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Strategies to Reduce Low-Value Cardiovascular Care: A Scientific Statement From the American Heart Association

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Abstract

Low-value health care services that provide little or no benefit to patients are common, potentially harmful, and costly. Nearly half of the patients in the United States will receive at least 1 low-value test or procedure annually, creating risk of avoidable complications from subsequent cascades of care and excess costs to patients and society. Reducing low-value care is of particular importance to cardiovascular health given the high prevalence and costs of cardiovascular disease in the United States. This scientific statement describes the current scope and impact of low-value cardiovascular care; reviews existing literature on patient-, clinician-, health system–, payer-, and

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policy-level interventions to reduce low-value care; proposes solutions to achieve meaningful and equitable reductions in low-value care; and suggests areas for future research priorities.

Keywords

AHA Scientific Statements; costs and cost analysis; delivery of health care; health services

For centuries, a key tenet of medicine has been to "first do no harm." Clearly, clinicians should not perform a medical intervention when the harms outweigh the benefits, and ideally, clinicians would not perform interventions if the harms and benefits were equivalent. However, what about the scenario in which the benefits minimally outweigh the harms or the balance between the two is unclear? Moreover, when the financial costs to the patient or society are factored in, these scenarios become truly questionable.

US health care spending is on an unsustainable upward trajectory. Prior studies and a report from the National Academy of Medicine have shown that ≈30% of health care spending may be considered unnecessary or wasteful.[1] Low-value health care is an important component of waste, accounting for $76 to $101 billion annually.[2] Low-value care is complex and occurs for many reasons, including misaligned financial incentives, defensive medical practice, deference to patient requests for testing or treatment, non–evidence-based clinical heuristics, and clinical practice cultures that encourage excessive care. Reducing low-value care is a complex undertaking, but it is an important means of delivering appropriate care and reducing spending without adversely affecting beneficial health care services that improve individual and population health.

Low-value care can generally be thought of as health care services that provide no net benefit from a cost-benefit perspective. The consideration of net benefit should take into account the potential of the service to provide clinically meaningful health benefits, the potential to cause harm, any existing alternatives to the service (of which there can be >1), and the cost of the service to both patients and society. Common clinical scenarios in which health care services do and do not provide net benefit are described in Appropriate Use Criteria and other low-value lists such as the American Board of Internal Medicine Foundation's Choosing Wisely initiative (Table 1).[3–7] These lists were created by expert consensus under the guidance of professional societies such as the American Heart Association and American College of Cardiology.[8] Although these lists have catalyzed the national conversation around low-value health care, they rarely incorporate the cost of health care services.

In the United States, no consensus exists on how to incorporate cost into the definition of low-value care. However, excluding costs is inconsistent with Porter's[9] widely cited definition of value—health outcomes achieved per dollar spent (Figure 1)—and failure to account for cost implies that low-value care is no different from clinically ineffective care. The rise of managed care and value-based payments reflects an understanding by policymakers that the rising costs of health care may lead to tradeoffs; spending on low-value care diverts spending from high-value care that improves the health of the population. Therefore, this scientific statement includes quantitative evidence, when

available, on the cost-effectiveness of services to weigh tradeoffs between health outcomes and costs and to supplement the low-value lists developed by professional societies. Because cost-effectiveness thresholds can be arbitrary and change over time, an incremental cost-effectiveness ratio greater than $100 000 to $150 000 per quality-adjusted life-year may suggest low-value care in the United States.[10,11]

It is important to note that value assessments can vary depending on (1) the outcome(s) and time horizon chosen to measure the clinical impact of the service (benefits as well as harms) and (2) whether the assessments reflect the priorities of the patient, clinician(s), health system, payer, or society. Ideally, the adjudication of value should take all of these different perspectives into account; a framework for considering different perspectives within the value equation is provided in Figure 2. For example, costs may include money and resources from a societal perspective but may also include physical or emotional costs from a patient perspective. Similarly, outcomes may include mortality, clinical markers such cholesterol levels, and patient-reported outcomes such as functional status. This scientific statement aims to give consideration to each perspective when possible, focusing on strategies to avoid care when the outcome/cost ratio is unfavorable (boxes B and D in Figure 2). However, there are certain scenarios in which different perspectives cannot be reconciled (eg, a “rarely appropriate” diagnostic test with low out-of-pocket cost may provide valuable reassurance to a patient but is of low value to society). Thus, the strategies described in this scientific statement may need to be tailored to specific services and settings.

Moreover, uncertainty may exist in both the health outcomes numerator and cost denominator of the value equation. Although some types of care may be more clearly high or low value, others may have more controversial evidence or uncertainty, depending on the patient or the clinical scenario. Acting on value assessments, especially as described later in this scientific statement, should be focused on that care that is most clearly and definitively low value.

Increasing overall health care value is critical to improving population health, as noted in recent efforts such as the American Heart Association’s Value in Healthcare Initiative.[12] This scientific statement is focused specifically on strategies to reduce low-value care. Accordingly, this scientific statement (1) describes the current scope and impact of low-value cardiovascular care, (2) reviews existing interventions to reduce low-value care, (3) proposes solutions to achieve meaningful and equitable reductions in low-value care, and (4) suggests areas of future research and directions for action.

MEASUREMENT AND PREVALENCE OF LOW-VALUE CARE

Measurement of Low-Value Care

A fundamental challenge in reducing low-value care is reliable and valid measurement and attribution. Although many measures of low-value care are currently in widespread use, many of the algorithms currently used to identify low-value services from administrative data may be lacking in coding or criterion validity.[13] Using electronic health record data also may be problematic; automated algorithms within the electronic health records may misclassify >20% of health care services as low-value compared with manual chart review.[14]

The use of automated or templated notes may reduce misclassification, but further study is needed. Manual chart review has its own challenges and may not be the gold standard for identification of low-value care. Accurate chart abstraction depends on both the information entered by clinicians and the ability to extract data from charts reliably (eg, with trained abstractors). Attribution of low-value care presents another challenge because physician and practice identifiers frequently change over time. Algorithms to identify and attribute low-value health care services that are tailored to specific data sources and that have been tested against manual chart review should be used whenever possible.

In addition, patient-reported outcomes (eg, symptom burden, functional status, and health-related quality of life) should be measured along with traditional outcomes such as mortality and readmission. Patient-reported outcomes are increasingly being emphasized as performance measures and in the consideration of health care value.[15] Although many patient-reported outcomes are infrequently assessed or documented in routine clinical care, an increasing number of these measures are being refined to allow collection outside of the clinical workflow. An example is the Veterans Health Administration's Patient Reported Outcomes and Symptom Tracker for patients undergoing percutaneous coronary intervention (PCI) for stable angina.[16] These methods should allow the collection of patient-reported outcomes more broadly to better understand the value of tests and therapeutics from the patient perspective.

