Pet birds and lung cancer

EDITOR,—In response to John Britton and Sarah Lewis's editorial on the risk of lung cancer associated with exposure to birds and possible confounding by heavy smoking by those who kept birds,[1] we wish to point out that our study did assess the total number of cigarettes smoked by cases and controls up to five years before the diagnosis of lung cancer, and the number of smoking years.[2] We did not present these findings in our paper since there was no significant difference in the total exposure to cigarettes between smokers with pet birds and those without.

As there was some discrepancy between our findings (in 239 cases)[2] and those of Gardiner and colleagues (in 143 cases),[3] we wish to point out the differences in the studies. Our cases were incident, and a reasonable participation rate was achieved among the cases and controls. The British study seems to have been of prevalent lung cancers, with diagnoses five years before the study; thus there is the possibility that, owing to the high mortality from lung cancer, people with severe disease (who may have had more birds) were lost during this period. No information was provided on the participation rates among the cases, and duration of exposure was not analysed. From the non-significant point estimates of the odds ratios (which were close to 2·0 for people who kept birds 10 to 20 years before admission and 2·2 for employees of pet shops and keepers of caged birds) it seems that the British study lacks the power to provide a definitive answer to the hypothesis in question.

More importantly, the validity of hospital based controls reflecting the true underlying distribution of the exposure of the population is questionable. Exposure to birds among patients who develop clinically severe heart disease might well be greater than that in the population at large (they may have a passive lifestyle). If this is also a predictor of bird keeping, an overrepresentation of the underlying population exposure to birds is expected. Differences between the odds ratios for the orthopaedic controls and the heart disease controls confirm this expectation. In general, selection and power in this study need to be questioned.

The findings of the three independent studies on the subject[2-4] confirm the hypothesis that exposure to birds (or bird faecal products) increases the risk of lung cancer. Work should now concentrate on the aetiology—whether viral, fungal, or physical—and means of prevention.

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1 Britton J, Lewis S. Pet birds and lung cancer. *BMJ* 1992;**305**: 970-1. (24 October.)
2 Kohlmeier L, Arminger G, Bartolomeycik S, Bellach B, Relun J, Thamm M. Pet birds as an independent risk factor for lung cancer: case-control study. *BMJ* 1992;**305**:986-9. (24 October.)
3 Gardiner AJS, Forey BA, Lee PN. Avian exposure and bronchogenic carcinoma. *BMJ* 1992;**305**:989-92. (24 October.)
4 Holst PA, Kromhout D, Brand R. Pet birds as an independent risk factor for lung cancer. *BMJ* 1988;**297**:1319-21.

Advice to authors

Priority will be given to letters that are less than 400 words long and are typed with double spacing. All authors should sign the letter. Please enclose a stamped addressed envelope for acknowledgment.

EDITOR,—John Britton and Sarah Lewis suggest[1] that the increased risk of lung cancer associated with exposure to pet birds[2-4] might have arisen because of failure to adjust for confounding effects of smoking. This could not have been so in our study.[4] Our control groups showed no relation between keeping birds and any index of smoking habits (table). Keeping birds was also not correlated with social grade, contrary to Britton and Lewis's assumptions (table). Pigeon keepers were more commonly of social grade D, but they did not smoke more—indeed, they were more commonly never smokers than other controls.

Britton and Lewis suggest restricting attention to lifelong non-smokers. This would require another study. There were only five cases of lung cancer in lifelong non-smokers (of whom two had kept birds, though none pigeons) in our study,[4] only one in Holst's study,[3] and only 11 in Kohlmeier and colleagues'.[2]

Kohlmeier and colleagues question lack of power and the method of selecting controls in our study. Since our study looked at three times as many cases of lung cancer as did Holst's it had adequate power to meet our objective, which was to confirm or deny the strong association that he reported. The power was, however, inadequate to confirm or deny the weaker association reported by Kohlmeier and colleagues.

Choice of controls is a contentious issue. We did not use population controls because we thought that being ill and in a hospital environment may affect answers to questions and because of likely differential non-response rates—which are clearly evident in Kohlmeier and colleagues' study. Our hospital controls were easy to obtain and caused no problems with non-response: all subjects approached agreed to be interviewed. To guard against bias arising if a control disease was itself related to keeping birds we used two control groups. Frequency of keeping birds was similar in the heart disease and orthopaedic controls, which suggests that any bias is minor.

We agree with Kohlmeier and colleagues that the overall evidence is consistent with exposure to birds increasing the risk of lung cancer. Combining the relative risks of 6·7,[2] 2·14,[3] and 1·58[1] by meta-analysis gives an estimate of 2·21 (95% confidence interval 1·54 to 3·16). Though we agree that examination of the possible aetiology is important, we are more cautious in our interpretation and prefer to see results from other studies, both epidemiological and ecological, before considering that a hazard has certainly been shown.

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4 Gardiner AJS, Forey BA, Lee PN. Avian exposure and bronchogenic carcinoma. *BMJ* 1992;**305**:989-92. (24 October.)

