CORRESPONDENCE

Mortality of Dutch coal miners in relation to pneumoconiosis, chronic obstructive pulmonary disease, and lung function

EDITOR.—Meijers *et al* presented a very interesting study on mortality of Dutch coal miners.¹ Most of the coal miners, 3367 out of 3790 (89%), had radiological manifestations of coal workers' pneumoconiosis (CWP). All the coal miners had an increased mortality due to ischaemic heart disease (IHD) in all four periods of follow up when compared with the total male population in the Netherlands. The increase varied between 10% and 25%. It was unlikely that smoking habits were responsible for this increase as the SMR for lung cancer was 1.02.

Fibrinogen is an established risk factor for IHD^{2,3} and it has been found that coal miners with pneumoconiosis have higher plasma concentrations of fibrinogen than coal miners without pneumoconiosis.⁴ Thus it seems that these findings on coalminers with pneumoconiosis could also be included in the hypothesis linking exposure to dust with increased concentrations of plasma fibrinogen and IHD.

The hypothesis of exposure through inhaled particles and the occurrence of IHD can be expressed in the following way. Long term inhalation of particles retained in the lungs will create a low grade inflammation associated with an increase in plasma fibrinogen. The high concentrations of fibrinogen will increase the likelihood of blood clotting and thereby the risk for myocardial infarction and IHD.^{5,6}

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Bronchial reactions to exposure to welding fumes

EDITOR.—We read with great interest the recent article by Contreras *et al*¹ describing non-specific bronchial hyperresponsiveness and differential pulmonary responses to welding fumes of differing constituents in a small group of current welders with respiratory symptoms suggestive of asthma. The authors concluded that in this group of symptomatic people, the reactions found were likely to represent irritant responses as

there were no late asthmatic reactions, and no evidence of sensitisation.

This raises the issue of how we generalise the findings of this study to workplaces and workers with substantial exposure to welding fume.

Although Contreras *et al* noted these interesting findings in a group of symptomatic workers, no mention was made of whether asthma or wheeze had been diagnosed and whether the respiratory symptoms of cough, chest tightness, and dyspnoea were only work related, or whether these symptoms predated employment as a welder. Similarly, no asymptomatic welders were included for comparison and one person had certainly had a notable, presumably irritant, exposure in the past that would be highly likely to influence bronchial responsiveness and response to welding fume.

This interesting study now poses two further questions; what is the longer term importance of this acute response (if any), and what is the importance of acute pulmonary responses in welders with no respiratory symptoms?

We have recently studied, in the workplace, a large group of welders in New Zealand, and a similar group of non-exposed workers, welding mild steel predominantly with MIG and TIG techniques.² We noted that all welders as a group sustained a mean fall in FEV₁ of about 4% at 15 minutes after welding started, although within the welding group, certain individual welders sustained much larger falls (>15% in some cases). Interestingly, not all these were accompanied by current or work related respiratory symptoms. Also, we were able to show that the falls in FEV₁ were negated by the proper use of local extraction ventilation. Although we agree that the fall in FEV₁ found may represent a simple irritant response, we think that the presence of this FEV₁ response may predict longer term sequelae, and in particular may lead to the development of an asthma like state, bronchial hyperresponsiveness, and accelerated loss of lung volume. This is now the thrust of a follow up study on our original group of welders.

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- 1 Contreras GR, Chan-Yeung M. Bronchial reactions to exposure to welding fumes. *Occup Environ Med* 1997;54:836-9.
- 2 Fishwick D, Bradshaw LM, Slater T, *et al*. Respiratory symptoms, across shift lung function changes and lifetime exposures in New Zealand welders. *Scand J Work Environ Health* 1997;23:351-8.

Authors' reply—Fishwick *et al* brought up important points in their letter. Because of limited space, we were unable to put in as much clinical information as we would like. The welders studied did not have any symptoms before they started their trade as a welder. All of them were sent to us for evaluation of work relatedness of their symptoms. Unfortunately, we were unable to study a group of asymptomatic welders as controls.

