who did not smoke compared with 26% of the non-smokers.

It was found that the smokers started smoking earlier than the experimental smokers. Seventeen per cent of smokers had puffed their first cigarette before the age of 7 compared with 6% of the experimental smokers. When asked why they thought children of their own age did not smoke, all groups gave 'parents advised against it' and 'because of health reasons' as the first two reasons. The non-smokers gave 'that it was a dirty habit' as their third reason and this differed from the other two groups. The smokers viewed smoking much more positively than the non-smokers and most of them felt that smoking was enjoyable, gave more adult status, and that it was pleasant to smoke with one's friends.

The Home Care of the Highly Dependent Patient. P. PASKER, J. S. A. ASHLEY and J. CRESSWELL (*Dept. of Public Health, London School of Hygiene and Tropical Medicine*).

The objectives of the studies discussed in the paper were: (1) to develop nursing dependency as an indicator of use which can be employed both in institutions and in the community to measure the matching of skills to needs; (2) to examine the social and economic circumstances of patients with high levels of nursing dependency who are receiving their nursing care in a non-institutional setting, i.e., at home. The nursing dependency measure had already been validated in hospitals by Barr; it had not, however, been used in a community setting and so had to be adapted accordingly. Validation studies carried out showed that the modified version still remained valid in an institutional setting. A feasibility study was, therefore, carried out in a clearly defined area using this measure as a cross sector indicator of nursing use; there were 320 recipients of local authority health and welfare services and hospital in-patient care. This showed that 44% of high care patients were being nursed at home. As the amount of statutory nursing services which this group received was much less than that given to comparable institutionalized cases, the magnitude of the role played by relatives in support of this group was underlined. A further pilot study was carried out, designed more specifically to test a questionnaire relating to the social and economic circumstances of this high-care group in the community. This study examined in depth 45 high-care cases located on the case loads of home nurses and a geriatric health visitor.

Mortality among Workers at Two Copper Works where Cadmium was in Use. JOAN M. DAVIES (*Royal Marsden Hospital and Institute of Cancer Research, Fulham Road, London*).

In 1955 and 1959 Bonnell *et al.*^{1,2} reported that numerous workers exposed to cadmium oxide fume in the production of copper-cadmium alloys were found to have proteinuria and/or disabling emphysema. Only two deaths from the renal form of chronic cadmium poisoning appear to be on record in this country, and the respiratory form is considered to be of greater import.

In 1967 Kipling and Waterhouse³ reported an excess of cases of carcinoma of the prostate (0.58 expected, 4 observed) among cadmium workers in another industry; no further reports on this possible association appear to have been published.

During a survey conducted for other reasons death certificates were scanned for all residents of a rural district where two copper works were situated, including one of the factories studied by Bonnell. The opportunity was taken to abstract details of all the 700 deaths from 1948–70 of men described on their certificates as copper workers; deaths during 1941–7 will be added later. Only a minority was likely to have been exposed to cadmium; these could to some extent be distinguished by the occupation descriptions 'caster' or 'furnaceman'.

The series of 700 deaths was analysed by a proportional mortality technique; the proportional distribution of causes of death was generally similar to the national distribution. Seven deaths were ascribed to chronic cadmium poisoning and four other certificates mentioned the condition as a contributory cause. Bronchitis and/or emphysema were mentioned most frequently on the certificates of men described as casters or furnacemen. There appeared to be no excess of deaths from neoplastic diseases, from carcinoma of the lung, or from carcinoma of the prostate (9.8 expected, 10 observed). The expected number of deaths from nephritis and nephrosis was 5.3 and 15 were observed, the excess being concentrated during 1948–56; four more such deaths have so far been noted during 1941–47. Three of these 19 men were described as furnacemen, and these findings suggest the possibility that unrecognized deaths from the renal form of chronic cadmium poisoning may have occurred among this group of workers.

- (1) Bonnell, J. A. (1955). Emphysema and proteinuria in men casting copper-cadmium alloys. *Brit. J. industr. Med.*, 12, 181.
- (2) Bonnell, J. A., Kazantzis, G. and King, E. (1959). A follow-up study of men exposed to cadmium oxide fume. *Brit. J. industr. Med.*, 16, 135.
- (3) Kipling, M. D., and Waterhouse, J. A. H. (1967). Cadmium and prostatic carcinoma. *Lancet*, 1, 730.

SIXTH SESSION (*Chairman: G. BOURKE*)

Malignancy in Crohn's Disease. Mrs. P. PRIOR (*Dept. of Social Medicine, University of Birmingham*).

A series of 295 patients, treated at the General Hospital, Birmingham, for Crohn's disease, has been followed up by one consultant for over 30 years. Periods of observation ranged from 34 years in one case to at least one year for those patients with a recent diagnosis, giving in total more than 4,000 patient-years of observation.

The pattern of malignancy was examined in this series, evidence for which was obtained from the patients' clinical records as well as the index of the Birmingham Cancer Registry.

