

## The Right to Bear Legs—An Amendment to Healthcare: How Preventing Amputations Can Save Billions for the US Health-care System

To the Editor:

Current prevalence estimates suggest that 20.8 million US residents have diabetes, and this number is predicted to more than double to 43 million by the year 2040.<sup>1, 2</sup> As a chronic disease, diabetes is extremely costly. Direct medical expenditures totaled \$92 billion in 2002. Indirect expenditures resulting from lost workdays and disability totaled \$40 billion.<sup>3</sup> The cost burden of diabetes accounted for 18% of all US health expenditures (\$865 billion in 2002). Adjusting for health-care inflation, we estimate the totals for diabetes-related expenditures to escalate to \$122 billion and \$54 billion in 2007 for direct and indirect costs, respectively. It has been estimated that “health-care inflation” is twice the average economic inflation rate.<sup>4</sup> To adjust for health-care inflation, we used the inflation calculator available from the US Department of Labor/Bureau of Labor Statistics<sup>5</sup> and doubled the rate.

Up to 25% of individuals with diabetes will develop a foot ulcer during their lifetime.<sup>6</sup> Foot ulcers and infections are the most common reason for hospital admission of individuals with diabetes.<sup>7</sup> Foot ulcers cost between \$7,439<sup>8</sup> and \$20,622<sup>9</sup> per episode (adjusting for health-care inflation in 2007). The annual incidence of foot ulcerations in people with diabetes is between 2% in a retrospective cohort<sup>10</sup> and 6.8% in prospective clinical data.<sup>11</sup> Gordois et al estimated that \$9 billion were spent on the treatment of diabetic foot ulcers in 2001.<sup>12</sup> These authors’ calculations were based on an estimate of 11.1 million people with diabetes in the US and the cost was based on gauze dressings twice daily. Our calculations are based on the American Diabetes Association estimate that there are 20.8 million people with diabetes and the cost data presented above.<sup>1</sup> Considering these new data on increasing incidence and cost inflation, we estimate that up to

\$19 billion was spent on care of diabetic foot ulcers in 2007 (Table 1).

Eighty-five percent of diabetes-related lower extremity amputations (DRLEA) are preceded by a foot ulcer.<sup>13</sup> The direct costs of major limb amputation are estimated to be \$70,434 (adjusting for health-care inflation in 2007), which includes the cost of a prosthetic limb.<sup>12</sup> The lifetime projected cost of a major amputation, considering rehabilitation and future prostheses, can be as much as \$500,000.<sup>14, 15</sup> The annual incidence of lower-extremity amputation is 5 to 8 per 1,000 people with diabetes.<sup>16-18</sup> We estimate that expenditures for amputations in those with diabetes to be approximately \$11.7 billion (Table 1).

Diabetic foot ulcerations and amputations are largely preventable. In pivotal trials, foot ulcer recurrence rates were found to decrease by 48% with a multidisciplinary approach and four podiatry visits yearly,<sup>19</sup> by 53% with custom off-loading footwear,<sup>20</sup> and by 73% with the use of a dermal thermometer and education.<sup>21</sup> The potential cost savings if these initiatives were implemented nationally could be \$9 billion to \$14 billion annually (Table 2).

Pecoraro reported that roughly 86% of amputations were preceded by an identifiable and preventable pivotal event.<sup>13</sup> Similarly, the International Diabetes Federation<sup>22</sup> and World Health Organization<sup>23</sup> launched a campaign in 2005 highlighting that 85% of DRLEAs are preventable. In practice, comprehensive amputation-prevention programs have reduced the rates of amputation by 50% to 69%.<sup>17, 24, 25</sup> That could translate to a cost savings of up to \$8 billion annually (Table 2).

Together, effective diabetic foot ulcer and amputation prevention could realistically save the US health-care system up to \$21.8 billion annually. Relatively low-cost preventative measures could be adopted quickly and result in this significant cost savings. Unfortunately, diabetic foot complications are overlooked and neglected. Diabetic foot ulcer and amputation-prevention measurements need to be added to the Healthcare Effectiveness Data and Information Set (HEDIS).<sup>26</sup> Pivotal prevention services are not reimbursed adequately. Physicians should have ade-

**Table 1. Adjusted Health-care Expenditures for Diabetic Foot Ulcers and Amputations**

	Incidence	Number of Patients <sup>a</sup>	Cost per Episode	Total
Diabetic foot ulceration	4.4% <sup>b</sup>	915,200	\$20,622 <sup>c</sup>	\$18.9 billion
Lower-extremity amputation	0.8%	166,400	\$70,434 <sup>c</sup>	\$11.7 billion

<sup>a</sup>Based on 20.8 million people with diabetes in the US (American Diabetes Association).

<sup>b</sup>Average incidence of retrospective and prospective studies.<sup>10, 11</sup>

<sup>c</sup>Adjusted for health-care inflation.

**Table 2. Projected Cost Savings from Amputation-Prevention Strategies**

	Estimated 2007 Costs	Practical Reduction	Potential Annual Cost Savings (in billions)
Diabetic foot ulceration	\$18.9 billion	48–73% <sup>19-21</sup>	\$9.1–\$13.8
Lower-extremity amputation	\$11.7 billion	50–69% <sup>17, 24, 25</sup>	\$5.8–\$8
Total	\$30.6 billion	N/A	\$14.9–\$21.8

Abbreviation: N/A, not applicable.

quate reimbursement and access to high-risk patients for comprehensive prevention. Only then can we attain realistic estimates of the scope of the problem and encourage proper prevention.

Third-party payors need to reimburse for a preventative comprehensive diabetic foot screening at a frequency that depends on the overall risk category of the patient (more frequent for higher risk, less frequent for lower risk). Similarly, inexpensive tools might play a substantive role. As an example, skin temperature monitoring has been shown in three randomized controlled trials<sup>27-29</sup> to drastically reduce the risk of foot ulceration in high-risk patients. There are several studies that support the benefit of therapeutic shoes and insoles<sup>20</sup>; and while the benefit of protective shoes and insoles is occasionally questioned, the fact that poor footwear causes ulcerations is not.<sup>30</sup> We suggest that keeping one's limbs is a right, not a privilege. Urgent attention is needed to this debilitating consequence of diabetes. The above measures constitute a start on the right foot.

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