EDITOR,—In the two recent case-control studies exploring the association between pet bird keeping and risk of lung cancer the proportion of people who had ever kept pet birds is comparable for cases (41% in L Kohlmeier and colleagues' study[1] and 50% in Austen J Gardiner and colleagues' study[2]) but drastically different for controls (24% and 51% respectively). These differences raise the question of whether one of the two control groups was inadequate.

A possible source of selection bias in Kohlmeier and colleagues' study is that people who kept birds were more reluctant to receive interviewers at their house than those who did not. This selection bias would affect only controls since cases were interviewed in hospital. Of the 635 controls contacted, 137 (22%) refused to participate. I have computed that if 51% of the non-participating controls kept birds the odds ratio for lung cancers would be

Relation of bird keeping to smoking and social grade among 286 control subjects. Values are numbers (percentages) *

Characteristic	All controls	Ever kept pet birds	Kept pet birds 5-14 years before admission	Ever kept pigeons
Smoking habit:				
Never smoked	63 (22)	36 (24)	14 (32)	7 (41)
Ex-smoker	108 (38)	53 (36)	14 (32)	4 (24)
Current smoker:				
Pipe only	6 (2)	4 (3)	2 (5)	
Cigar only	5 (2)	3 (2)	2 (5)	1 (6)
Hand rolled only	9 (3)	3 (2)		
Manufactured cigarettes only:				
1-19/day	35 (12)	16 (11)	3 (7)	1 (6)
20/day	25 (9)	11 (7)	2 (5)	2 (12)
>20/day	25 (9)	15 (10)	5 (11)	2 (12)
Other (mixed, quantity not known)	10 (3)	6 (4)	2 (5)	
Social grade:				
AB	11 (4)	5 (3)		1 (6)
C1	55 (19)	34 (23)	12 (27)	2 (12)
C2	106 (37)	52 (35)	17 (39)	4 (24)
D	110 (38)	56 (38)	15 (34)	10 (59)
Housewife	4 (1)			
Total	286 (100)	147 (100)	44 (100)	17 (100)

*Differences shown were not significant after adjustment for age.

1·6 (95% confidence interval 1·2 to 2·2). Did the authors collect information on whether non-participants had or had not been exposed to pet birds? On the other hand, the proportion of controls who had kept pet birds in Gardiner and colleagues' study is high, suggesting that this control group may have been overexposed compared with the population of origin of the cases.

Because of the small number of non-smokers among the cases in Kohlmeier and colleagues' study it is not certain that the absence of a significant interaction between bird keeping and smoking in the logistic regression model allows us to rule out a potential multiplicative interaction between these two factors with respect to lung cancer. Some insight into whether bird keeping is an independent risk factor for lung cancer could be obtained if the authors reported the numbers of cases and controls not exposed to either smoking or pet birds, exposed to pet birds but not to smoking, exposed to smoking but not to pet birds, and exposed to both smoking and pet birds.

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2 Gardiner AJS, Forey BA, Lee PN. Avian exposure and bronchogenic carcinoma. *BMJ* 1992;**305**:989-92. (24 October.)

EDITOR,—The first two sentences of John Britton and Sarah Lewis's editorial[1] illustrate a common misconception. They suggest that because cigarette smoking accounts for about 80% of deaths from lung cancer the contribution of other causes must be small. The fallacy arises because different causes of disease act in concert and not in competition. Avoidance of any one may be sufficient to prevent illness developing.

The fact that 80% of lung cancers could be eliminated by abolition of smoking does not preclude the possibility that 100% might be prevented by some other public health measure. In the same way, the fact that all cases of a disease are attributable to a genetic defect cannot be taken to imply that the environment makes no important contribution to its aetiology. Phenylketonuria is genetically determined, but it is also "completely" attributable to consumption of foods containing phenylalanine.

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EDITOR,—Two recent papers indicate that contact with pet birds may increase the risk of developing lung cancer.[1,2] In these papers (and in the pioneer study by Holst *et al*[3]) adjustment was made for smoking habits and other variables.[4]

None of the papers adjusted for atopic disease. Atopic allergy is common and is a confounding factor related to both the exposure and the condition under study. People with asthma, hay fever, and related allergies are less likely to keep pets, including pet birds, as they are well aware of the potential hazards. This applies also to all members of their families. People with asthma tend to refrain from smoking as this will aggravate their symptoms. In their households smoking is usually not permitted as passive smoking may also provoke asthmatic symptoms in susceptible people.

Thus lung cancer is not positively related to keeping pets. Rather, the absence of pets protects against lung cancer indirectly, smoking and a familial predisposition to atopy being the confounding variables. Further research on this issue should properly control for asthma and other atopic conditions. This applies to both patients with lung cancer and controls as well as their households.