Expected rates for malignant tumours were computed from cancer registrations and census population figures for the Birmingham region. Expectations, for grouped and individual sites, were obtained and compared with the observed number of tumours at these sites.

The results of the analysis showed that a significant excess of tumours developed within the alimentary tract and that the excess was confined to the small intestine and pancreas (including ampulla of Vater). At each of these sites the observed number of tumours was very significantly in excess of expectation and, also, they developed at a relatively early age compared with other sites within the digestive system. In contrast, the number of large bowel tumours was close to expectation.

Mortality in Rheumatoid Arthritis. R. T. BENN and P. H. N. WOOD (*Arthritis and Rheumatism Council Field Unit, Manchester*).

One-hundred and eighty-nine patients were admitted consecutively to the Royal Bath Hospital, Harrogate, seen by the same clinician, diagnosed as having rheumatoid arthritis (RA) according to standard criteria, and followed for about 20 years. All of the males and 91% of the females have been successfully traced. It was found that in both sexes and at all ages these patients show a higher mortality than the general population of England and Wales. Moreover, the mortality was correlated with the initial grade of functional impairment.

Death certificates have been obtained for the 116 patients who have so far died. Of these 12% give RA as the underlying cause and a further 38% mention it as a contributory cause, leaving 50% of the certificates with no mention of RA. These proportions were practically the same in both sexes. The ratio of about 1 to 3 of 'underlying' to 'contributory' mentions was also found in multiple cause tabulations supplied by the Registrar General. These figures give some indication of the extent to which mortality figures underrepresent the prevalence of the disease.

A number of investigators have suggested possible associations of other diseases with RA, and striking confirmation has been found for the suggested association with pulmonary tuberculosis, since no less than 6 of the 36 male deaths were attributed to this cause. This excess can only partly be explained by some of the men having increased occupational risk as coal miners. On the other hand, there were no marked deficits in cancer or stroke, both of which have been suggested to have negative associations with RA.

A Cardiovascular Survey in Six Hard and Six Soft Water Towns. F. STITT (*London School of Hygiene and Tropical Medicine*).

SEVENTH SESSION (*Chairman: G. KNOX*)

A Method for the Assessment of Hearing Impairment. J. PEARSON (*Dept. of Social and Occupational Medicine, University of Dundee*).

The most convenient test of hearing is the pure-tone audiogram, giving the threshold of hearing at 6 or 8 frequencies for each ear. This paper describes an attempt to derive a function, consisting of linear combination of these thresholds, which measures the degree of impairment of the hearing loss.

The data used consisted of (a) pure-tone audiogram, (b) questionnaires relating to difficulties with hearing, and

(c) speech audiograms, an objective measure of the ability to understand speech. This information was available for 96 long-service weavers, 96 controls, and 108 other subjects, who included many with otological abnormalities.

The main technique used in deriving the function was discriminant analysis. Some problems were encountered in defining the basic groups of 'deaf' and 'not deaf' persons on which the discriminant analysis was carried out, since absolute measures of deafness were not available. Two different definitions, one based on the questionnaire and a second based on the speech audiogram, were used.

In the two discriminant functions, the major contribution came from the same frequencies, and they had similar coefficients. The coefficients were averaged to give the final function which involved only three frequencies and had simple coefficients. This procedure improved the overall discrimination. The function consisted of: (threshold at 2kHz) $- \frac{1}{2}$ (threshold at 4kHz) $+ \frac{1}{2}$ (threshold at 6kHz).

The derivation of the function was confined to the population of weavers, an occupational group exhibiting noise-induced hearing loss. The wider application of the function was shown by the satisfactory discrimination achieved in the other two groups of the study.

Grades of impairment were suggested in terms of the value of the discriminating function. The difficulties experienced by the subjects, and the proportion of the population affected at the various levels of the function, were used as the basis of this grading. Impairment was considered to start when the value of the function exceeded 35dB.

Alternative Methods for the Analysis of Complex Epidemiological Data. G. J. DRAPER (*Department of Social Medicine, Oxford University*).

Many epidemiological studies are analysed using methods of standardization or the concept of relative risk. These techniques are related to each other and to methods recently developed for the analysis of contingency tables. The latter can be readily applied to many types of epidemiological data and, by devising suitable computational methods (which are not unduly complicated), the usual types of analysis may be greatly extended.

Thus, in examining the effects of possible aetiological factors on mortality or the development of disease, it is possible not only to investigate associations between the factors and the disease but also to measure the magnitude of the effects of the factors and the way in which they interact with each other or are inter-related. The existence, within the population studied, of groups with unexpectedly high or low risks may also be investigated. (The methods considered are based on the log-linear model and measures of association in contingency tables rather than on multiple regression analysis.)

The use of relative risks and also, to some extent, the method of indirect standardization, implies that the factor or factors under consideration influence the risk of disease in an approximately multiplicative way. However, in certain cases it is more reasonable to suppose that risks