

# Understanding the Medical and Nonmedical Value of Diagnostic Testing

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## ABSTRACT

**Objectives:** To develop a framework for defining the potential value of diagnostic testing, and discuss its implications for the health-care delivery system.

**Methods:** We reviewed the conceptual and empirical literature related to the valuing of diagnostic tests, and used this information to create a framework for characterizing their value. We then made inferences about the impact of this framework on health insurance coverage, health technology assessment, physician–patient relationships, and public health policy.

**Results:** Three dimensions can effectively classify the potential value created by diagnostic tests: 1) medical value (impact on treatment decisions); 2) planning value (affect on patients' ability to make better life decisions); and 3) psychic value (how test information affects patients'

sense of self). This comprehensive framework for valuing diagnostics suggests that existing health technology assessments may systematically under- or overvalue diagnostics, leading to potentially incorrect conclusions about cost-effectiveness. Further, failure to account for all value dimensions may lead to distorted payments under a value-based health-care system.

**Conclusions:** The potential value created by medical diagnostics incorporates medical value as well as value associated with well-being and planning. Consideration of all three dimensions has important implications for technology assessment and value-based payment.

**Keywords:** cost-effectiveness analysis, health-care decision-makers, health economics methods, value of information, willingness to pay.

## Introduction

Health policy experts have called for a “value-based” US health-care system in which providers would compete for patients on the basis of price and quality, and payments would be based on value provided rather than costs [1]. Although the impact of such a system is uncertain, some have suggested that it could reduce overall US health expenditures by as much as 30% without adversely affecting medical outcomes [2]. Others note that value-based approaches could encourage employees to choose healthier lifestyles, higher-quality providers, and more effective treatments [3]. They may also help to rationalize drug benefits [4] and enhance patients' compliance with chronic medications [5]. As one observer recently noted, “‘value-based’ is the preferred health care prefix of our era [6].”

The success of a value-based system hinges on valid definitions and measures of value across the spectrum of health-care services. This has largely been taken for granted, but there is not yet a shared meaning of “value” or systems in place capable of measuring it. Consider, for example, the current debate over advanced diagnostic imaging. Physicians cite new imaging techniques as an example of truly essential medical innovation [7,8]; however, some policymakers have questioned its value [9,10], and rapid growth in spending for diagnostic services in the Medicare program has led to congressionally mandated reimbursement cuts [11]. This disconnection between those convinced of imaging's value and those questioning it underscores the challenges of implementing a US value-based health-care system.

For surgical or pharmacological treatments, the concept of value is relatively straightforward. Life expectancy and quality of

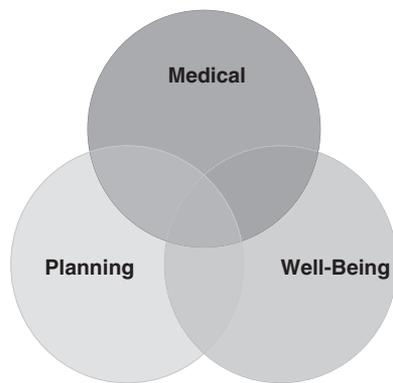
life have been measured—albeit with some controversy—using standard health technology assessment techniques [12]. But as Fryback and Thornbury have noted, these value measurement techniques are more difficult to apply to diagnostics because their clinical impact depends upon the sequelae of clinical interventions. In other words, diagnostics affect treatment decisions, and treatment decisions affect outcomes [13]. Asch et al. further observed that clinical impact alone is an insufficient measure of value for diagnostics because diagnostics also have the potential to affect patients' sense of psychic value whether or not they affect treatment [14]. For example, a diagnostic test for dementia may have relatively little impact on treatment or outcomes, but may have a substantial effect on the patient's psychic value.

This article has several objectives that contribute to the literature on the value of diagnostic tests. First, it seeks to highlight the potential value of diagnostic testing for medical decision-making. Second, the particular dimension of value on which we focus is the value of diagnostic testing in resolving patients' uncertainty about their medical conditions. This dimension of value—what we term the “value of knowing”—has been largely ignored in the cost-benefit literature. But it is important to recognize this dimension of value, both for more accurate economic evaluations of health-care treatments and technologies, and for appropriate design of health insurance policies. A third aim is to discuss the implications of this framework for policymaking, health technology assessment, optimal insurance design, the physician–patient relationship, and public health policy. Finally, we explore the obstacles to measuring the value of diagnostics, and offer some possible strategies for overcoming them.

## Defining Value for Diagnostics

Conceptually, a diagnostic test can be defined as an information-gathering exercise in health-care delivery. This can range from a simple clinical assessment (e.g., observation, palpitation, blood

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**Figure 1** Dimensions of diagnostic value.

pressure check) to an advanced in vitro or sophisticated diagnostic imaging study. Regardless of type, diagnostics have the potential to create value along three dimensions (Fig. 1).

