

## Correspondence

## Influenza Vaccination in Patients With Cancer

A study by Keam et al demonstrated that influenza vaccination, regardless of timing during 3-week cytotoxic chemotherapy cycles, may provide seroprotection.<sup>1</sup> The majority of patients in this study were women with either breast or lung cancer. In an earlier study of patients with colorectal cancer, influenza vaccination was found to result in fewer cases of influenza, fewer cases of pneumonia, and fewer interruptions of chemotherapy.<sup>2</sup> Therefore, it would be of interest to learn whether influenza vaccination might help patients with other forms of cancer.

To shed some light on this question, we examined death rates from influenza/pneumonia in 50 US states and the District of Columbia. We correlated these rates with death rates from common forms of cancer.

We obtained age-adjusted influenza/pneumonia state death rates from *National Vital Statistics Reports* for 2013, which to our knowledge are the most recent available.<sup>3</sup> We obtained age-adjusted state death rates for common forms of cancer from the American Cancer Society.<sup>4</sup>

We found a significant correlation between influenza/pneumonia state death rates and death rates from colorectal cancer in men ( $\beta$ , .550;  $P < .001$ ), colorectal cancer in women ( $\beta$ , .340;  $P = .015$ ), and lung cancer in men ( $\beta$ , .428;  $P = .002$ ). There was no significant correlation of influenza/pneumonia state death rates noted with female breast cancer ( $\beta$ , .170;  $P = .234$ ), non-Hodgkin lymphoma ( $\beta$ , .105;  $P = .464$ ), lung cancer in women ( $\beta$ , .102;  $P = .478$ ), pancreatic cancer in men ( $\beta$ , .106;  $P = .458$ ), pancreatic cancer in women ( $\beta$ , .057;  $P = .692$ ), or prostate cancer state death rates ( $\beta$ , .024;  $P = .868$ ).

Because of the powerful relationship between obesity and colorectal cancer,<sup>5</sup> we performed multivariate linear regression analysis with colorectal cancer state death rates as the dependent variable and influenza/pneumonia state death rates and Centers for Disease Control and Prevention state obesity rates<sup>6</sup> as independent variables. The correlation between the colorectal cancer death rate in men and influenza/pneumonia was significant ( $\beta$ , .200;  $P = .001$ ) and independent of obesity ( $\beta$ , .467;  $P < .001$ ). The correlation between the colorectal cancer death rate in women and influenza/pneumonia was not significant

( $\beta$ , .053;  $P = .260$ ), although the effect of obesity was significant ( $\beta$ , .237;  $P < .001$ ).

A weakness in our analysis was our assumption that differences in influenza mortality are due to differential rates of vaccination. The Centers for Disease Control and Prevention reported that state variability in child and adult flu vaccination coverage is substantial.<sup>7</sup> Although some studies have found that influenza vaccination reduces the winter mortality risk from any cause by 50% among the elderly, the mortality benefit of the influenza vaccination remains controversial.<sup>8</sup>

Another weakness is possible confounding by the ecological fallacy (or ecological inference fallacy), a logical fallacy in the interpretation of statistical data in which inferences regarding the nature of individuals are derived from inferences for the group to which those individuals belong.<sup>9</sup> In this case, inferences regarding influenza and cancer in individuals were being drawn from the characteristics of the US states in which they reside rather than from the individuals themselves.

Almost anyone can benefit from the influenza vaccination to some extent. However, influenza vaccine response in many patients with cancer is inadequate in comparison with age-matched healthy controls.<sup>10</sup> After vaccination, increased survival may occur primarily in men with colorectal or lung cancer. Further studies could be worthwhile.

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### CONFLICT OF INTEREST DISCLOSURES

The authors made no disclosures.

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## Correspondence

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