Prevalence of Low-Value Care

Diagnostic and screening tests are enormously useful to clinicians caring for patients with known or suspected cardiovascular disease. However, they may be prone to overuse because they are broadly available, potentially lucrative, and generally low risk and because patients often face low out-of-pocket costs for testing. If patients are not carefully selected for testing, the rate of false-positive test results increases, and incidental findings may lead to further unnecessary medical referrals, testing, and anxiety. Many studies have shown that diagnostic testing is common in populations with a low disease prevalence or in patients with a low pretest probability of disease. For example, laboratory testing for high-sensitivity troponin and BNP (brain natriuretic peptide) levels is common in patients presenting for acute care without a clear cause of symptoms, and these tests are often performed serially with minimal evidence of patient benefit.[17] Similarly, patients referred for noninvasive coronary artery disease (CAD) testing have low rates of subsequent clinical events[18] and often have no discernible changes in clinical care or symptom burden relief that result from testing.[19] Meta-analyses of noninvasive testing indicate that up to 20% of echocardiograms and up to 50% of all stress tests performed in the United States are rated as rarely appropriate.[20] Many of these rarely appropriate noninvasive tests lead to subsequent invasive testing and its commensurate risk; nearly 70% of patients referred for invasive coronary angiography are found to have nonobstructive disease.[21]

Concerns about low-value diagnostic and screening tests also extend to consumer products that are not regulated by the US Food and Drug Administration. Devices to monitor heart rate and physical activity are used by >50 million Americans.[22] Some of these devices are also designed to evaluate abnormal heart rhythms through photoplethysmographic sensors or

single-channel electrocardiographic recordings, but more than a third of these recordings may be subject to misinterpretation.[22] Potentially unnecessary referrals for cardiology consultation are often initiated by low-value diagnostic and screening tests. In studies on geographic variations in Medicare spending, rates of specialist consultations are significantly greater in higher-spending areas compared with lower-spending areas and correlate with use of diagnostic and screening tests.[23] Surveys of primary care physicians suggest that for a patient with a given clinical profile, the largest variation in clinical decision-making between high- and low-spending areas was in the likelihood to refer.[24] The COVID-19 pandemic caused many referrals (as well as routine annual or semiannual follow-up visits) to cardiologists to be deferred, providing a potential opportunity to study their value.[25]

Common cardiovascular therapeutics (eg, invasive procedures and medications) are critical to improve patient outcomes but are often used in low-value situations. For example, ≈10% to 15% of PCIs performed in the United States are classified as rarely appropriate.[26] Approximately 20% to 25% of implantable cardioverter defibrillators were not evidence based before the implementation of corrective penalties, and most patients receiving a primary prevention implantable cardioverter defibrillator receive a dual-chamber device despite not having clinical indications for pacing.[27,28] Concerns about low-value therapeutics also extend to medications; patients with cardiovascular disease are frequently prescribed brand-name medications that are more expensive than the generic equivalents that are similar in effectiveness.[29] These examples suggest a need to both improve patient selection for therapeutics and enhance choice of therapeutic options to improve value.

The pace of innovation and diffusion of new technologies to diagnose and treat cardiovascular disease also may exacerbate concerns about low-value care. New high-cost therapeutics are potentially high value but require careful patient selection, payer interventions, or even governmental regulation to ensure that benefits are commensurate with the high therapeutic costs. For example, use of tafamidis to treat transthyretin amyloid cardiomyopathy was approved via the US Food and Drug Administration's Orphan Drug Development pathway, which qualifies the sponsor for special development and marketing incentives and may have a lower evidentiary bar for approval because well-characterized efficacy end points often are not available for rare diseases. However, the real-world use of tafamidis is likely to move beyond the parameters of the orphan designation because of the expansion of indications and a higher population prevalence of amyloid cardiomyopathy than expected.[30] The wholesale acquisition cost of tafamidis is $225 000 per treated patient per year, raising questions not only about which patients will be able to access this drug but also about the resulting budgetary impact of tafamidis and other novel high-cost prescription drugs on the entire health care sector.[31]

IMPACT OF LOW-VALUE CARE

Patient Outcomes

Low-value screening and diagnostic testing increase the likelihood of subsequent specialist visits, diagnostic tests, and procedures.[32] This can be described as a cascade of care, that is, downstream health care use triggered by an unnecessary service.[33] Low-value care cascades can have negative consequences. False-positive tests can lead to additional testing with

invasive procedures (eg, coronary angiography after stress testing) that carry procedural risks. In a national survey of primary care physicians, 80% of respondents who had been involved in care cascades from unnecessary testing felt that the cascade caused harm to the patient or care team.[34] Still, this concern must be balanced by the possibility of false-negative tests and missed opportunities for guideline-recommended testing, which also can have negative patient consequences. For example, a broad reduction in reimbursement for screening tests for osteoporosis in Canada led to reductions in testing among high-risk patients who would have benefited from testing.[35]

Incidental findings from diagnostic and screening tests are also a concern. Although some findings may be highly clinically significant, others ultimately would not have harmed the patient but lead to additional follow-up and testing. For example, although 1% to 2% of patients undergoing coronary computed tomography angiography have a clinically significant incidental finding such as discovery of a malignancy, 12% of patients have a lung nodule that requires subsequent serial imaging but is not clinically significant.[36,37] Last, many diagnostic tests also involve exposure to ionizing radiation. Repeated exposures such as with annual nuclear stress testing can lead to a small but significant increase in the risk of developing cancer.[38]

Low-value therapeutic procedures are potentially more harmful to patients. In addition to the direct harm to patients from undergoing an unnecessary procedure, up to 15% of patients undergoing low-value procedures experience hospital-acquired complications such as infections.[39] It is important to note that although additional testing and procedures may provide reassurance to patients in some settings, they can also provoke unnecessary anxiety.

