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Incidence-based cost estimates require population-based incidence data. A critique of Mahan et al.

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Dear Sirs,

As a health economist, I read with interest the article by Mahan et al. which calculates the monetary burden of deep-vein thrombosis (DVT) in the absence of pulmonary embolism (PE) (1). Mahan et al. multiply numbers of incident and recurrent DVT cases by average costs per incident or recurrent case. That approach requires estimates of incidence and recurrence derived from population-based epidemiologic data using a case definition consistent with that used to calculate per-person medical cost estimates. In particular, because the per-case cost estimates are specific to symptomatic DVT cases, symptomatic DVT incidence must be used to assess aggregate costs. The "weakest link" in cost studies is most commonly found in epidemiologic measures such as incidence, case fatality, and preventable fraction rather than economic methods or cost data (2).

Population-based US studies report an annual incidence of clinically recognized venous thromboembolism (VTE; which includes both DVT and PE) between 1.0 and 1.5 per 1,000 adults (3–5). Since most population-based studies report that DVT accounts for approximately 65–70% of VTE (4–8), the annual incidence of symptomatic DVT should be between 0.65 and 1.0 per 1,000 US adults, or a total of 160,000 to 240,000 new cases of symptomatic DVT per year. Extrapolating from the findings of two recent population-based cohort studies in Europe (6, 7), the true incidence of symptomatic DVT is likely to be at the upper end of that range, or 250,000 US adults per year. Mahan et al. (1) estimated 378,623 to 2 million new cases of DVT per year, which is substantially greater than the number of incident symptomatic DVT cases recorded in population-based studies.

In Table 4 of their manuscript, Mahan et al. report approximately 3 million Americans have DVT with a recurrence risk of DVT of 0.09 (9%) per year (1). That implies 270,000 recurrent symptomatic DVT each year. However, in the Olmstead County study the risk of VTE recurrence was 12.9% during the first year and an average of 1.9% per year for the second through the 10th years (9). Other prospective studies have estimated the annual risk of VTE recurrence to be 2–3% per year after the first 12 months (10, 11). Consequently, applying a fixed

9% annual recurrent risk to the estimated number of adults who have had a DVT substantially overstates the number of recurrences. In addition, Mahan et al. appear to have overstated the risk of death attributable to VTE recurrence, which was assumed to be 9% (1). A prospective cohort study found that although the one-year case-fatality rate among patients with recurrent VTE was 9%, only 3.8% had deaths attributed to definite or probable PE (12), because many people with recurrent VTE die from other causes.

Estimates of economic burden of disease should be based on epidemiologic measures calculated using consistent case definitions and samples representative of the general population. By choosing assumptions about the incidence and recurrence of DVT that are high relative to estimates based on population-based epidemiologic data, Mahan et al. have derived estimates of aggregate costs associated with DVT that appear too high. Even the lower end of their cost ranges may be twice the true cost. Thus, rather than total DVT costs of $7.5 to $39.5 billion, perhaps $5 billion would be more plausible. The latter estimate is still large but within the range of existing cost estimates of up to $10 billion for DVT and PE together (13).

Existing population-based data on VTE incidence do have limitations (14, 15), and it might be argued that the true incidence of DVT is higher. First, most studies have enrolled subjects of predominantly European ancestry, and symptomatic VTE incidence is 40% higher among Blacks or African-Americans than Whites (16–19). On the other hand, VTE incidence is lower among non-Black Hispanics and Asians (16–18), and the overall rate for the US population appears to be the same or slightly lower than that among Whites alone (16, 18). Second, the total incidence of DVT, including asymptomatic DVT or cases of DVT detected though routine imaging, is higher than the incidence of symptomatic DVT. For example, whereas two population-based studies in Denmark reported symptomatic VTE incidence of 0.7 to 1.2 per 1,000 adults per year (20, 21), a research study that screened Danish adults found a total DVT incidence of 2.7 per 1,000 per year (22). However, numbers of asymptomatic DVT cases should not be included if cost estimates are derived from data on patients with symptomatic DVT.

The U.S. Surgeon General and the Centers for Disease Control and Prevention (CDC) recognise the need for improved estimates of the public health burden of VTE (15, 23, 24). In addition, the CDC National Center on Birth Defects and Developmental Disabilities (NCBDDD) has established the reduction of deaths from DVT and PE as one of its three priorities for the period 2011–2015 (13). Since approximately 50% of VTE diagnoses occur during stays in acute care hospitals or within 90 days of a hospital discharge (3, 25), hospital-acquired or –associated VTE represent a prime opportunity for prevention. I agree with Mahan et al. that proven, evidence-based strategies can substantially reduce the burden of hospital-associated DVT and PE. Studies have shown that up to one-half of postoperative or hospital-associated DVT or PE events are preventable if hospitals closely adhere to standardised protocols of risk assessment and prevention and implement continuous quality improvement activities (26–30). Not only can appropriate prophylaxis reduce the risk of life-threatening blood clots, it can also potentially save hospitals and payers money (31–33).

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