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We would like to add some caveats, without which the assertion is not strictly correct. These caveats are uncontroversial in Bayesian theory and are supported by Lindley and, presumably, Burton *et al*. We hope that it will be helpful if we make them explicit.

The result of a standard analysis cannot be interpreted as a Bayesian result if the analysis has incorporated any of the following elements:

- Bonferroni corrections or other adjustments to error levels
- analyses that are mathematically multivariate even though there is a univariate main outcome measure—for example, standard methods for analysing clinical trials with interim analyses
- analyses that ignore sources of variance—for example, common methods of evaluating survey data that take into account sampling variation but not measurement error
- conditional designs that violate the likelihood principle[3] by adjusting the result of any part of an analysis on the grounds that another analysis was either planned or carried out—for example, clinical trials again
- test statistics chosen for their frequentist properties—for example, unbiased statistics used in preference to more natural or more powerful biased statistics

It can be seen from this list that the design of Bayesian studies can be markedly different from the more common frequentist designs. A major benefit of Bayesian theory to the practising epidemiologist is the fact that Bayesian designs can be vastly more flexible. For example, in a Bayesian design conservatism in combining multiple results is built in to the model and does not have to be adjusted according to the number of analyses.[4-6]

In summary, there are many cases in which Bayesian theory can be used to provide a fruitful alternative interpretation to a standard calculation, as Burton *et al* suggest; but there are other cases in which a Bayesian analysis yields not only a different interpretation but also a different design and different numbers.

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Reply

We thank Dr Grossman and Dr Parmar for their positive comments. Their letter provides a valuable addendum to our original paper[1] and, as they assumed, we concur completely with what they have written.

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Bracken fern consumption and human bladder cancer

EDITOR,—In a recently published paper, Wilson *et al*[1] reviewed four studies that explored the relation between bracken and human health: a case-control study of gastric cancer in North Wales; a cohort study of oesophageal cancer in Japan; an ecological study in North Wales that compared standardised mortality and incidence rates for gastric and oesophageal cancer in 34 districts with survey maps of bracken areas; and an ecological study in Costa Rica that compared age specific incidence rates for gastric, oesophageal, and cervical cancer among people born in bracken free compared with bracken infested areas. Although some weak associations were noted in these studies, Wilson *et al* felt that statistical analyses were limited and that little evidence exists for a carcinogenic hazard from bracken.

We would like to call attention to the results of our case-control study that assessed the risk of bladder cancer from bracken fern consumption.[2] Bracken has been shown to be carcinogenic in experimental and observational animal studies, producing bladder tumours in guinea pigs and cattle.[3-5] Our study was conducted in northern New England to determine reasons for the high bladder cancer mortality rates in this area.

The study included all white residents of Vermont and New Hampshire who died during 1975–79 from bladder cancer. Two randomly selected controls per case, matched on state, gender, race, age (±2 years) and year of death, were randomly selected from all other resident deaths (excluding suicides). A questionnaire sought information on demographic characteristics, lifetime occupational and residential histories, history of tobacco and beverage use, medical history including bladder infection, and consumption of selected dietary items including bracken fern (fiddlehead greens). Interviews were conducted with the next of kin of 325 cases and 673 controls. Odds ratios (OR) were calculated using both conditional and unconditional logistic regression. As both methods yielded similar results, the unconditional results were presented. A total of 24 cases (7.4%) and 71 controls (10.6%) were reported to have ever eaten bracken fern (OR=0.6, 95% confidence intervals (CI)=0.4, 1.0). Regular consumption of bracken fern was reported for 15 cases (4.6%) and 38 controls (5.6%), OR=0.8 (CI=0.4, 1.4). Our negative findings are consistent with a Canadian population-based case-control study of 480 male and 152 female case-control pairs that showed no excess bladder cancer risk associated with consumption of fiddlehead greens.[6] These studies provide further support for the conclusions of Wilson *et al*[1] that bracken poses no serious health threat to exposed populations.

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Reply

We thank Brown *et al* for their helpful letter in response to our paper about the possible effects of bracken upon human health.[1]

Although we were aware of, and commented upon bracken consumption by people in Japan and South America, we were not aware that bracken, in the form of "fiddlehead greens" was eaten by some of the population of New England. Most studies of possible associations between cancers in humans and bracken have looked only at the risk of stomach and oesophageal cancers.[2-5] Therefore, the case-control study by Brown *et al* is particularly valuable and does indeed strengthen the evidence that consumption of bracken may not pose a serious threat to human health.

However, within the United Kingdom, the commonest human exposure to bracken is via possible inhalation and ingestion of spores, not through consumption of the plant as a foodstuff. We were unable to find any studies attempting to explore the relation between this exposure and human health effects. Such studies in populations who repeatedly work among bracken during the sporing season would be especially pertinent.

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