Health Care Spending

The annual cost of some low-value cardiovascular services has been estimated among Medicare fee-for-service beneficiaries. Examples include low-value stress testing in stable CAD ($212 million–$2.1 billion), PCI for stable CAD ($212 million–$2.8 billion), and preoperative noninvasive testing ($102–$238 million).[40] Low-value care cascades after preoperative ECGs are estimated to cost $35 million annually across all Medicare fee-for-service beneficiaries.[33] The total cost savings from using generic rather than brand-name medications for cardiovascular disease are uncertain but are likely to be significant. For example, among Medicare fee-for-service patients with diabetes, $1.4 billion dollars more per year was spent on brand-name medications compared with identical numbers of similar patients receiving care in the Veterans Health Administration.[41] The costs of low-value services that require adjudication from clinical data (such as low-value use of implantable cardioverter defibrillators) have not been estimated in the literature but are certain to be substantial. There is also a high degree of hospital variation in spending on high-cost procedures such as transcatheter aortic valve replacement, left ventricular assist device implantation, and left atrial appendage closure despite adjustment for patient characteristics, suggesting opportunities to improve the value of these procedures.[42]

Furthermore, the rising costs of health care are increasingly falling on patients. High-deductible health plans are growing in popularity, and out-of-network surprise billing has become common enough that state legislatures have intervened to regulate this practice.[43]

Patients undergoing tests and procedures of limited benefit may face not only the out-of-pocket financial costs associated with deductibles and coinsurance but also travel expenses and time costs of care (ie, missed work or reduced leisure time). In worst-case scenarios, financial toxicity from low-value care could lead to bankruptcy or homelessness.

Applying existing cost-savings interventions to reduce low-value care would potentially save the US health care system $13 to 29 billion annually.[2] Accordingly, the next section of this scientific statement reviews the evidence supporting some of these interventions.

INTERVENTION TYPES AND EVIDENCE BASE

Patient- and Clinician-Level Interventions

Patient Education and Shared Decision-Making—Patient education can improve disease-specific patient-centered outcomes.[44,45] For example, a Cochrane review showed that patients with CAD who received educational materials scored higher on several metrics of health-related quality of life. These interventions typically motivate patients to participate in value-based decisions about their health care and often focus on patient-reported outcomes such as burden of care (eg, treatment side effects) and functioning (eg, symptom control and psychosocial health). In heart failure, education on self-management and the importance of medication adherence has reduced readmission rates and, in some cases, contributed to cost savings of $2823 per patient while costing just $100.[46]

Patient education holds promise in reducing low-value care directly, although evidence for cardiovascular-specific care is more limited. Among patients with low back pain, a brief educational intervention about the utility of spine imaging reduced the use of x-rays by ≈30%.[47] Another study found that patients randomized to receive shared decision-making (SDM) support for preference-sensitive surgeries (eg, laminectomy for low back pain) received 10% fewer surgeries, leading to a 5% reduction in overall costs compared with patients who received usual care.[48] SDM approaches for other preference-sensitive treatments such as PCI in stable CAD have shown promise in improving knowledge about the risks and benefits of PCI but have not been explicitly shown to reduce the use of low-value PCI.[49,50] Although mandates for SDM for some procedures such as implantable cardioverter defibrillators have been implemented by some health care payers,[51] its effectiveness in reducing low-value care may be enhanced by coupling SDM with other interventions such as varying patient out-of-pocket costs according to the expected benefits of the test (ie, value-based insurance design, described further in the Payer- and Policy-Level Interventions section).

Clinician Education—The dissemination of information about the value of health care services forms the cornerstone of clinician educational programs to reduce low-value care. These educational campaigns are frequently based on Appropriate Use Criteria developed by professional societies and sometimes incorporate cost-benefit analyses such as in the low-value lists published by the American Board of Internal Medicine's Choosing Wisely campaign.[7] Clinician education alone may result in modest reductions in low-value testing: Studies testing educational interventions have found relative reductions in rarely appropriate echocardiogram orders by ≈30% and rarely appropriate myocardial perfusion imaging by

≈10%.[52,53] Coupling educational interventions with audit and feedback or decision support tools has shown small additional reductions in low-value echocardiography and stress testing of 2% to 10%.[54–56] Education-based efforts are limited in that they are difficult to sustain; once the intervention ends, observed reductions in low-value care return to preintervention levels.[57,58]

Clinical Decision Support—Providing feedback to ordering clinicians about their low-value care practices, whether in personalized periodic reports or at the point of ordering through electronic decision support (EDS), has shown mixed results in changing clinician practice patterns.[59–62] EDS tools generally involve interactive electronic forms or reminders that require the ordering clinician to justify the selection of tests or treatments. The variable impact of EDS tools is likely attributable to differences among the specific test or treatment studied, the characteristics of the EDS tool itself, and factors related to local practice patterns, among others. For example, rarely appropriate stress tests were reduced by 16% after implementation of an EDS tool among several hospitals in a single metropolitan area, but a similar tool tested in another study had no impact on rates of rarely appropriate testing.[61,62] As the use of EDS tools increases, they should be continually reviewed and revised to ensure that they are based on up-to-date evidence and simple to use within the clinical workflow. Some tools increase complexity without measurable increases in health care value or may even be harmful.[63]

There is growing recognition that EDS may be most effective when coupled with reduction or elimination of reimbursement for low-value care. In 2020, Medicare established the Appropriate Use Criteria Program, which requires consultation with a qualified Clinical Decision Support Mechanism to establish appropriateness for certain advanced imaging tests.[64] This program may aid in the collection of accurate data reports on clinician ordering practices but will likely be more useful as part of a larger, systematic approach that includes tailored outreach strategies and management of stages of change to achieve meaningful reductions in low-value testing.[65]

Behavioral Science Approaches (Nudges)—Education-based efforts rely on improving rational clinical decision-making to reduce low-value care. Behavioral science principles posit that psychosocial factors are also powerful forces in clinical decision-making (eg, inclination to demonstrate consistency, desire to conform to peer behavior, perceived demand from patients). Tools that harness psychosocial factors to affect clinical decision-making are sometimes called nudges and have demonstrated promise in moving clinicians away from low-value care decisions, although again evidence in cardiovascular care is more limited. For example, in a study of clinicians randomized to public display of a poster affirming commitment to evidence-based antibiotic prescribing practices, inappropriate prescribing rates fell by nearly 20%.[66] Other forms of commitment to evidence-based care that were not publicly displayed or reported have not been effective.[67] Another nudge approach harnesses the power of default order sets; implementation of generic medication default order sets leads to 20% relative reductions in the use of high-cost brand-name medications.[68]

Summary and Key Components—The evidence base on the effectiveness of patient education and SDM approaches to reduce low-value care is somewhat limited and largely lies outside of cardiovascular disease. However, these approaches may be useful when misconceptions exist about the intended purpose of a potentially low-value health care service (eg, PCI for stable angina). Motivating patients to take part in care decisions, particularly those that may be of low or uncertain value, holds promise in reducing low-value care and increasing patient-centered care. Multidisciplinary efforts that focus on patient-centered and patient-reported outcomes, as well as exposing patients to financial risk based on the societal value of the test (eg, high out-of-pocket costs for low-value testing), may increase the likelihood of success of these approaches. Implementation strategies for prolonged effectiveness of these approaches are less clear.

