be correlated and, in fact, may sometimes even be inversely related.

Although prior studies have examined the relationship between appropriateness and outcomes in certain invasive procedures, such as percutaneous coronary intervention,^{4,5} the relationship between imaging appropriateness and outcomes is poorly understood. In this issue of the *Journal of the American Heart Association (JAHA)*, Tharmaratnam et al examine whether there are differences in healthcare service use and outcomes among patients who receive care from cardiologists who tend to order TTEs at different appropriateness levels.⁶ They conducted a secondary analysis of the control arm of the Echo WISELY (A Multi-Centered Feedback and Education Intervention Designed to Reduce Inappropriate Transthoracic Echocardiograms) trial.⁷ They grouped 35 Ontario, Canada-based cardiologists into tertiles of rarely appropriate TTE ordering frequency: low (0%–9% of TTEs rarely appropriate), moderate (9%–14% of TTEs rarely appropriate), or high (14%–35% of TTEs rarely appropriate). Next, they identified 1677 patients with heart failure referred to one of these cardiologists during the 2-year trial and used administrative data to measure the patients' healthcare service use (outpatient visits and subsequent procedures) and clinical outcomes (hospitalization and mortality) in the year after the index visit with the cardiologist. They found that there were no differences in the use of subsequent cardiovascular tests or clinical outcomes between patients who received care by cardiologists in any of the appropriateness tertiles. However, the patients who received care by the cardiologists in the highest rarely appropriate ordering tertile tended to have fewer implantable cardioverter-defibrillators placed and fewer β blockers prescribed, suggesting a possibility that these patients may have received fewer evidence-based therapies.

The biggest strength of the study is the novel use of methods linking administrative data (providing an accurate assessment of procedure use and outcomes) with clinical trial data on the appropriate ordering practices of cardiologists. By doing so, Tharmaratnam et al⁶ were able to provide an intriguing insight: they found no relationship between physicians' tendency to order rarely appropriate imaging tests and subsequent healthcare service use and outcomes. However, there are 2 important

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limitations to note. First, the exposure–outcome relationship in their study is not explicit. The study cohort involves patients who are diagnosed with heart failure who are referred to a cardiologist for management. That cardiologist has ordered TTEs of a certain level of appropriateness in the past, measured in the clinical trial and likely unrelated to the particular patient with heart failure for whom outcomes were assessed. Thus, the direct relationship between receipt of an appropriate (or rarely appropriate) imaging test and subsequent outcomes remains unknown. Second, although there was lower use of implantable cardioverter-defibrillators and β blockers in the patients who received care by the highest rarely appropriate tertile of cardiologists, the data set did not contain information on whether patients had heart failure with preserved or reduced ejection fraction. Therefore, it is unknown whether this observation truly represents underuse of evidence-based therapies because primary prevention defibrillators and β blockers have no mortality benefit in patients with heart failure with preserved ejection fraction. There is also no clear rationale for why cardiologists who tend to order more rarely appropriate TTEs would implant fewer defibrillators or prescribe fewer β blockers.

The study also brings up a complicated issue in cardiac imaging research: the selection of clinical outcomes to measure the quality and effectiveness of imaging tests. Recent large comparative effectiveness clinical trials of imaging tests (such as the PROMISE [Prospective Multicenter Imaging Study for Evaluation of Chest Pain] trial⁸) used major clinical end points, such as cardiovascular hospitalization and mortality. Although these end points are clearly important, it may take years to manifest any meaningful difference in outcomes because they rely on the cascade of care that follows an imaging test. This is evidenced by the low number of end points observed in the PROMISE trial: \approx 3% achieved a composite end point of death, myocardial infarction, hospitalization for unstable angina, or major procedural complication at 2 years. This suggests that an imaging test could, in theory, improve clinical outcomes, such as mortality, but only with the following significant caveats: (1) only in select patients in whom the test reveals an actionable finding, (2) only in patients in whom the actionable finding initiates a cascade of care with evidence-based therapies, and (3) only in patients who live long enough to derive the mortality benefit of the evidence-based therapies. This stands in contrast to the relatively straightforward task of measuring the quality and potential effectiveness of imaging tests by rating their appropriateness on the basis of published criteria.

Currently, appropriateness and outcomes are used differently by different organizations. Although the Centers for Medicare and Medicaid Services has mainly focused on outcomes for both public reporting and payment, cardiovascular professional societies have maintained a focus on

appropriateness. Both are critical to improving healthcare quality. Routine measurement and public reporting of hospital outcomes have incentivized hospitals to improve care quality for certain cardiovascular conditions and have empowered patients to choose where they receive care.⁹ Meanwhile, studies of appropriateness have shown that between 15% and 20% of TTEs and between 32% and 48% of stress tests are considered rarely appropriate,¹⁰ and that overuse of cardiac imaging contributes significantly to healthcare waste (cardiovascular imaging alone accounts for nearly 40% of Medicare Part B spending on medical imaging).¹¹ As the US healthcare system transitions to value-based payments, the connection between these different dimensions of healthcare quality needs to be better understood. Future studies should test the following: (1) the direct relationship between appropriate use of testing and clinical outcomes in patients with common cardiovascular conditions, such as coronary artery disease and heart failure; and (2) the relationship between appropriateness and certain patient-centered outcomes, such as psychosocial health and symptom control, which are taking on an increasingly important role in healthcare quality. In the meantime, appropriateness and outcomes will both continue to be important quality metrics. In 2020, the Centers for Medicare and Medicaid Services is planning to mandate appropriateness-based clinical decision support within the electronic health record for nuclear stress testing.¹² The study by Tharmaratnam et al⁶ supports this mandate by suggesting that appropriateness and outcomes are complementary measures of cardiovascular healthcare quality.

Disclosures

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