Table 2 Odds ratios of 16 cases (more daughters than sons within a family) compared with 27 controls (43 sons) for exposure variables

Variable	Odds ratio (95% CI)
Spraying days 1990 (30 days)	18.4 (1.72-196)
Cross current sprayer (10 days/y)	1.7 (1.05-2.59)
Herbicide sprayer (5 days/y)	3.6 (1.10-11.6)
(Manual) knapsack sprayer (5 days/y)	2.2 (1.06-4.66)
Metiram (1 spraying/y)	1.3 (1.05-1.61)
Azinphos-methyl (0/1)	4.4 (1.11-17.3)
Paraquat (0/1)	>5.6* (>5.6-<13.4)

*Paraquat was used by all families with more daughters compared with 74% in the control group.

ratio for gravidity (OR 1.35, 95% CI 0.92-1.99) was not significant and adjustment did not influence the regression coefficient or standard errors of variables of interest, only crude ORs are given.

No relation was found for most of the variables studied in our time to pregnancy study, but the results suggest a relation between use of a cross current airblast sprayer (days/y) (OR = 1.3, 95% CI 0.96-1.72) and use of a herbicide sprayer (days/y) (OR = 2.0, 95% CI 1.08-3.76) and production of daughters. Also we compared families with more daughters than sons with the other families. Instead of gravidity we corrected for the number of children within a family (OR = 1.23, 95% CI 0.66-2.31). As some families also conceived children before the time of the study (1978-90) number of children is a surrogate measure for gravidity. Because differences with or without adjustment were small, table 2 gives only crude ORs. For the 43 families a relation was found between the number of days with use of a herbicide sprayer (days/y), a cross current airblast sprayer (days/y), and a knapsack sprayer (days/y) and the number of daughters within a family. When comparing families with more daughters than sons (16 families), the number of spraying days a year was 37 compared with 25 for the other families, 7.6 v 3.3 days/y for the herbicide sprayer, 16 v 5.4 days/y for the cross current airblast sprayer, and 7.1 v 3.0 days/y for the knapsack sprayer. In families with more daughters use of the specific pesticides Azinphos-methyl (insecticide), Metiram (fungicide), and Paraquat (herbicide) was higher. Table 2 shows the results of the ORs.

For families with more sons than daughters (17) a significant OR was found for use of a cross current sprayer (yes or no, OR = 0.16, 95% CI 0.03-0.82), and number of spraying days with this type of sprayer (OR = 0.54 per 10 spraying days/y, 95% CI 0.30-0.98).

Discussion

Overall sex ratio was not different from the expected ratio of 0.51. James hypothesised that high concentrations of testosterone at the time of conception produce boys, and high concentrations of gonadotrophin produce girls. Among the offspring of DBCP applicators³ a highly significant excess of daughters was found. As exposure to pesticides in fruit growing typically includes mixed exposure to many different compounds, similar to that found for DBCP, it is not possible to predict the direction of a

shift in sex ratio induced by exposure to pesticides among this group. As the number of subgroups is small it is impossible to draw firm conclusions, but some of the results are of interest. From our results there are some indications that exposure to pesticides in agriculture may affect offspring sex ratio. The shift towards daughters in the most recent period (sex ratio of 0.33) was remarkable. Also the finding that spraying frequency, frequency of use of specific equipment, and use of some specific pesticides are related to a shift towards more daughters within a family may point to an exposure effect. One should be careful in interpreting these results. The fact that use of several pesticides is related to sex ratio does not necessarily imply that individual pesticides are causally related to sex ratio. Fruit growers use a complex mixture of agents and the use of one agent is often correlated with the use of another one. It is unlikely that the shift in sex ratio is caused by the introduction of particular pesticides as all pesticides have been applied to some extent during the study period. Because application techniques changed considerably over time, the introduction of certain techniques seems a more plausible explanation for this finding. It is possible that with certain underlying mechanisms, effects may not be caused by exposure of the male worker only, as most women live near the orchard and they often participate during particular activities like pruning, thinning, and harvesting. No seasonal trends were found in this analysis as was found for time to pregnancy. Our finding that there might be a difference in time to pregnancy for boys and girls as well, may indicate that both sex ratio and time to pregnancy are interlinked. We cannot explain why exposure variables associated with time to pregnancy are not related to sex ratio.