Reducing low-value care through clinician-level interventions may be most effective through a layering approach.[69] At the foundation are educational efforts designed to inform clinicians of the relative value of medical interventions, usually through implementation of clinical practice guidelines or point-of-care appropriateness to achieve standardized care. This approach is familiar to clinicians because it is based on rational clinical decision-making, and it mirrors historical requirements of certification and continuing education. Methods to reinforce these educational efforts can be achieved through auditing and feedback of individual care patterns compared with peers or established guidelines. Layered on top of these more traditional methods of reducing low-value care are emerging interventions that make use of behavioral science nudges to encourage high-value clinical decision-making such as encouraging public commitment to avoid specific low-value health care services or default order sets.

Payer- and Policy-Level Interventions

Health Care Payer and System Structure—Several studies have demonstrated differences in low-value health care service use across health care payers and health systems. Compared with Medicare fee-for-service beneficiaries, patients receiving care in integrated health systems (such as the Veterans Health Administration and Kaiser Permanente) or who are insured by capitated health plans (such as Medicare Advantage) generally have lower rates of both overall and low-value cardiovascular procedures.[70–74] Studies also suggest that there may be differences in rates of high- and low-value services between Medicaid-insured and commercially insured patients.[74,75] Although the payment or system structure itself may influence the use of low-value services, there also may be differences attributable to specific interventions that payers and policymakers have explored to better align payments with value. These interventions are described here.

National Coverage Determinations—National coverage determinations are made by the Centers for Medicare & Medicaid Services (CMS) and apply to all Medicare beneficiaries, with commercial insurers typically following these guidelines. CMS may limit coverage of tests and therapeutics that are not deemed reasonable and necessary for the diagnosis or treatment of an illness or injury. Coverage determinations are made through an evidence-based process with opportunities for public commentary. In some cases, CMS has pursued a “Coverage With Evidence Development” approach, which requires data

collection in an approved registry or clinical trial as a condition of coverage. For example, left atrial appendage closure devices were approved in 2016 for use in patients with atrial fibrillation with (1) an elevated risk of stroke, (2) a formal SDM interaction, (3) an inability to take long-term anticoagulation, and (4) enrollment in a prospective national registry. The coverage restrictions increase the likelihood that payments for use of tests and treatments are consistent with the clinical evidence supporting their use. Occasionally, national coverage determinations (or decisions to deny coverage) have provoked controversy such as the 2015 noncoverage decision for coronary artery calcium scanning.[76] These controversies highlight the inherent difficulty of assessing the value of tests and therapeutics in a manner that is broadly acceptable to all stakeholders.

Prior Authorization—Some cardiac tests and treatments such as imaging stress tests and high-cost pharmaceuticals require prior authorization by payers. Prior authorization has been shown to reduce use; implementation of a prior authorization program lowered use rates of advanced imaging with magnetic resonance and computed tomography studies by as much as 15%.[77] These programs may also reduce the use of low-value services specifically; there is moderate correlation between the clinical appropriateness of echocardiograms and preauthorization determinations.[78] In other studies in which clinician groups have designated clinical personnel to act as gatekeepers for diagnostic and laboratory testing, low-value testing was reduced by 21% to 32%.[79,80]

However, there are major drawbacks to prior authorization and gatekeeper programs in their current forms. First, the administrative burden on clinicians to obtain approvals for high-value tests and treatments is significant.[81] Many cardiovascular clinicians are frustrated by the time, money, and resources required for prior authorization processes. Even more frustrating can be the frequent denials (often from clinicians who are not cardiovascular specialists), the perceptions of being excluded from the decision-making process, and the feelings of less-than-adequate care provided to patients. Second, there are possible unintended consequences of patients not receiving appropriate care as a result of these administrative burdens. For example, most insurance payers imposed stringent restrictions on the use of proprotein convertase subtilisin/kexin type 9 inhibitors, leading to frequent denials, relatively slow uptake of the drug even to high-risk patients, and widening of existing disparities in treatment among underresourced patients and patients of color.[82,83] Last, it is important to note that prior authorization requirements are often imposed by payers as a result of high prices that are set by industry partners (pharmaceutical and device companies). Avoiding the negative consequences of prior authorization requirements will require industry partners to price technologies at levels that provide good value to patients and society.

Tiered Formularies—Tiered formularies, in which patients face progressively higher copayments for treatments that provide less value (eg, brand-name pharmaceuticals versus comparable generics), have shown utility in improving the value of pharmacotherapeutics. Patients and health care professionals are thus incentivized to use medications with lower copayments. One study examined the impact of a formulary that explicitly used cost-effectiveness analyses to set medication copayments and found a net decrease in

expenditures of $8 per member per month, translating to significant cost savings overall.[84] However, tiered formularies require careful design to avoid unintended consequences. Formularies designed solely on the basis of cost to payers (eg, a payer contracts with a pharmaceutical company to offer a brand-name medication at a discount to the payer but similar out-of-pocket costs to patients) may lead to underuse of high-cost therapies among patients of lower socioeconomic status.[85]

Pay-for-Performance Programs—Pay-for-performance programs such as the Merit-Based Incentive Payment System tie portions of reimbursement to quality and efficiency measures to incentivize the appropriate use of high-value health care services.[86] In response to calls for these programs to include measures of low-value care (to disincentivize their use), some low-value measures such as use of cardiac stress imaging in asymptomatic low-risk patients were added to the 2020 Merit-Based Incentive Payment System quality measures list.[87,88] A recent meta-analysis of pay-for-performance programs showed that such programs are associated with modest improvements in selected types of high-value care in the ambulatory setting (eg, prescribing antihypertensive medications for patients with hypertension), but their impact on low-value care was not studied.[89] The first mandatory reporting year of the Merit-Based Incentive Payment System program was 2017 affecting 2019 payments, and data on the impact of Merit-Based Incentive Payment System on low-value care are not yet available.

Alternative Payment Models—Alternative payment models such as accountable care organizations (ACOs) and episode-based payments programs such as the Medicare Bundled Payments for Care Improvement provide incentives for population health management, meeting quality metrics, and reducing unnecessary expenditures during high-cost health care episodes.[86] Under ACO payment models, spending for all health care services is benchmarked against a global budget, with shared savings incentives for members of the ACO to stay within the budget and to meet certain quality metrics. Although these payment models do not incentivize reductions in low-value care specifically, they have been shown to discourage the provision of services that contribute to spending but not to improved health. In the first year of the Pioneer ACO program, there were small but statistically significant reductions in the use of low-value services (by 2%) and in spending on low-value services (by 5%) among ACO participants compared with control subjects.[90] Implementation of a Medicaid ACO model in Oregon and Colorado was associated with reductions in some measures of low-value care by up to 3%.[91] Medicare's Shared Savings Program ACO enrollment was associated with up to 6% reductions in low-value cancer screening, suggesting that ACO models may be similarly effective for low-value cardiovascular testing.[92] However, the impact of ACOs on low-value cardiovascular care may depend on whether cardiologists participate in ACOs. One study found that annual spending on patients with cardiovascular disease may be modestly lower when care is provided in ACOs with cardiologist participation,[93] but another found that there are no differences in the use of potentially low-value PCI procedures by cardiologists who did and did not participate in ACOs.[94]

Medicare's Bundled Payments for Care Improvement initiatives have reduced spending modestly for some procedures such as joint replacement, but their specific impact on low-value care is not well known.[95,96] More data on the Bundled Payments for Care Improvement Advance program will become available in coming years and may shed more light on its impact on low-value care.

