

language will add less than one-tenth of a page to an average PDR listing and cost about \$842 more per product.⁷ The annual costs of printing the larger labels

in the PDR, therefore, will increase by \$0.13 million.

Over 10 years, the agency estimates that the annualized compliance costs of

the final rule will be approximately \$580,000. These costs are summarized in table 3.

TABLE 3.—COSTS TO REVISE PROFESSIONAL LABELING AND INCREMENTAL PRINTING COSTS

	One-Time Labeling Revision Costs	Annual Incremental Printing Costs	Annual PDR Costs
Per product cost ¹	\$4,379	\$37	\$842
Number of affected products	669	669	160
Total	\$2,929,228	\$24,439	\$134,720
Total annualized costs ²	\$417,056	\$24,439	\$134,720

¹ Rounding may affect totals.

² One-time costs are annualized over 10 years at 7 percent.

C. Benefits

Bacterial resistance to antibacterial drugs directly affects health care costs by requiring the use of newer and more expensive drugs and by requiring longer treatment and hospitalization periods for patients infected by resistant bacteria. The societal costs of the infections from these resistant bacteria include both the direct costs for additional drugs and medical care and the indirect costs of lost productivity for patients with extended illness and increased mortality. The agency did not receive any direct comments on the benefits estimate in the proposed rule. However, during the review of the proposed rule, the Office of Management and Budget (OMB) requested that the agency estimate mortality attributable to resistant bacteria for the final rule. Thus, the final analysis of impacts also includes an estimate of the number of lifeyears saved.

1. Direct Costs of Resistant Infections

Most studies on the cost of hospital infections in the United States have not separated infections caused by resistant bacteria from those caused by susceptible bacteria. Researchers from the CDC, examining summary reports of outbreak investigations for 1971 through 1980, as well as published and unpublished reports of infections caused by bacteria with known antibacterial resistance, found that infections from resistant bacteria were typically associated with substantially longer hospital stays. The examined studies, however, had too few subjects to allow statistical analysis (Ref. 8).

Two recent studies on the effects of methicillin-resistant *Staphylococcus aureus* (MRSA) reported significantly different lengths of stay for patients infected with resistant bacteria compared to controls. The studies

included only patients with similar underlying diseases. One study found that patients with infections from resistant bacteria stayed an average of 9.5 days in an intensive care unit (ICU) while control patients stayed there 5 days (Ref. 9). The other study found that patients with infections from resistant bacteria stayed an average of 21 days in an ICU compared to 12.5 days for control patients (Ref. 10).

Three regional studies directly compared the costs of infections caused by resistant and susceptible bacteria. In the first study, using hospital discharge data from hospitals in New York City, researchers modeled differences between infections caused by MRSA and those caused by methicillin-susceptible *S. aureus* (MSSA). They estimated that each MRSA infection costs an additional \$2,500 in direct medical costs and longer hospital stays (Ref. 11).

The second study, performed at a university teaching hospital in North Carolina, also measured length of hospital stay and direct costs of hospitalization for patients with hospital-acquired bloodstream infections caused by MRSA and MSSA bacteria (Ref. 12). Patients infected with resistant bacteria stayed 8 additional days in the hospital (i.e., 12 days with MRSA infections compared to 4 days with MSSA infections), costing approximately \$17,000 more in direct hospital costs.

In the third study, conducted at a Boston hospital, researchers examined the economic impact of antibiotic resistance in *Pseudomonas aeruginosa* (Ref. 13). This study compared length of stay and costs for three groups: (1) Patients with susceptible bacteria, (2) patients with some baseline resistant bacteria, and (3) patients with resistance that emerged while hospitalized. Daily hospital charges of \$2,059 were the same for all three groups. Also, the

length of stay was similar for patients infected with susceptible bacteria and those with baseline resistant bacteria. However, patients in whom resistant bacteria emerged during hospitalization incurred additional costs of \$7,340 for 3.5 extra days.

The total number of annual infections caused by resistant bacteria is uncertain. Although diagnosis codes exist for infections with drug-resistant microorganisms, the codes are intended only to supplement other codes for infectious conditions and are not always included in patient data. As a result, hospital patient records may provide only an estimate of the minimum number of cases of drug-resistant infections in a given year. The U.S. National Center for Health Statistics publishes annual estimates of the number of diagnoses (by diagnosis code) in nonfederal short-stay hospitals from the National Hospital Discharge Survey (NHDS). NHDS estimates about 18,000 and 43,000 cases of infections by resistant microorganisms for 1995 and 1997, respectively (Refs. 14 and 15). On the basis of data from a larger national sample of hospital patients, the Healthcare Cost and Utilization Project (HCUP) estimates 84,000 diagnoses of resistant infections in community hospitals for 1997 (Ref. 16). CDC hospital surveillance data for 5 known strains of resistant bacteria for 1995 suggest a much higher figure, approximately 279,000 cases (Ref. 17). For this analysis, FDA has assumed the average of the 1995 data, or that 150,000 hospital-acquired infections per year are attributable to resistant bacteria. Thus, if patients incur additional hospital charges of only \$2,500 per resistant infection, the total hospital cost attributable to antibacterial resistance is estimated at \$375 million annually. However, these costs are likely understated because the more recent

products in the print version of the PDR are also included in the CD-ROM and Internet version.

⁷ \$842 per product = (\$9,500 per page + columns per page) × 0.266 column.