The more important point brought up by Fishwick *et al* concerns the importance of this acute irritant response and whether it predicts longer term sequelae. It has been documented among workers in grain, cotton, and swine confinement industries that acute decline in lung function during a shift is an independent predictor of longitudinal decline in lung function. This subject has been reviewed in depth by Becklake.¹ Although the observations were limited to organic dust, it is likely that exposure to fumes may lead to similar changes. Fishwick *et al* are wise to follow up their welders with acute airway response to welding.

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Heavy physical work and occurrence of sciatic pain: need for Poisson log linear models or for better data?

EDITOR.—In a recent issue of *Occupational and Environmental Medicine*, Nurminen presented a re-examination of data from a sample of 419 workers previously analysed by Riihimäki.^{1,2} The objective given by Nurminen was to clarify the role that heavy physical work had in the production of back pain. The data on occurrence of sciatic pain according to age, earlier back accident, and occupation (concrete reinforcement workers versus maintenance house painters) presented in a 48 cell multiway contingency table were reanalysed with a Poisson log linear model. The conclusion was that earlier back accident, aging, and also heavy physical work (more precisely, belonging to the group of concrete reinforcement workers) were related to sciatic pain, whereas the first analysis had failed to show the role of heavy physical work.

The paper is interesting in that it reminds us of important methodological aspects on confounding, interaction, and the comparison between models. It also presents the Poisson log linear model. The reader may regret the lack of details in the presentation of this model, as it is less widely known than logistic or additive models. The model remains obscure, except for specialists who, presumably, are already familiar with it.

The reader may also regret the lack of discussion on several methodological points: is this model really more parsimonious than the logistic model, as it contains 24 parameters, which seems much for describing a 48 cell contingency table? The p value for occupation and sciatica is 0.048. Does it remain <0.05 if the terms in the model are slightly changed, or if age is treated differently? How far is it possible to draw statistical inference about associations between heavy work and sciatica, beyond this particular data set?

However, the most questionable point about this interesting statistical and methodological exercise deals with its relevance for a better understanding of the occupational determinants of sciatica. The analysis presented by Riihimäki was done more than 10 years ago. In 1985 it would have been difficult, maybe impossible, to use a Poisson log linear model, as the methodological references given by Nurminen had not yet been published. Clearly, the tools for analysis have improved in the

past decade. This is a progress which made possible the reanalysis of data if, as in this particular example, the array of data was given in the original paper. But it must be remembered that the epidemiology of occupational back disorders has also made progress in 10 years. This aspect is almost absent from the paper, whereas recent articles insist, among other aspects, on the importance of assessing exposure rather than use of job titles.³

In conclusion, the emphasis given to the need for sound methodology should be complemented by two other important aspects: firstly, for prevention of back disorders at the workplace the first necessity is good data and studies tackling adequately assessment of exposure, recall bias, misclassification, and selection effect, preferably with a prospective design. Secondly, negative results are difficult to interpret, in general, and especially in less recent studies, as they may be negative for many different reasons. Whether or not occupation is a significant factor in the data reanalysed by Nurminen is probably not a crucial point, as heavy physical work is, anyway, widely recognised as a risk factor for low back disorders.^{4,5}

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- 1 Nurminen M. Reanalysis of the occurrence of back pain among construction workers: modelling for the interdependent effects of heavy physical work, earlier back accidents, and aging. *Occup Environ Med* 1997;54:807-11.
- 2 Riihimäki H. Back pain and heavy physical work: a comparative study of concrete reinforcement workers and maintenance house painters. *Br J Ind Med* 1985;42:226-32.
- 3 Burdorf A, Rossignol M, Fathallah FA, et al. Challenges in assessing risk factors in epidemiologic studies on back disorders. *Am J Ind Med* 1997;32:142-52.
- 4 Scientific Committee for Musculoskeletal disorders of the International Commission on Occupational Health Musculoskeletal disorders. Work-related risk factors and prevention. *Int J Occup Environ Health* 1996;23:239-46.
- 5 Riihimäki H. Low-back pain, its origin and risk indicators. *Scand J Work Environ Health* 1991;17:81-90.

Author's reply—In a commentary of my reanalysis¹ of data from a study conducted by Riihimäki² on the effects of heavy physical work and the occurrence of sciatic pain, Leclerc and Gueguen bring to the fore some important methodological aspects. I take on the editor's kind request to respond to these issues.