Value-Based Insurance Design—Conventional health insurance is designed such that all health care services require similar cost sharing for patients (typically a fixed-percentage coinsurance requirement or fixed-value copayment) regardless of the value of the service. For example, each patient has to pay a $25 copayment to receive a stress test, regardless of the appropriateness of the test. In contrast, Value-Based Insurance Design (VBID) varies patient copayments across the spectrum of care to encourage the use of high-value health services and to discourage low-value services.[97] Copayments are minimized or eliminated for health care services deemed high value, whereas copayments are increased for low-value services with little or no evidence of benefit. Using value-based insurance design to reduce low-value care is appealing.[98] For example, high-value stress testing in a patient at intermediate risk for CAD could be greatly subsidized (eg, 10% patient/90% payer), whereas low-value annual stress testing in a patient with no change in symptoms could be minimally subsidized (eg, 90% patient/10% payer). However, the impact of VBID on the use of low-value services is not well understood because studies of VBID to date have focused primarily on the provision of high-value care. For example, VBID programs that reduce or eliminate copayments for diabetes and hypertension medications can increase medication adherence.[99] Some European countries set prices for medications using VBID principles, but the impact is unclear because many patients have secondary insurance that covers the higher cost of lower-value medications.[100] There are also several concerns about VBID: (1) There are challenges in ascertaining whether care is high or low value from administrative claims or electronic health record data; (2) patients often forego high-value care even if it is provided at little or no cost; (3) some patients might be less willing to adhere to necessary treatments for which they did not make some payments; and (4) patients must be able to distinguish between services that are of high and low value, which can be challenging.[101]

Medical Liability Reform—Clinicians who have concerns about medical liability (ie, being sued for malpractice) may practice "defensive medicine" and contribute to low-value care. Studies have shown that liability concerns are associated with use of potentially low-value health care services, particularly diagnostic tests.[102–104] Legal reforms that limit awards to plaintiffs (ie, damage caps) have been enacted by several states, leading to substantial declines in the dollar amount of paid claims.[105] Studies have shown that cardiologists practicing in states that enacted damage caps may have altered their practice patterns in the initial evaluation of patients with suspected CAD by performing fewer invasive coronary angiograms and revascularization procedures compared with cardiologists in states without damage caps.[106] However, the absolute difference was modest, and the impact of liability reform on low-value care was not studied.

Summary and Key Components—National coverage determinations aim to limit new high-cost tests and therapeutics to patients most likely to derive benefit according

to the available evidence but may inadvertently restrict services even among patients who may derive benefit at reasonable cost. Thus, coverage determinations should include longitudinal data collection and reassessments of coverage based on new evidence and ongoing evaluations of disparities in the use of approved tests and therapeutics. Prior authorization may be effective in reducing low-value health care services but has many drawbacks such as creating a high administrative burden on health care professionals and potentially denying access to care among patients who may benefit from the service. New payment and health care delivery models such as ACOs have modestly reduced low-value care; less is known about the impact of pay-for-performance or episode-based payments. VBID and tiered formularies have shown promise in reducing low-value care but require careful design to avoid unintended consequences that may result in unequitable care.

EQUITY CONCERNS

Overview

A growing body of literature describes pervasive and persistent gaps in the delivery of cardiovascular care because of structural racism and bias.[107,108] Inequities in care also exist at the intersections of race and ethnicity, gender and sex, age, geography, and socioeconomic status. Interventions to reduce low-value care may unintentionally worsen these disparities if policies are not designed with at-risk populations in mind. This concern is driven primarily by 3 mechanisms: heterogeneity of effects and application, allocation and availability of community resources, and financial incentives that are unfairly applied across clinicians caring for at-risk populations.

Heterogeneity of Effects and Application

Some tests and treatments may be more effective, and therefore of higher value, among selected populations. In groups in whom the prevalence of disease is higher (eg, metabolic syndrome among South Asian patients or hypertensive heart disease among Black patients), screening tests among asymptomatic individuals may provide more value compared with groups with lower disease prevalence. Interventions to reduce low-value care may also be unevenly applied, potentially worsening disparities in the quality and outcomes of care. For example, a 2018 report by the Association of Black Cardiologists describes the disproportionate impact of prior authorization requirements on underresourced patients and patients of color.[109] Similarly, CMS' noncoverage decision for coronary artery calcium scanning effectively excluded even higher-risk groups (eg, patients with a strong family history of CAD and a low-risk categorization from the Pooled Cohort Equation) from receiving the test despite evidence of its cost-effectiveness in those populations.[110]

Community Resources

Lack of community resources to navigate health care can hinder efforts to reduce low-value care. Increases in cost sharing (eg, high-deductible health plans) that are indiscriminately applied can lead to reductions in the use of preventive and essential care, thereby worsening health disparities.[111] More nuanced value-based insurance designs may mitigate some of these concerns. For example, in the Post-Myocardial Infarction Free Rx Event and Economic Evaluation trial, eliminating medication copayments for secondary

prevention of acute myocardial infarction was more effective in reducing rates of major adverse cardiovascular events among patients of color compared with White patients.[112] Furthermore, health care interventions that would be considered unnecessary or wasteful in high–socioeconomic status populations may be needed in groups with lower socioeconomic status. For example, community health workers have been shown to help patients with lower health literacy navigate the health care system and to improve rates of high-value preventive care and medication adherence,[113,114] which may ultimately lead to cost savings. In addition, reallocating resources to provide multidisciplinary care to higher-risk individuals may improve value.[115] For example, among patients with hypertension, costs per visit with multidisciplinary care were higher compared with usual care ($131 versus $74), but overall cost savings were observed through reductions in per-person costs for emergency department visits ($0 versus $11) and per 1–mm Hg systolic blood pressure reductions ($27 versus $193).[116]

Inequity Related to Financial Incentives

Programs designed to encourage clinician efficiency may unfairly penalize safety-net providers. Clinicians and hospitals that treat larger proportions of patients with low socioeconomic status are more likely to have lower pay-for-performance scores; they are less likely to receive financial bonuses and more likely to incur financial penalties as a result.[117,118] Adjusting pay-for-performance metrics for social risk factors has significant financial implications for hospitals participating in alternative payment models. For example, Medicare's lack of adjustment for social risk factors such as poverty, disability, and housing instability in the Hospital Readmissions Reduction program resulted in millions of dollars of additional penalties for safety-net hospitals.[119,120] Similarly, outpatient practices that serve patients with the highest proportion of social risk factors perform worse on metrics that emphasize clinical outcomes instead of the provision of guideline-recommended care.[121] These practices would fare poorly under value-based payment programs that do not account for social risk factors, bias, and structural racism.