In conclusion, we think that the suggestion by James to analyse sex ratio is a useful one and should be explored further. To consider both sex ratio and time to pregnancy simultaneously may have advantages in elucidating occupational hazards of (pesticide) exposure. Our results do show that other variables such as families with predominantly daughters or sons, which are indicative of a shift in sex ratio, might be more powerful because they use another sampling unit (family instead of a crude stratification by exposure). Especially in this study among agricultural workers an analysis on a family level might be relevant because the exposure might be aggregated at the family level as well. In general, it seems useful to explore, after time to pregnancy and sex ratio, the presence of families with a predominance of one of the sexes as little is known about the underlying biological mechanisms as well as the statistical properties of these indices.

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- 2 Ptashnik G, Yanai-Inbar I. Dibromochloropropane (DBCP): an 8-year re-evaluation of testicular function and reproductive performance. *Fertil Steril* 1987;47:317-23.
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NOTICE

The Toxicity of Mixtures of Solvents. 13 June 1995. London.

A one day meeting organised jointly by the SCI Health and Safety Group, RSC Toxicology Subject Group, and the Institute of Occupational Hygiene. The meeting will examine the theoretical and practical difficulties in assessing the toxicity of solvent mixtures and effecting control of exposure. Data from experimental studies, occupational exposures and poisoning incidents will be reviewed with an aim of understanding the nature of mixed solvent toxicity. The second half of the meeting will concentrate on industrial experiences, and will consider techniques for assessing and controlling exposures to mixtures of solvents in the workplace.

For further information please contact: SCI Conference Office, 14/15 Belgrave Square, London SW1X 8PS. Tel: +44 (0)171-235-3681; Fax: +44 (0)171-823-1698.

BOOK REVIEWS

Book review editor: R L Maynard

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(The price and availability are occasionally subject to revision by the Publishers.)

List of MAK and BAT Values 1994. By DEUTSCHE FORSCHUNGSGEMEINSCHAFT. (Pp 165; Price DM 54.00.) 1994. Weinheim, Germany: and New York NY 10010-4606, USA: VCH Verlagsgesellschaft, and VCH Publishers. ISSN 0177-7580 and ISBN 3-527-27564-9.

Occupational physicians who are interested in standards applied in other countries will be interested in this, the 1994 edition of the

MAK and BAT values used in Germany. A valuable introductory chapter on the significance and use of MAK values is included: much basic regulatory toxicology can be learnt from this section.

Many compounds have been allocated MAK values and these are listed in an easy to read table. Formally, and notes on carcinogenesis, reproductive toxicology and vapour pressure of the compounds are included. Carcinogens are treated separately and here again the discussion is helpful, with lists of carcinogens and suspected carcinogens provided.

Should you buy this book? It is dubious whether doctors practising occupational medicine in the United Kingdom will think this book valuable: for international companies with branches in Germany it is essential.

R L MAYNARD

Biological Exposure Values for Occupational Toxicants and Carcinogens. Critical Data Evaluation for BAT and EKA Values. Volume 1. Edited by D HENSCHLER, G LEHNERT. (Pp 235; price DM 158.00.) 1994. Weinheim, Federal Republic of Germany: VCH Verlagsgesellschaft mbH. ISBN 3 527 27032 9.

This volume is an English translation, originally published in German, of the conclusions of a Deutsche Forschungsgemeinschaft Working Group charged with recommending BAT (biological tolerance values) and EKA (exposure equivalents for carcinogenic substances) values. Over the past 10 years, the Working Group has set 51 BAT values. This volume contains the documentation for 22 substances and includes 19 BAT and 3 EKA values. The editors have plans to publish further volumes covering the remaining substances.

In setting biological exposure values, the Working Group distinguishes between those substances for which a BAT can be set that will prevent adverse health effects and carcinogens, for which they take the view that it is not possible to establish a safe level. In this case as a limit value cannot be set, biological exposure equivalents (EKA), which are based on the relation between airborne exposure and the concentration of the substance in blood or urine are reported. Data are presented for alkali chromates, cobalt, and pentachlorophenol.

This volume describes the mechanism used by the Working Group for arriving at a BAT value. The scientific literature for each substance is scrutinised and summarised according to an agreed protocol. Documentation is given for a BAT aluminium, fluoride, and a range of organic substances (including carbon disulphide, dichloromethane, phenol, and tetrachloroethane). It is evident that in many cases, the data are very limited, and that some BAT values that have been proposed might be more accurately described as exposure based rather than health based. The BAT values for at least six substances are listed as "provisional" because in the opinion of the Working Group there are insufficient data to set a health based limit.

This is a useful volume that shows the scientific basis and process adopted in Germany for setting BAT values. One cannot help notice, however, that for a number

of substances reported in this volume, the data are over 10 years old. It is a pity the authors did not take the opportunity to update their submissions before publishing this English edition.

