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Online-Only Material: The eFigure is available at http://www.jamainternalmed.com.

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Optimal Interval for Routine Cytologic Screening in the United States

Despite the success of cytology-based (Papanicolaou) screening in the United States, over 12 000 women develop and 4000 women die from cervical cancer each year,[1] signaling important flaws in current practice. Paradoxically, a large proportion of women are overscreened,[2] while at least 50% of cases occur among women who are infrequently or never screened.[3] Guidelines have historically recommended screening early and frequently (eg, annually) to offset the poor sensitivity of a single Papanicolaou test. However, a better understanding of the slow natural course of disease, the availability of highly sensitive tests to detect oncogenic human papillomavirus, the causal agent of cervical cancer, and evidence of adverse pregnancy outcomes associated with precancer treatment have triggered momentum toward less aggressive screening in the general population. Consensus guidelines issued this year now recommend screening no earlier than age 21 years and no more frequently than every 3 years for routine cytologic screening to minimize overuse and patient harms while maintaining high levels of cancer prevention.[4,5] Because the impact of changing guidelines on cervical cancer will not be observed for several years, we used a mathematical simulation model to project the cost-effectiveness of routine cytologic screening at different intervals.

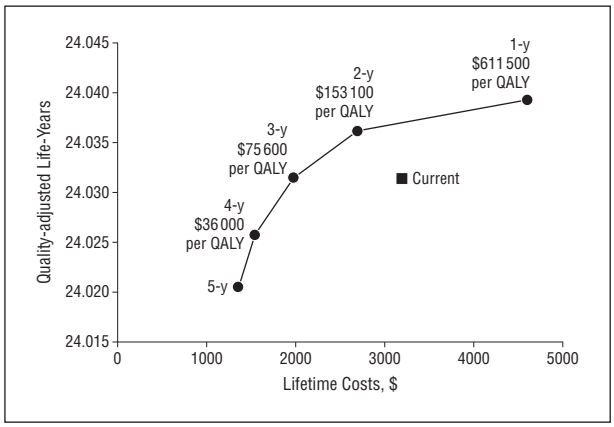

Figure. Efficiency frontier. Lifetime costs, quality-adjusted life years (QALYs), and incremental cost-effectiveness ratios ($ per QALY gained) are displayed for routine cytologic screening at intervals ranging from every 1 to 5 years (circles) and current screening at variable rates (square).

Methods. The mathematical model simulates the natural history of cervical cancer in US females based on data from epidemiological studies and cancer registries (eMethods, eTable 1, eTable2, and eFigure; http://www.jamainternalmed.com). Individuals enter the model and transition between clinically relevant health states in monthly time steps. The model simulates detailed cervical cancer control strategies and tracks each woman's health status and resource use to generate estimates of quality-adjusted life expectancy and lifetime costs of interventions. Strategies included routine cytologic screening at 1- to 5-year intervals and a baseline scenario reflecting current US screening rates.[6] Costs included screening, diagnosis, and treatment of disease, patient time, and patient transportation (eTable 3). Incremental cost-effectiveness ratios were calculated (additional cost divided by the additional health benefit of a strategy compared with the next-less-costly strategy) and discussed in the context of $50 000 to $100 000 per quality-adjusted life year (QALY) gained, commonly cited thresholds indicating good value for money in the United States.[7]

Results. The **Figure** displays the projected outcomes for each screening scenario. As expected, both lifetime costs and health benefits increased as routine screening was administered more frequently. It is important to note that screening all eligible women every 2 or 3 years was associated with similar or greater QALYs and lower costs than screening at current US rates. For example, cytologic testing every 3 years yielded a cost savings of $1210 per woman and slightly higher QALYs compared with current screening.

Annual and biennial screening had cost-effectiveness ratios that exceeded $150 000 per QALY gained. Screening every 3 years cost less than the upper threshold of $100 000 per QALY gained (ie, $75 600 per QALY gained). Screening every 4 years cost less than the lower threshold of $50 000 per QALY gained ($36 000 per QALY

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gained), although this strategy resulted in lower health benefits than current screening.

Comment. Our analysis has 2 main findings: (1) compared with current practice, screening all eligible women every 2 or 3 years can yield equal or greater health benefits at a significant cost savings, and (2) routine screening more often than every 3 years exceeds conventional thresholds for cost-effectiveness in the United States. Together, these findings support recent guidelines recommending routine cytologic screening at 3-year intervals.[4,5]

Investments in programs to achieve high coverage of 3-year screening can be considerable, up to $1200 per screen-eligible woman, before spending on cervical cancer screening reaches current levels. Programs, such as call/recall systems and community-based outreach—likely to be less than $1200 per woman—can focus not only on removing barriers for underscreened women but also on decreasing use in women who unnecessarily get annual routine screening. Attaining high coverage across all eligible women has the added advantage of promoting equity in health gains across subgroup populations, such as minorities and the uninsured, known to have high rates of cervical cancer incidence and mortality.

Our analysis has limitations. Because we did not explicitly model heterogeneous subgroups, our estimates may be conservative if improved access to screening leads to the reduction of cases that otherwise would have differentially worse outcomes and/or higher costs than average. We also did not assess the impact of improving compliance to diagnostic visits and access to timely treatment among women who are screened appropriately, efforts that are paramount to reducing cervical cancer burden in the United States.

We conclude that improving cervical cancer screening does not necessitate increased expenditures in the United States. Indeed, shifting away from the status quo, with at least half of women getting screened too frequently and over a quarter not frequently enough, can likely reduce current expenditures without compromising the tremendous health gains already achieved in cervical cancer prevention. This cost savings can be invested in more prudent ways to improve health, whether through cervical cancer prevention or other health interventions.

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Healthcare and Lifestyle Practices of Healthcare Workers: Do Healthcare Workers Practice What They Preach?

Healthcare workers (HCWs) represent an important group in which to study individual health behaviors, both because they are more knowledgeable than others about health care choices and because they serve as role models for patients.[1,2] We sought to describe the prevalence of preventative and lifestyle behaviors among HCWs in a nationally representative sample of American adults.

Methods. The Behavioral Risk Factor Surveillance System (BRFSS)[3] is an annual telephone survey of the adult US population conducted by the Centers for Disease Control and Prevention. We included all respondents to the question "Do you provide direct patient care as part of your routine work?" asked in 2008 and 2010. Overall response rates were 53.3% in 2008 and 54.6% in 2010. The Beth Israel Deaconess Medical Center committee on clinical investigations (Boston, Massachusetts) approved our analyses.

We assessed 6 preventative health behaviors and 14 lifestyle factors as binary variables (**Table**), defining outcomes as less desirable behaviors. We used logistic regression to estimate risk ratios (RR) when outcomes were

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