The optimal way to address social risk factors in value-based payment is still unclear. Many policymakers have objected to the adjustment of outcomes for social risk factors, seeing this as excusing or accepting lower-quality care that is delivered to underresourced populations and masking lower quality with statistical adjustments.[122] Achieving favorable outcomes for patients with greater social risk may require additional resources to achieve the same level of outcomes in more advantaged populations. Thus, policies designed to provide financial incentives for high-value care should be carefully crafted to avoid penalizing hospitals and clinicians who have higher care-delivery costs in part because of their patients' more limited resources and to avoid masking lower-quality care delivered to underresourced populations.

SOLUTIONS: ACHIEVING MEANINGFUL AND EQUITABLE REDUCTIONS IN LOW-VALUE CARE

Framework: The Social-Ecological Model of Health Promotion

The causes of low-value care are complex and include misaligned financial incentives, patient expectations, local practice culture, and non–evidence-based clinical heuristics,

among others. Cardiovascular health care may be particularly prone to low-value health care service use because cardiovascular disease is highly prevalent, often presents acutely and sometimes fatally, and is frequently documented in the press and other lay reports. Society's desire to treat and prevent cardiovascular disease, coupled with the rapid pace of technological innovation in cardiovascular tests and therapeutics, may sometimes outstrip our understanding of how to maximize the value of cardiovascular health care services.

Interventions to reduce low-value care are also wide ranging and include patient-, clinician-, payer-, and policy-level solutions that are summarized in Table 2. Given the complexity of the problem, the overall approach may best be viewed through a framework. The social-ecological model of health promotion posits that effecting change requires acting simultaneously across multiple perspectives. Addressing a single driver of low-value care or applying a single solution to reduce low-value care is unlikely to be successful. Furthermore, interventions to reduce low-value cardiovascular care may differ according to the type of service; approaches to reduce rarely appropriate echocardiograms may require involving ordering clinicians and echocardiography laboratories, whereas approaches to maximize generic rather than brand-name medications may require involving medical and informational technology teams. Because of these challenges, it is critical to consider and act across different perspectives, to emphasize continual data collection and measurement of impact and consequences, and to use multiple synergistic approaches to increase the likelihood of success (Figure 3). Last, any effort to reduce low-value care should occur on a foundation of standardized care that is based on the implementation of clinical practice guidelines, perhaps coupled with transparency and public reporting of value metrics to motivate organizations to reduce low-value care.

Principles of Deimplementation

The emerging field of deimplementation science provides useful principles to reduce health care practices that are considered ineffective or harmful.[123,124] Three broad principles should be considered, described simply by Powers et al[125] as evidence, eminence, and economics. The first principle of evidence involves the development of high-quality empirical data showing that a health care service provides little or no benefit to patients and is not cost-effective. Such evidence is frequently generated for emerging tests and therapeutics through clinical trials and cost-effectiveness analyses but is less common for services that are already in widespread use but are of questionable value. Recent examples of the latter include the ORBITA trial (Objective Randomized Blinded Investigation With Optimal Medical Therapy of Angioplasty in Stable Angina) and the ISCHEMIA trial (International Study of Comparative Health Effectiveness With Medical and Invasive Approaches) to understand the value of coronary revascularization for stable ischemic heart disease.[126,127] The second principle of eminence involves securing broad acceptance of evidence that a service is of low value. This involves engaging stakeholders such as patient advocacy groups and leveraging the influence of professional societies to engage clinicians and health systems. The third principle of economics involves aligning financial incentives with health care value. Value-based payment arrangements such as those used by ACOs should be supplemented with quality metrics or pay-for-performance programs targeted specifically at low-value health care services. Transparency and public reporting of value

metrics could motivate health care organizations to retain market share and reputation, which in turn may help organizations generate more revenue. Considering cost-effectiveness in coverage decisions, which is currently prohibited at CMS, would enable reduction or elimination of payments for health care services that are clearly of low value.

Focus on Areas of Highest Impact

Efforts to reduce low-value care should focus on services that have high baseline rates of low-value use or that contribute significantly to health care costs. Recent studies have shown that rates of preoperative stress testing before low-risk surgery are low, occurring in <4% of eligible patients.[128,129] Yet, this recommendation appears in 7 different specialty lists for the Choosing Wisely campaign, suggesting that there are better opportunities for reducing low-value care. For example, estimates suggest that nearly 25% of elective PCIs may be categorized as rarely appropriate if guidelines are updated to reflect the results of the ISCHEMIA trial, reflecting up to 200 000 PCIs at a cost of $6 billion annually.[130,131] Future iterations of Choosing Wisely and other low-value lists, as well as interventions to reduce low-value care, should explicitly target those low-value services that affect the largest number of patients and produce the largest amount of waste.

Ensuring Health Equity

Measures of health equity should be routinely incorporated into evaluations of value-based payment programs.[107,132] Stratification of program effects by race and ethnicity, sex, age, and social risk factors may be helpful in ascertaining differential impacts. Designing policies that use antiracist strategies may prevent recurrent disparities created by existing health care policies such as prior authorization programs. Including a diverse team of stakeholders through study development and enrollment may lead to better outcomes across diverse population groups. Value-based payments should be designed to adjust upfront for social risk factors such as low income and housing instability to avoid penalizing safety-net clinicians.[133] Ensuring that guidelines account for possible heterogeneous treatment effects across different patient groups is critical to avoid “1 size fits all” approaches to reducing low-value care. Effects of interventions on high-value, guideline-recommended care also should be tested to ensure that interventions do not indiscriminately reduce overall health care services. Last, community resources should be considered before implementation of interventions that may disproportionately affect certain groups such as use of high-deductible health plans among lower-income patients.

FUTURE RESEARCH DIRECTIONS

Research Priorities

High-impact research priorities that will contribute substantially to knowledge about the use of low-value care and strategies to reduce low-value care are listed below.