I fully agree with Leclerc and Gueguen's stance to search for high quality epidemiological data that are needed to study proficiently low back problems at work. This is a general desideratum which I discussed briefly in my paper. In particular, I referred to a recent study³ that, owing to its prospective design, could avoid many of the methodological pitfalls that often plague retrospective studies. Considerations of biases in study design, exposure assessment, etc, that threaten validity should override concerns about statistical shortcomings. If the study design is biased, there may be only limited, or no, statistical methods available to correct or to reduce bias in the data analysis phase. Conversely, a study base can be unbiased, but a published paper of the study may report an erroneous conclusion because of a deficient

statistical analysis. In this situation, a reanalysis of the data is called for, not only because the data may be included in overviews, but because researchers always report under-correction. Leclerc and Gueguen are correct in pointing out the importance of a quantitative estimate of exposure instead of a job title. However, I judged the frequency data of Riihimäki² to be worthy of reanalysis, because the contrast in physical loading of the two occupational categories was so extreme.

It would be a regrettable state of affairs, indeed, if epidemiologists had not been aware of the availability of the Poisson regression in the past. However, according to my knowledge this is not the case. The log linear modelling technique is a general method to handle qualitative data that have many categorical variables. The method is particularly suited for determining interactions between variables by fitting models that are linear in the logarithmic scale. The major use of Poisson log linear models is to fit them to multiway frequency data—such as those in table 4 of Riihimäki.² Poisson regression is also a basic model that is often applied for incidence type data. In epidemiology, logistic models were introduced in the 1960s, whereas log linear models were first used in the social sciences before they became generally available in the 1970s, when epidemiologists started to use them. A review⁴ of developments in statistical modelling in epidemiology in the 1980s included several applications of the Poisson regression. A survey⁵ of methods and statistical models located 200 occupational cohort studies published in 1990-1. Multivariable modelling was performed in 20% of the studies, with use divided about equally between logistic, Poisson, and proportional hazards regression. I myself first used log linear models in occupational epidemiology more than 15 years ago.⁶ Clearly, contrary to the opinion of Leclerc and Gueguen, Poisson models do not remain "obscure" for the practitioners of epidemiology.

Leclerc and Gueguen misinform by asserting that "In 1985 it would have been difficult, maybe impossible, to use a Poisson log linear model, as the methodological references given by Nurminen had not yet been published." The methodological references that I gave in my paper were chosen to be either quite recent or widely available publications. But, for example, the book by Haberman⁷ (reference 15, Nurminen¹) that presents the Poisson log linear model was published in 1978. The program GLIM, used by Riihimäki² in her analysis, is fully implemented for fitting a Poisson log linear model. Actually, I first analysed the data with GLIM. I later carried out the analysis with the S-PLUS system because of its better capabilities for graphical display.

Leclerc and Gueguen are concerned about the parsimony of the log linear model that consumed 24 parameters to put a structure on grouped data with 48 frequencies; this left 48-24=24 degrees of freedom (df). The logistic model accepted by Riihimäki² contained only seven parameters to structure the 24 proportions; there remained 24-7=17 df. However, my reanalysis indicated that Riihimäki's logistic model lacked the necessary terms to determine the interactions present in the data. Thus, the number of parameters in these models are not comparable. The parsimony of the log linear model that I referred to dealt with the formulation of age as a second order polynomial variable instead of a categorical variable. As age was involved in

multiple interaction terms, the use of age as a categorical variable would have included too many parameters in the model. Thus, it could be argued that the more complex log linear model was more parsimonious than the simpler logistic model because the former had more df—that is, a greater number of free parameters.

Leclerc and Gueguen were also concerned whether the significant p value (0.048) for the interaction term between occupation and sciatica would stay below the arbitrary 0.05 level with slight changes in the model specification. The answer is: no, it probably would not be that robust; nor do I see this to be a critical question. I have expressed elsewhere,⁸ and this is a widely accepted stance of modern epidemiologists, that significance testing should not be performed in the spirit of decision making according to a predetermined criterion (p<0.05). Better here that quantitative estimates of the effects of risk factors on the occurrence of sciatica should also be provided.