### Medical Value

Medical value reflects a diagnostic's ability to inform clinical treatment. Examples include complete blood counts to detect disease; mammograms to detect breast cancer; x-rays to diagnose pneumonia; or magnetic resonance imaging to inform musculoskeletal surgical decisions. The medical value of diagnostics is typically evaluated using standard cost-effectiveness analysis methods when the diagnosis-treatment link is direct; however, patient preferences for treatment may not be well captured. A patient who knows she is at risk for dementia may forego a life-extending treatment with associated mortality or morbidity risks because she may not want to trade off high-quality current years for low-quality future years.

### Planning Value

Planning value refers to a diagnostic test's ability to inform patients' about choices on reproduction, work, retirement, long-term health, financial plans, and so on. Research has suggested, for example, that many people would want to know early in life if there were a gene that predicted whether they would eventually contract Alzheimer's disease, even in the absence of preventative measures or treatment for the disease. On average, respondents to one survey stated that they would be willing to pay several hundred dollars for such a genetic test. When asked what they would do with the test information, respondents pointed to planning; for example, they would "sign advance directives, spend more time with family, get their finances in order, and/or buy long-term care insurance [15]."

Imagine a genetic test that could determine with certainty whether one will eventually contract Huntington's disease. From a medical treatment perspective, this test has little value because it does not affect treatment, but nevertheless, it could be highly valued by a patient concerned about childbearing if she is at risk for the disease based on family history. Even in the absence of formal tests, clinicians and genetic counselors may use their knowledge of genetics and epidemiology to help concerned families gauge their chances of contracting a disease and to plan accordingly.

### Psychic Value

Psychic value captures how diagnostics can directly change patients' sense of satisfaction, and may yield either positive (good

news) or negative (bad news) value [14]. Although perhaps the least-studied dimension of value, it could also be the most important, especially for certain medical conditions where treatment is unavailable or ineffective but knowledge of the disease can have a profound impact on one's sense of psychic value. Consider a patient with lower back pain who is extremely concerned that the pain may be indicative of a serious health-care condition, like cancer. Although the medical value of advanced imaging for initial, acute lower back pain is negligible [16], such a test may have a very large psychic value for the patient.

Differences in the relative importance of these three dimensions depend on the perspective of the affected party. For example, medical value is likely to be more heavily weighted by physicians based on their training, role in health-care decision-making, and the fact that they do not directly benefit financially from the pure value of knowing. Nevertheless, physicians would not be expected to completely ignore the value of knowing when they act as the patient's agent. In contrast, the patient is more likely to weigh the value of knowing and planning relatively more heavily than the physician. Finally, payers are likely to place the most weight on medical value and the least weight on planning or psychic value because, beyond the general need to keep customers satisfied with their health plan benefits, they receive little or no benefit from these nonmedical value dimensions.

Asch et al. provided perhaps the first conceptual treatment of the psychic value associated with diagnostics, which he coined "knowing for knowing's sake [14]." Asch et al. highlighted the importance of different psychological impacts associated with receiving equal amounts of good or bad news from a diagnostic test. Although traditional economic theory would suggest that patients apply the same value to equal increments of good and bad news, behavioral economics incorporates the well-documented phenomenon that patients are loss averse—they need to be compensated more for bad news than they are willing to pay for good news [17].

Recently, two of this article's authors built on this fundamental insight to create a more general conceptual model for measuring the psychic value of diagnostics, and used it to help explain patients' test-taking behavior [18]. The results of that analysis revealed that the pure value of knowing from diagnostic testing depends on test accuracy, pretest disease risk, the patient's discount rate, time to disease onset, the degree of a patient's worry about disease onset, and the patient's aversion to receiving bad news (loss aversion). As derived from that study, the pure value of knowing increases (testing becomes more likely) under certain conditions.

*When tests are more accurate.* The model predicted that less accurate tests would have lower value, especially when resolving inaccuracy is difficult or expensive. This result aligns with empirical research showing that patients place higher value on more accurate genetic tests for Alzheimer's disease [15], cancer [19], and Down's syndrome [20]. Not all empirical evidence, however, shows that accurate tests are more highly valued. Providing patients with information about test accuracy was shown to have no impact on willingness to pay for prostate cancer screening [21] or whole-body PET scans for cancer [22].

*When pretest expectation of bad news is low or the bad news is not catastrophic or occurs far into the future.* Consistent with findings in both cognitive science and behavioral economics, this result implies that patients value a diagnostic test most when the chances and consequences of a bad outcome are relatively small. In other words, patients tend to prefer tests that rule out rare

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