This book will be of interest to occupational health professionals, physicians, hygienists and technical policymakers interested in the interpretation of biological monitoring and effect monitoring data and in the setting of health guidance values and benchmarks.

H K WILSON

Lexicon of alcohol and drug terms, 1st edition. Compiled by T BABOR, R CAMPBELL, R ROOM, J SAUNDERS, for the World Health Organisation (Pp 65; price Swiss francs 17.-) 1994. Office of Publications, World Health Organisation, Geneva, Switzerland: World Health Organisation. ISBN 92 4 154468 6.

This book provides concise, accurate, and up to date definitions of terms encountered frequently in the clinical, social science, and research literature about substance abuse. Psychological, social, clinical, and pharmacological aspects are well represented in an easy to read style with ample cross referencing, making the book acceptable to the international multidisciplinary readership for which it is intended. Terms that are misused frequently or that have a multifaceted interpretation, such as "dependence" and "withdrawal" are explained particularly well.

Some readers may find certain definitions rather simplistic or too complex but this is to some extent inevitable within the confines of a small reference text written for a wide audience. For example, clinical details are comprehensive but include terms such as "dysarthria", "hyperacusis" and "nystagmus", with which the non-clinician may be unfamiliar. Others may feel that to define "needle-sharing" as "the use of syringes . . . by more than one person . . ." falls outside the objective of the lexicon "to define what is not self-explanatory".

This book is likely to prove particularly useful to those who require clear, contemporary definitions for purposes of teaching, publication, or professional discourse. Students of medicine, nursing, and allied sciences and those for whom English is not their first language will find it a helpful reference source. It is a pity that the authors chose to exclude slang terms; a guide to these would have been helpful, interesting, and probably entertaining!

S M BRADBURY

Hunter's Diseases of Occupations, 8th ed. Edited by P A B RAFFLE, P H ADAMS, P J BAXTER, W R LEE. (Pp 804; price £145.) London: Edward Arnold. ISBN 0-340-55173-9.

This is the latest edition of Hunter's famous textbook about diseases of occupations. Many people reading this review will have seen or will possess an earlier edition. If you do have an earlier edition, hold on to it. You will need it for the section on the history of occupational diseases that has sadly had to be jettisoned from this edition because of

lack of space. Nor should you imagine that this textbook is all you need for the practice of occupational medicine; as the Editors make quite clear in the Preface, this book is *only* about occupational diseases (their causation, features, and management) and does not pretend to cover all the other facets of the practice of occupational medicine. Also, although there is brief mention made of the effects of harmful environmental exposures, the book does not cover this aspect in any detail.

This is a weighty tome: 2 kg on my kitchen scales. I confess to an aversion to large textbooks, so it took some time and various threats from my friendly book review editor to induce me to take the plunge into this book. When I did, I was pleasantly surprised. Overall, this is a good book and an improvement upon recent previous editions. It presents a review of knowledge on the whole spectrum of occupational diseases, with some useful background material on mechanisms and medico-legal aspects (including compensation). Although it is long, this is a reflection of the breadth of subject matter it covers rather than of the space allotted to each topic. None of the chapters is verbose for the sake of it. Some can be read right through (for example, the chapters on neurotoxic effects and vibration) whereas others (for example, the chapters on metals and organic chemical compounds) are clearly more suitable for reference purposes. There is inevitably some repetition when topics are approached from different angles, starting from the exposure or from the body system affected, but the cross referencing is good and I found no glaring inconsistencies.

The idea of what constitutes an "occupational disease" has evolved as work patterns and concepts of disease have changed. This 8th edition of Hunter's work includes material on newer conditions related to work, with chapters on indoor air pollution (including sick building syndrome), repeated movements and repeated trauma (including repetitive strain injury), and stress at work. It is good to see these areas covered but this highlights a problem with textbooks: they can never be fully up to date and they may give one particular view on issues that are not yet resolved. The problem of one sided treatment has been largely avoided here, at the expense of seeming rather vague at times, but the lack of the most recent references was irritating in some places. For example, the issue of whether or not exposure to low level electromagnetic fields from visual display unit equipment can lead to miscarriages could have been dealt with more definitely if the more recent research results had been included.

Who will this book be of interest to? It is, of course, aimed at clinicians in general rather than the small band of doctors and other professionals who would call themselves occupational health specialists. It is a useful reference book for clinicians, provided they know of its existence in their local library. Another group who are apparently making much use of this book as an authoritative source are lawyers with an interest in occupational diseases; perhaps this is a sign of the times. Candidates for the Associate of the Faculty of Occupational Medicine will find it useful but perhaps do not need their own copies. Personally, I think I will use this book from