

potentially useful support for clinicians. At the most basic level, they provide ready access to vast reservoirs of information, which may, however, be quite difficult to sort through to find what is needed. At higher levels, computers can support care management decisions by making accurate predictions of outcome, or can simulate the whole decision process, and provide algorithmic guidance. Computer-based predictions using Bayesian or statistical regression models inform a clinical decision but do not actually reach a “conclusion” or “recommendation.” Machine learning methods are being applied to pattern recognition tasks such as the examination of skin lesions and the interpretation of x-rays. Artificial intelligence (AI) systems attempt to simulate or replace human reasoning with a computer-based analogue. Natural language processing allows the system to access and process large amounts of data, both from the EHR and from the medical literature. To date, such approaches have achieved only limited success. The most prominent example, IBM’s Watson program, introduced publicly in 2011, has yet to produce persuasive evidence of clinical decision support utility. Reminder or protocol-directed systems do not make predictions but use existing algorithms, such as guidelines or appropriate utilization criteria, to direct clinical practice. In general, however, decision support systems have so far had little impact on practice. Reminder systems built into EHRs have shown the most promise, particularly in correcting drug dosing and promoting adherence to guidelines. Checklists may also help avoid or reduce errors.

■ **DECISION ANALYSIS**

Compared with the decision support methods discussed earlier, decision analysis represents a normative prescriptive approach to decision-making in the face of uncertainty. Its principal application is in complex decisions. For example, public health policy decisions often involve *trade-offs* in length versus quality of life, benefits versus resource use, population versus individual health, and *uncertainty* regarding efficacy, effectiveness, and adverse events as well as *values* or preferences regarding mortality and morbidity outcomes.

One recent analysis using this approach involved the optimal screening strategy for breast cancer, which has remained