1. Patient- and clinician-level priorities:
    a. Develop novel strategies for patient engagement and effective communication of the potential harms of low-value care. In particular, strategies that embed patient education and SDM resources within

the clinical workflow (including effective and unobtrusive feedback mechanisms) are likely to be the most effective.

b. Incorporate patient-reported outcomes into the value equation. Health care stakeholders need to better understand the value of tests and therapeutics from the patient perspective, which may aid in setting prices for services that are based on outcomes and costs to maximize value from both patient and societal perspectives.

c. Understand how best to implement patient- and clinician-level interventions to reduce low-value care, and deimplement current practices that contribute to low-value care. Reach, Effectiveness, Adoption, Implementation, and Maintenance or similar frameworks can be used to understand barriers and facilitators for broad implementation of interventions that have been shown to be effective.

d. Improve the use of EDS tools so that they fit the needs of specific populations, and make them less cumbersome and more functional to increase their adoption and impact.

e. Assess whether educational programs on value-based care during medical school and graduate medical education reduce low-value care. Education of clinicians early in their careers may create a culture shift that leads to careful consideration of value in health care delivery.

2. Payer- and policy-level priorities

a. Develop and test best practices to engage stakeholder groups (eg, patients, clinicians, health system and industry leaders, and policymakers across diverse demographics such as race, ethnicity, sex, and income) that share common goals of improving outcomes and reducing costs. Stakeholder engagement is critical to broaden the reach of interventions to reduce low-value care.

b. Improve the measurement and attribution of low-value care by developing validated and reliable algorithms tailored to specific data sources, including administrative claims and templated notes within electronic health records.

c. Redesign the prior authorization process by reducing or removing its administrative burden on clinicians, removing barriers to appropriate access to patients, and reducing its potential to worsen disparities in care among underserved patients and patients of color.[81,83,134]

d. Better understand the impact of value-based insurer programs, including narrow networks (eg, strictly limiting referrals to low-cost clinicians), risk-sharing contracts (eg, not reimbursing health care professionals for avoidable complications), pay-for-performance programs, and medical liability reform on low-value cardiovascular care through systematic data collection as policies are implemented.

e. Longitudinally assess the value of new and emerging diagnostics and therapeutics. Monitoring of clinical and patient-centered outcomes and costs in the clinical setting (ie, the real world) is important to achieve the right balance between advancing medicine and innovation and ensuring adequate evidence of benefit and value.

f. Encourage and incentivize industry partners (eg, pharmaceutical and device companies) to develop technologies that not only are efficacious at improving health but also are priced at levels that provide good value to patients and society. The onus to use high-cost medical diagnostics and therapeutics wisely cannot be placed solely on patients, clinicians, and payers without industry partners being held accountable for prices that are too high relative to the benefits delivered.

g. Understand the health care impact of the SARS-Cov-2 pandemic. Differences in the use of health care services during the pandemic and their impact on patient outcomes and costs may provide a natural experiment opportunity to understand the value of certain health care services, particularly those that are already in widespread use but of questionable value.

CONCLUSIONS

At best, spending on low-value care potentially diverts resources from higher-value services that would benefit patients more effectively at the same or reduced cost. At worst, low-value care results in physical harm in the form of preventable morbidity and mortality. Thus, reducing low-value care is one of the few patient-centered solutions that directly address both the need to control health care spending and the societal imperative to devote its limited resources to beneficial health care services that improve health. Achieving meaningful reductions in low-value cardiovascular care is possible through the interventions and research priorities outlined in this scientific statement and will benefit both patients and society.

Disclosures

Writing Group Disclosures

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This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be "significant" if (a) the person receives $10 000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns $10 000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.

*Modest.

†Significant.

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†Significant.

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$$\text{Value} = \frac{\text{Outcome}}{\text{Cost}}$$

Figure 1. Porter's definition of value in health care.[9]

	Greater Outcome (e.g., high ARR, high PRO, low NNT)	**Lesser Outcome** (e.g., low ARR, low PRO, high NNT)
High Cost (e.g., money, resources, physical/emotional)	**A** (higher value)	**B** (lowest value)
Low Cost (e.g., money, resources, physical/emotional)	**C** (highest value)	**D** (lower value)

Figure 2. Perspectives to consider in the value equation.

Different perspectives on costs and outcomes that can be considered when defining value of a health care service. For example, costs may include money and resources from a societal perspective but may also include physical or emotional costs from a patient perspective. Similarly, outcomes may include mortality, clinical markers such cholesterol levels, and patient-reported outcomes (PROs) such as functional status. Number needed to treat (NNT) may also help define value from a societal perspective. ARR indicates absolute risk reduction.

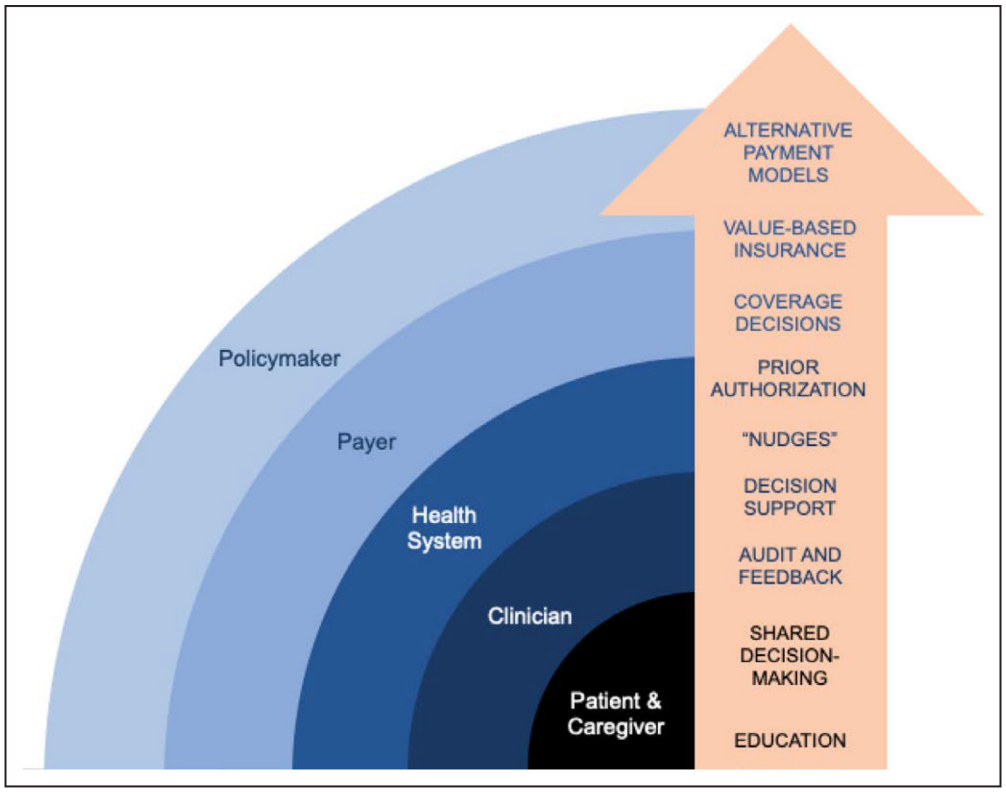

Figure 3. Framework to reduce low-value care: the social-ecological model of health promotion.