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1 Gardiner AJS, Forey BA, Lee PN. Avian exposure and bronchogenic carcinoma. *BMJ* 1992;**305**:989-92. (24 October.)
2 Kohlmeier L, Arminger G, Bartolomeycik S, Bellach B, Rehm J, Thamm M. Pet birds as an independent risk factor for lung cancer: case-control study. *BMJ* 1992;**305**:986-9. (24 October.)
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4 Britton J, Lewis S. Pet birds and lung cancer. *BMJ* 1992;**305**: 970-1. (24 October.)

Misuse of anabolic drugs

EDITOR,—H M Perry and B N C Littlepage warn of the increasing use of anabolic steroids among non-competitive athletes.[1] Other authors have attempted to draw doctors' attention to this alarming trend,[2,3] and the government is at last funding research into patterns of use of anabolic steroids in Britain (Department of Health, personal communication).

Surveys of the prevalence of use of anabolic steroids such as those quoted by Perry and Littlepage have been scarce and have chiefly been carried out in the United States. There is growing evidence, however, that the problem is at least as widespread in Britain. I recently conducted a survey (unpublished) of 687 students attending a Scottish college of technology. The response rate was 92%. Eighteen students admitted to current or previous use of anabolic steroids (15/341 (4·4%) male students and 3/292 (1·0%) female students. Fourteen of these had first used these drugs at age 17 or less, and 10 at age 15 or less. Six combined oral and intramuscular routes of administration. Fifteen admitted to having obtained the drugs from an illegal source. The most common reason given for use of these potentially harmful drugs was enhancement of appearance, not athletic performance. Participation in a wide range of sports, many of which are not traditionally associated with use of anabolic steroids (such as football, hockey, and middle distance running), was reported, suggesting that patients who are not "well muscled" should not escape suspicion.

Surveys like this must be repeated on a larger scale and in a range of populations to establish the true extent of the problem. Anabolic steroids are readily available, effective, and relatively inexpensive.[2] If, as this survey suggests, people commonly start using them at school age and nearly one in 20 male college students uses them then they may represent a public health problem that ranks after only alcohol, tobacco, and cannabis use.

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1 Perry HM, Littlepage BNC. Misusing anabolic steroids. *BMJ* 1992;**305**:1241-2. (21 November.)
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EDITOR,—H M Perry and B N C Littlepage highlight many complications due to misuse of anabolic steroids but do not mention thrombosis.[1] We report on a 26 year bodybuilder who suffered pulmonary emboli while taking the anabolic agent methandienone.

The man initially presented with pleuritic chest pain and haemoptysis. A ventilation-perfusion scan showed a mismatched wedge shaped defect, and he was given anticoagulant drugs. At that time he had no apparent risk factors for thrombosis. He was discharged taking 10 mg of warfarin as an outpatient, but the dose proved difficult to titrate, being subject to large day to day variation. Three months later he was readmitted with further pleuritic chest pain. The ventilation-perfusion scan was unchanged, but he confessed to having taken a minimum of 25 mg of methandienone a week over the preceding six months to supplement his weightlifting. The drug's potentiation of warfarin was thought to have accounted for the difficulties in anticoagulation.

There are several case reports associating misuse of anabolic steroids with thrombosis.[2,3] The clinical circumstances of our case and the others reported suggest a causal relation. Potential mediators of the hypercoagulable state include enhanced platelet aggregation, alteration in coagulation or fibrinolytic proteins, and increased vascular reactivity.[4]

Acute thrombotic events in well muscled people should alert doctors to potential misuse of anabolic steroids as the risks are underappreciated.

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1 Perry HM, Littlepage BNC. Misusing anabolic drugs. *BMJ* 1992;**305**:1241-2. (21 November.)
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EDITOR,—I am surprised that H M Perry and B N C Littlepage do not mention testicular changes in men who use anabolic drugs.[1] High doses of androgens or anabolic steroids suppress the pituitary-testicular axis, commonly giving rise to clinically apparent testicular atrophy and azoospermia or oligospermia.[2] Serum gonadotrophin concentrations are usually undetectable or low normal. These changes are reversible if the man stops using anabolic steroids.

Perry and Littlepage could have enhanced their clinical message by stating that well muscled men with testicular atrophy should be assumed to be taking anabolic steroids until proved otherwise. The same applies to well muscled women with amenorrhoea.

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1 Perry HM, Littlepage BNC. Misusing anabolic drugs. *BMJ* 1992;**305**:1241-2. (21 November.)
2 Knuth UA, Maniera H, Nieschlag E. Anabolic steroids and semen parameters in bodybuilders. *Fertil Steril* 1989;**52**: 1041-7.

EDITOR,—Having recently admitted two patients in their early 20s with problems related to use of anabolic steroids we believe that H M Perry and B N C Littlepage's editorial should have highlighted the need to consider this diagnosis in patients of normal build as well as in well muscled patients.[1] Both our patients were male amateur weightlifters who used anabolic steroids to improve their muscle bulk. Both presented with atypical chest pain, and rhabdomyolysis secondary to excessive physical activity and use of anabolic steroids was subsequently diagnosed.[2] The first patient was of an extremely muscular build and the diagnosis was obvious from an early stage, but the second man was of normal build and had only just started using these substances.