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Effect of screening on cervical cancer mortality in England and Wales: analysis of trends with an age period cohort model

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The number of women dying from cervical cancer in 1997 was 7% lower than in 1996 and has fallen by over 25% since 1992.¹ Such rapid change must be at least partly due to cervical screening, although strong cohort effects have caused large fluctuations in cervical

mortality in the past.² We modelled mortality data, taking into account the effects of age and year of birth and looking for trends in time within four age groups to estimate the beneficial effects of cervical screening.

Subjects, methods, and results

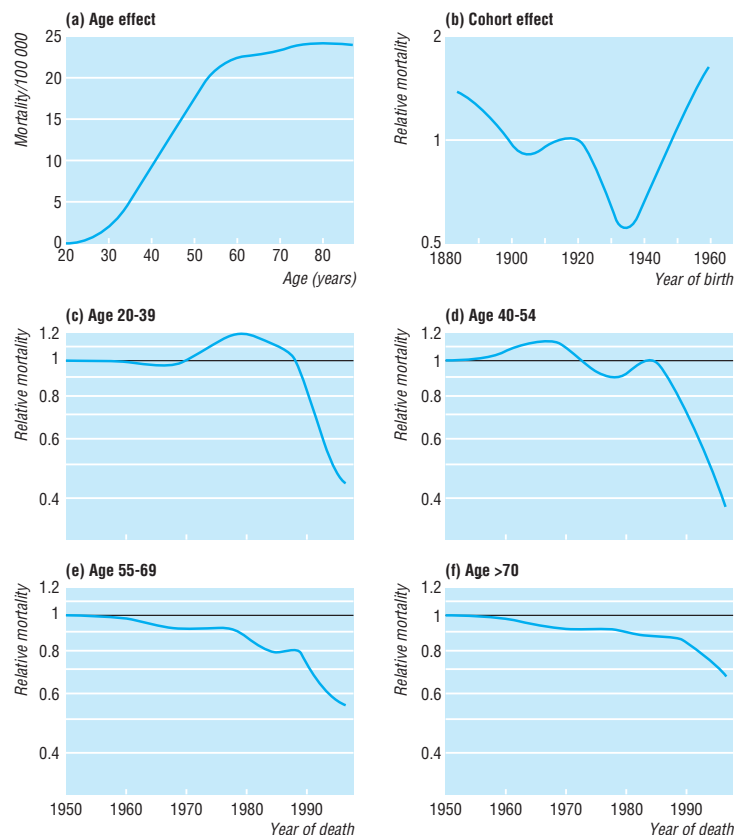
We obtained mortality data, in 5 year age bands, from death registrations in England and Wales and calculated rates using mid-year population estimates. Mortality since 1993 was adjusted upwards by 4% because of changes in classification of cause of death.³

We modelled the data assuming that the age specific mortality is the product of a smoothly varying age effect, birth cohort effect, and age dependent period effects. Confidence intervals are approximate. Details of the statistical modelling are available from the authors on request.

The top of the figure shows the estimated underlying mortality for cervical cancer as a function of age (a) and the multiplicative effect of year of birth on the age specific rate (b). Compared with women born in 1922, the risk for those born in 1957 is increased 1.5 times (95% confidence interval 1.2 to 1.9). The increased risk in women born since 1935 coincides with changing sexual behaviour associated with the "swinging '60s" and the widespread use of oral contraceptives in the early 1970s.

The bottom of the figure shows the trends in cervical cancer mortality after age and cohort effects were accounted for. No significant trends occurred in mortality before the mid-1980s, but mortality subsequently fell progressively (and significantly). The reduction in relative risk was greatest in the youngest age groups and least in those aged over 70 years.

If it is assumed that a model using only age and birth cohort effects would fit the data adequately if there had been no screening, then the estimated age and birth cohort effects can be used to predict what the



Effect of age (a) and year of birth (b) on mortality from cervical cancer and trends in mortality after age and cohort effects were adjusted for in four age groups (c-f)

death rate would have been without screening. The number of lives "saved" can be estimated from the effects of the age dependent trends on the predicted number of deaths in each age group. We estimate that there were about 1300 (1000 to 1600) fewer cervical cancer deaths in 1997 and 8250 (6900 to 9900) fewer between 1988 and 1997 as a result of screening.