To what extent can the conclusions drawn from the reanalysis be generalised? Leclerc and Gueguen inquire specifically about the possibility of drawing statistical inferences about the associations between heavy work and sciatica beyond this particular data set. The results from a statistical analysis are, of course, bound to the particular timing and setting of the study. Hence it cannot be inferred statistically that the findings are generalisable to a new population or some population at large. Causal inference is not statistical by nature; rather it strives to determine scientific explanations that would explain the results of the statistical analysis in a logically coherent way. Generalisability is enhanced by empirically showing absence of effect modification with important intrinsic features of the people under study.

Leclerc and Gueguen regard my reanalysis merely as a "statistical and methodological exercise", as they question its relevance for the better understanding of the occupational determinants of sciatica. Yet, the main conclusion of the reanalysis regarding the role of heavy physical work was opposite to that of the original analysis. Further, Leclerc and Gueguen maintain that the finding that heavy physical work in jobs in concrete reinforcement is a significant risk factor of sciatica in these data is not "crucial", as this relation is today widely recognised to hold for heavy physical work and low back disorders in general. Nevertheless, in view of future meta-analyses, it is important that the information contained in all available data sets bearing on the scientific issue are efficiently extracted and irreproachably interpreted. The generic theme of the November 1997 issue in which my article appeared was aging. As emphasised by Consionni *et al*⁹ in the same issue, confounding by age is often mixed up with effect modification by age. I pointed out that this basic methodological distinction was not realised in the original analysis;² this oversight prevented the finding that age modified the effect of work differently in the two vocations.

Finally, I am of the same opinion as Leclerc and Gueguen that, by and large, negative studies are difficult to interpret. But, Riihimäki's study² cannot be classified as negative, because the study hypothesis—heavy physical work is related to sciatic pain—was actually supported by the data. Riihimäki simply failed to show the relation statistically. This was the main point that I tried to bring out in my paper.

In conclusion, it remains enigmatic to me why Leclerc and Gueguen, in the title of their commentary, juxtapose the use of Poisson modelling with the quality of epidemiological data.

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- 1 Nurminen M. Reanalysis of the occurrence of back pain among construction workers: modelling for the interdependent effects of heavy physical work, earlier back accidents, and aging. *Occup Environ Med* 1997;54:807-11.
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NOTICES

Health and the Environment: a new specialist option in the MSc in Environmental Technology. Imperial College of Science, Technology and Medicine, London.

The MSc in Environmental Technology provides training in environmental economics, law, policy, science, health, and technology. It is divided into three parts and various options. The CORE COURSE held in the autumn term provides a broad interdisciplinary understanding of the environment involving law, economics, health, and policy with the underlying science. In the second term, students select one SPECIALIST OPTION for in depth study. The third term of the MSc is spent on a practical RESEARCH PROJECT and is designed to incorporate career development skills. Many projects are done in collaboration with external organisations.

Recent increases in respiratory problems including asthma; air quality; environmental problems in cities; the health impacts of traffic pollution, pesticides, radon, and contaminated land and water; workplace hazards; local issues such as leukaemia clusters around nuclear power plants; and other health issues related to environmental and occupational pollution are explored in a comprehensive way in the *health and the environment* option of the MSc course.

This specialist option brings together the well established training in environmental science, technology, and management in the Centre for Environmental Technology with the expertise of the Imperial College School

of Medicine, including St Mary's and the National Heart and Lung Institute. The programme of lecture based modules and case studies is designed to provide graduates with appropriate interdisciplinary training in scientific, medical, and policy issues to meet the needs of (local) government, industry, and commerce within the United Kingdom, European Union, and the developing world. Hence, the course is ideal for candidates who wish to learn and develop skills with regard to the relation between environmental pollution and impacts on human health, or practitioners who wish to be abreast of the latest developments in this field.

The modules in the Health and Environmental option are (a) pollution and environmental assessment, (b) epidemiological principles and methods, (c) statistics and data handling, (d) toxicology and health risk assessment, (e) environment and health policy. The case studies are designed to evaluate the toxicological and epidemiological evidence of environmental hazards and the consequences for environment and health policy making.

The teaching quality on the MSc programme has recently been rated the best of its kind by the Higher Education Funding Council of England and Wales. The 1000 plus graduates since 1977 have been highly successful in gaining environment related employment. Bursaries of £1000 are available to some suitably qualified home students. The course is generously supported by the European Social Fund, the ESRC, NERC and a favourable loan facility.