Table 1.

Examples of High- and Low-Value Care

High-value care	Low-value care
High-sensitivity troponin testing in patients with acute chest pain	Serial high-sensitivity troponin testing in patients at low risk for cardiac ischemia
Stress testing in symptomatic patients at intermediate risk for CAD	Routine annual stress testing in patients after coronary revascularization
Echocardiography in patients presenting with syncope and a heart murmur	Echocardiography in patients presenting with syncope without signs, symptoms, or electrocardiographic evidence of cardiac disease
Coronary calcium scanning in patients at intermediate risk of ASCVD and for whom the decision about statin use is uncertain	Coronary calcium scanning in patients with known clinical ASCVD
PCI in patients with ST-segment–elevation acute myocardial infarction	PCI in patients with a low-risk stress test and manageable symptoms
Single-chamber primary prevention ICD placement in patients with LVEF <35%	Dual-chamber ICD placement in patients without pacing indications

ASCVD indicates atherosclerotic cardiovascular disease; CAD, coronary artery disease; ICD, implantable cardioverter defibrillator; LVEF, left ventricular ejection fraction; and PCI, percutaneous coronary intervention.

Table 2.

Summary of Interventions to Reduce Low-Value Care

Intervention	Description	Example	Advantages	Disadvantages
Patient- and clinician-level interventions				
Patient education and SDM	Provide information to patients to understand the risks and benefits of potentially low-value health care services and make decisions based on their care preferences	Delivery of educational materials about use of PCI in stable CAD to facilitate a SDM conversation with their clinician	Activate patients to take part in decisions about potentially low-value services Place importance on patient-centered outcomes Incorporate patient preferences for care into decisions	Delivery of materials and time for SDM conversations need to be incorporated into clinical workflow
Clinician education	Delivery of up-to-date, evidence-based information through any number of delivery mechanisms	Delivery of focused information regarding appropriateness of echocardiograms	Appeals to the fundamental principle of rational decision-making May satisfy continuing medical education requirements May be easily combined with other strategies	Modest effects and no evidence for sustained effects
Clinician audit and feedback	Provides clinicians with reports of low-value care that may be individualized or aggregated with or without comparisons to peers or over time	Periodic reporting of rate of appropriate use of myocardial perfusion imaging to ordering hospitalists compared with their peers	May be especially effective for groups with most frequent use of low-value care May be easily combined with other strategies	Modest effects and no evidence for sustained effects
Clinical decision support	Provides evidence-based information typically at the point of care to guide clinical decision-making as a requisite for order completion	Evidence-based guidance at the point of care for ordering the most appropriate stress test	Proven effectiveness in reducing some low-value services such as advanced imaging	Can be complex to design, implement, and update Contributes to clinician alert fatigue in the EHR Incentives for implementation may be lacking
Behavioral nudges	Strategies that work to reduce low-value care by addressing psychosocial factors through behavioral intervention	Establishing generic drugs as the default order when there is no benefit to more expensive alternatives	Designed to be unobtrusive to treating clinicians Compelling effectiveness has been demonstrated in some instances	Limited evidence in the clinical practice setting May be challenging to implement in more complex clinical decision-making scenarios
Payer- and policy-level interventions				
National coverage decisions	Large payers determine payment for new health care services to selected patients who meet criteria on the basis of available evidence	Left atrial appendage closure devices were approved in 2016 but limited to patients who met evidence-based criteria, underwent a formal shared decision-making process, and enrolled in a national registry	Coverage restrictions decrease the likelihood of off-label, potentially low-value services Postapproval monitoring for safety and efficacy is often required	Noncoverage decisions restrict services to all beneficiaries without consideration of individual patients in whom the service may be high value
Prior authorization	Determinations of payment for services are made on an individual basis, typically through a discussion between clinicians	Payments for some imaging stress tests require a discussion between the ordering clinician and a payer representative	Effective at reducing some low-value care services	High administrative burden to both clinicians and payers Stringent restrictions may limit services even to patients for whom the service may be considered high value

Intervention	Description	Example	Advantages	Disadvantages
Tiered formularies	Preferred medications (whether based on payer contracts with pharmaceutical companies or cost-effectiveness analyses) are provided for lower patient copayments	Low copayments for highly cost-effective medications; high copayments for less cost-effective medications	Patients and providers incentivized to use cost-effective medications with low copayments	Patient out-of-pocket costs must be considered (as opposed to payer costs alone) to avoid underuse of therapies among patients of low SES
Pay for performance	Portions of reimbursement are tied to quality and efficiency measures	Statin therapy for patients with known atherosclerotic cardiovascular disease or with LDL >190 mg/dL	Mandatory participation began in 2019, ensuring high reach Participation is associated with modest improvements in guideline-recommended care	Few measures of low-value care are currently included No data on benefit to health outcomes Possible unintended consequence of denying care to high-risk individuals who may worsen performance metrics
Alternative payment models	Financial incentives are tied to population health management, meeting quality metrics, and reducing unnecessary expenditures during high-cost health care episodes	ACOs: members receive shared-savings incentives to stay within a benchmarked global budget BPCI: participants receive a fixed amount of money for a 90-d episode of care for acute myocardial infarction	ACO membership is associated with modest reductions in low-value services typically performed in primary care settings BPCI participation is associated with modest reductions in spending	Reductions in low-value care may not extend to specialty care, including cardiovascular medicine Impact of BPCI participation on low-value care is not well understood Alternative payment models may unfairly penalize safety-net providers
VBID	Patient copayments (ie, cost-sharing requirements) for health care services are aligned with the value of the service	High-value stress testing in symptomatic intermediate-risk patients is highly subsidized (eg, 10% patient/90% payer); low-value stress testing in asymptomatic low-risk patients is minimally subsidized (eg, 90% patient/10% payer)	VBID medication programs have improved adherence and clinical markers of disease control Cost sharing for low-value services requires SDM with patients	Patients may forego high-value care for which they did not make any payments (ie, “skin in the game”) Some patients may not be able to distinguish between high- and low-value health care services

ACO indicates accountable care organization; BPCI, Bundled Payments for Care Improvement; CAD, coronary artery disease; EHR, electronic health record; LDL low-density lipoprotein; PCI, percutaneous coronary intervention; SDM, shared decision-making; SES, socioeconomic status; and VBID, Value-Based Insurance Design.