

effectiveness studies in the health economics literature have often relied on lower values, such as \$100,000, to represent the monetary value of a QALY. In addition, the \$5 million VSL is based on research conducted in the early 1990's and relies on relative risk and relative wages. Other typical estimates of the VSL have ranged from as low as \$2 million to as high as \$8 million.

We analyzed the societal benefit of the proposed rule using \$100,000 as the QALY value for preventing a nonfatal ADE and the low VSL estimate of \$2 million as the willingness-to-pay to avoid a fatality. The willingness-to-pay to avoid an average ADE decreased from \$183,900 to \$70,800 using these parameters. Overall, the estimated annualized benefit of the proposed rule fell from \$3.9 billion to \$1.5 billion, which would still exceed the estimated annualized costs.

5. Hospital Response Rates

The expected benefits rely on a faster rate of hospital acceptance of bar code technology than the rate expected in the absence of the regulation. The current estimate of public health benefits is based on all hospitals acquiring bar coding systems within 10 years as compared to 20 years without the proposed rule. However, because we are not requiring hospitals to make this investment, we examined the impact of different diffusion rates. ERG examined two additional scenarios: one in which the technology is accepted within 20 years with a rule as compared to 30 years without a rule, and one in which technology is accepted within 15 years, as compared to 20 years with a rule. Both cases decrease costs and benefits. The first case reduced expected net annualized net benefits from \$3.2 billion to \$2.0 billion. Annualized hospital expenditures declined from \$680 million to \$408 million, and benefits decreased from \$3.9 billion to \$1.8 billion. The second case reduced annualized net benefits to \$1.5 billion. Annualized hospital expenditures declined from \$680 million to \$303 million, and benefits decreased from \$3.9 billion to \$1.8 billion. The public health benefits of the proposed rule would still exceed costs and expenditures with these slower diffusion rates.

6. Hospital Intercept Rates with Machine-Readable Technology

The expected benefit of avoidance of patient ADEs is dependent on the expected rate of error interception. For this analysis, ERG found that about 45 percent of the errors that lead to

preventable ADEs originate in the dispensing and administration stages of the medication process and that the use of bar coded information and installed systems would intercept about 50 percent of these errors. Because of the direct relationship between expected interception rates and avoided ADEs, we tested the impact of the assumed rates. Although the literature has implied that interception rates as high as 85 percent are obtainable, ERG assumed a 50 percent rate to account for potential nonoptimal use of technology. If the true increase in interception rates were between 80 percent and 20 percent, the total number of avoided ADEs would be between 660,400 and 165,000. The monetized annualized value of these avoided ADEs would vary from the current estimate of \$3.9 billion to the lower and higher values of \$1.6 billion (with a 20 percent improvement in interception rates) or \$6.2 billion (with an 80 percent improvement in interception rates). From a societal perspective, therefore, the accelerated technology investment appears reasonable even with significantly lower interception rates.

7. Productivity Losses in Hospital Wards

The decision by hospitals to make significant investments in bar code reading technology is highly dependent on expected productivity changes in the delivery of bedside care by nurses. Our current analysis assumes a 3-percent productivity loss of ward nurses due to the use of this new technology. We examined the sensitivity of this estimate and found that if long-term productivity loss approximated only 1 percent of the current workload, the average annualized cost of accelerated hospital investments would decrease from \$680.0 million to \$246.7 million. However, if the productivity loss of nursing resources was as great as 5 percent, the annualized expenditures by hospitals would increase to \$1.2 billion. In order for the productivity losses to outweigh the expected benefits, however, there would have to be an almost 700-percent estimated productivity loss. We recognize the extreme uncertainty of this projection and particularly invite public comment in this area.

8. Minimum Hospital Response

The expected benefits rely on a faster rate of hospital acceptance of bar code technology than the rate expected in the absence of a rule. The current estimate of public health benefits is based on all hospitals acquiring bar code systems within 10 years as compared to 20 years

without the proposed rule. However, because we are not requiring hospitals to make this investment, we examined the minimum number of hospitals needed to install systems in order to be confident that benefits exceed costs. The ratio of costs to benefits implies that if only 0.05 percent of all hospitals in the United States (three facilities) make this investment 10 years earlier, the rule would generate sufficient public health benefits to justify costs. This estimate is based on average hospital size. We tested this assumption by assuming that only very small (fewer than 50 bed capacity) hospitals would adopt the technology. In this case, 22 hospitals would be required to adopt the technology (0.3 percent of all hospitals and 1.9 percent of all small capacity hospitals) in order for the expected benefits to exceed the costs.

9. Investments by Hospital Size

The internal decision to acquire and use new bar code reading technology could be affected by the size of the purchasing hospital. Hospitals that have already installed this equipment are, for the most part, fairly large or part of a large network of hospitals. Because the benefits of error interception are dependent on the number of annual admissions, we were concerned about the likelihood of technology adoption by small hospitals.

According to the most recent census, there are 1,117 hospitals in the United States with capacities fewer than 50 beds. These hospitals account for only about 3 percent of the estimated annualized opportunity cost of investment from this proposed rule, because the potential productivity losses are not as great as for larger hospitals. The annualized opportunity costs per facility with fewer than 50 beds is approximately \$57,100. However, because of the fewer admissions to hospitals of this size, we estimate that the interception rate of the bar code technology is expected to result in an average of 1.7 avoided ADEs per year per facility. The estimated societal benefit of avoiding 1.7 ADEs is \$303,800. If these small hospitals adopt technology at the same accelerated rate as all hospitals, the annualized benefit per hospital is \$86,900, or more than the investment.

We are aware that the estimated direct annual hospital cost savings of avoiding ADEs alone (\$2,257 per avoided ADE) may not cover the costs of the expected earlier investment pattern. For example, the average facility with fewer than 50 beds would experience direct annual cost savings of \$3,837 (1.7 ADEs avoided x \$2,257) and annualized costs