For further details contact: The Assistant Registrar (Admissions), Imperial College of Science, Technology and Medicine, London SW7 2AZ. Telephone 0044 171 594 8046; fax 0044 171 594 8004 email s.mathews@ic.ac.uk or <http://www.et.ic.ac.uk/>

IOSH '98: the working environment. 2-4 November 1998. Harrogate, Yorkshire, UK.

The Institution of Occupational Safety and Health's Annual Conference and Exhibition has the environment as this year's theme, embracing not only "green" issues, but also its relevance to the workplace as a whole.

Topics to be covered include risk perception, planning for disaster management, integrating safety, health, and the environment (SHE), occupational environmental health, waste management in the 21st century, and "corporate killing" and directors' liability. Modern working practices—from teleworking to hot desking—will also come under scrutiny.

The associated exhibition will showcase the products and services of over 100 organisations. Exhibition visitors have free entry to the Douglas Short and the Thomas Legge memorial lectures.

For further details contact: Deborah Fisher. Telephone 0044 116 258 3100; fax 0044 116 257 3101; email: cpdevnts@iosh.co.uk or www.iosh.co.uk

St John's Institute of Dermatology, Study Day in Occupational Dermatoses. Thursday 26 November 1998. London, UK.

This study day will cover aspects of dermatology in relation to work and occupational disease, with emphasis on recent advances. This should be of relevance to occupational physicians and nurses, dermatologists, and general practitioners with an interest in occupational

disease or dermatology. The fee is £150 per person, including lunch and refreshments. The closing date for enrolment and refunds is Monday 19 October 1998.

For further information please contact: Doris Holloway RGN, Course Organiser, St John's Institute of Dermatology, Contact Dermatitis Clinic, St Thomas' Hospital, Lambeth Palace Road, London SE1 7EH, UK. Telephone 00 44 171 928 9292 ext 1368; fax 00 44 171 620 0890.

International Film Festival on Occupational Safety and Health in Sao Paulo. 12-16 April 1999. Sao Paulo, Brazil.

The 4th International film and video festival on occupational safety and health will take place on the occasion of the 15th World Congress on Occupational Safety and Health. It is organised by the international section of the ISSA on prevention of occupational risks due to electricity, gas, long distance heating, and water, in conjunction with FUNDACENTRO, the Brazilian Organization for Industrial Safety and Medicine.

The festival will provide a review of the great variety of productions available in this field at the international level. All productions (VHS/PAL system) produced as from 1996 are eligible for admission. Prizes will be awarded for the best films and videos.

For further information please contact: ISSA Electricity Section, c/o Berufsgenossenschaft der Feinmechanik und Elektrotechnik, Gustav-Heinemann-Ufer 130, D-50968 Köln, Germany. Telephone 0049 221 3778 0; fax 0049 221 3778 134; e-mail: hv@bgfue.de or <http://www.bgfue.de>

International Symposium on the Training of Occupational Health and Safety Experts. 30 June to 2 July 1999. Mainz, Germany.

Call for papers

Industrial hygiene and ergonomics shed new light on occupational health and safety problems. Environmental problems interrelate with occupational health. Regulations are constantly evolving.

The role and tasks of occupational health and safety experts are therefore undergoing change. What consequences does this have for training objectives, training programmes, and teaching strategies?

An international symposium is being organised on these subjects by the International Social Security Association. It will be an opportunity for exchanges of experience and thoughts between all those concerned with the training of occupational health and safety experts (safety engineers and technicians, coordinators in the construction industry, occupational physicians, industrial hygienists, ergonomists, work psychologists).

All institutions involved in the training of these experts (accident insurance organisations, occupational risk prevention organisations, research centres, associations of experts, universities, schools, training centres, government authorities, etc) are invited to submit papers.

For further information contact: Institut National de Recherche et de Sécurité, Comité AISS Education et Formation, 30 rue Olivier Noyer, F-75680 Paris Cedex 14, France. Telephone 0033 1 40 44 31 19; fax 0033 1 40 44 30 99; email <http://www.inrs.fr>