Comment

Our analysis supports a beneficial effect of the national cervical screening programme (relaunched in 1988), which screens women aged 20-64. Before the relaunch screening had minimal effect on mortality. However, screening seems to have reduced cervical cancer mortality in 1997 by over 60% in those aged under 55. Although it is dangerous to attribute calendar effects to cervical screening, we know of no better explanation. This type of modelling does not permit estimation of the time lag between screening and improved mortality, but the natural course of cervical cancer and the history of cervical screening in England and Wales suggest that most of the effect on 1997 mortality is due to screening carried out between 1988 and 1995.

Our model does not constrain the calendar effects to be zero before 1980, so the small fluctuations observed between 1950 and 1987 both support the validity of the model and indicate the accuracy of our estimates. Confidence intervals may be misleading because they do not acknowledge the possibility of bias due to mismodelling.

The estimated number of lives saved by screening (1300 in 1997) is lower than some have suggested but is in keeping with our case-control based estimate of 2300 cancers prevented (95% confidence interval 1100 to 3900).⁴

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Competing interests: None declared.

Apology

Ideally this paper would have been published at the same time as the paper by Quinn et al showing that cervical screening in England seems to have reduced deaths from cervical cancer (3 April, pp 903-8). We apologise to Dr Sasieni and Mrs Adams that we didn't put the two papers together and that for various reasons we have been slow in publishing this paper.

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My elective

The silent sentinels

The air outside was warm and sultry, with no wind. Dark clouds covered the mountains, and mist lay over the forest and nearby hills. The scattered wooden houses seemed empty and derelict; the dusty roads were deserted. "Take a look around," he had said, "but be back by five."

The doctor visited the reservation once a fortnight. His patients were Gitksin Indians. Traditionally the Gitksin were hunters and skilled wood carvers, but those we had seen in the clinic were sad and smelt of whisky. The doctor said that when it all gets too much the Gitksin walk out on to the highway to join the Great Spirit.

I strolled to the settlement's northern edge, where the road to Alaska enters the forest and where a Gothic church displayed warnings about hell and the demon drink; past the railroad stop, where the diesel penetrates into the interior three times a week and where a naked light glared aimlessly in the early evening gloom; and on to the trading post, where Red Indian dolls from China cost 50 cents each. Then I saw the totem poles.

I had seen several pictures of those extraordinary creations, and had read about the guardian spirits that protect the Indian from harm. None of this produced the sense of wonder that the reality inspired. Carved out of giant cedar and over 60 feet tall, the totem poles stood erect against the darkening sky. Engraved on their northern aspects were haunting, mask like faces whose implacable expressions seemed vividly alive. Diverse in character, yet distinctive in form, the faces belonged to another world, far removed from mine. But most memorable were their staring eyes, which gazed across the valley to the horizon.

The man outside the medical hut seemed to be in pain. He was holding his lower abdomen and his face was drenched in sweat. His high cheekbones and swarthy complexion betrayed his Gitksin forebears, but he did not look a full blood.

"Is the clinic over, sir?" he asked.

"Finished an hour ago," the doctor replied. "If my friend hadn't been so engrossed in his sightseeing we'd be halfway home by now. What's the problem?"

The man told us that he had been in pain for three days. His family lived on the reservation but he worked at a logging camp 30 miles to the north and had set out on foot the previous day to reach the clinic.

We helped him inside, where the doctor told him that he needed surgery and that he should come with us to the hospital. The man quickly agreed and that night, 70 miles away, the surgeon removed a gangrenous appendix. When I saw him the next day he looked much better and, with a wry smile, thanked me for returning late from my sightseeing. I suggested it was not me he should thank, but his guardian spirit.

It is 20 years since my student elective. The totem poles are decaying fast. Continually at the mercy of mist and rain, their substance fragments and ultimately perishes. Soon they will be gone forever.

David Cummins, *clinical tutor, Harefield Hospital, Middlesex*

We welcome articles of up to 600 words on topics such as *A memorable patient, A paper that changed my practice, My most unfortunate mistake*, or any other piece conveying instruction, pathos, or humour. If possible the article should be supplied on a disk. Permission is needed from the patient or a relative if an identifiable patient is referred to. We also welcome contributions for "Endpieces," consisting of quotations of up to 80 words (but most are considerably shorter) from any source, ancient or modern, which have appealed to the reader.