

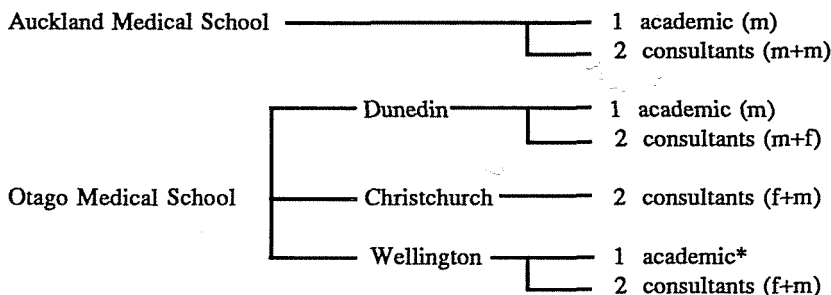
Women Biostatisticians in New Zealand

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1. Current biostatistics teaching and consulting staff in New Zealand

Women biostatisticians in New Zealand are a substantial proportion of a very small group of statisticians. The term "biostatisticians" refers to statisticians who work on research projects in the area of medical or health research. They are usually attached to schools of medicine where they provide consultancy services and teaching, although some are employed to work on large projects or within research units.

The structure of biostatistical services in New Zealand throughout the 1980s is shown below. All of these staff have been employed within the departments of community health but the consultant biostatisticians have responsibility for statistical assistance to all departments in their medical school, and even to medical research throughout the region. There are also several other biostatisticians working in research units, and even one working as a private consultant. The gender of the staff employed in February 1990 is denoted by f = female or m = male.



* disestablished at present

The general pattern is for one academic biostatistician (i.e. one university-funded teaching position) and two consultant biostatisticians in each medical school. However,

in the two satellite schools set up by the Otago Medical School, namely Wellington and Christchurch, the pattern has been altered.

The academic positions have carried all the standard benefits of academic appointments. None of them have ever been occupied by women but, as there have been only four incumbents ever, this is not particularly surprising.

Women have been a large part of the consulting staff since the 1970s. In February 1990 there were three women among the eight Medical Research Council-funded consulting biostatisticians (and one on a repatriation fellowship) and there have been about this number throughout the duration of the service in spite of several changes of staff.

2. Paths for women into and out of biostatistical consulting

All three women currently employed as consulting biostatisticians are in their forties and completed their degrees in the 1960s when few statistics courses were available. Therefore, two of these women do not have statistics degrees and gained much of their statistical knowledge after their first degrees. With the enormous increase since the early 1970s in the number of statistics courses available, it is reasonable to expect that future appointments in biostatistics will be to people with degrees in statistics, or at least with extensive statistical training and coursework, and that some appointees will hold higher degrees in biostatistics.

The paths into and out of biostatistics consulting have mostly involved moving from or to other projects. All three women currently employed came to biostatistics from research projects: the Tokelau Islander longitudinal study, the Dunedin Child Development study, and a study of alcoholics after treatment. Experience as a research assistant/biostatistician is a good training ground for biostatistical consulting. Those women who have left biostatistical consulting have moved to related areas or left to continue their training in biostatistics.

Of the nine women biostatisticians I know of who have ever been employed in consulting positions in New Zealand, six have children, and opportunities for part-time work have been important to them. The three currently employed all have children and all work less than full-time. We were amused to discover that there was a simple formula to describe how much we worked, the formula being to deduct 1/10th for each child. For all six women with children, the standard women's issues of maternity leave, employment protection, time out from the paid workforce, part-time work, and sick leave to care for children, have been important. Clearly, unless these issues are dealt with there could even be a reduction in the numbers of women in New Zealand employed as biostatisticians in the future.

3. The work of consulting biostatisticians

I am not aware of any way in which gender affects the work done by the consulting biostatisticians. As work comes in it is allocated to particular people on the basis of previous work with the same research group, current work load, the skills required for the work, and the skills possessed by the different biostatisticians.

The work can be divided into: (i) assistance with design; (ii) analysis; and (iii) write-up.

(i) *Advice on research design and study protocol:* The studies considered include clinical trials which usually have only one experimental factor but many covariates, some animal or cell experiments, clinical series, surveys, and epidemiologic studies such as case-control studies. Biostatistical assistance is given with:

- (a) the choice of design, e.g. independent groups versus repeated measures or matched groups;
- (b) the selection of appropriate measures;
- (c) the calculation of required sample sizes and power. This has always occurred but has become increasingly important with the new approach of ethical committees. Now, research is considered unethical if too few or too many observations will be collected, even if the research procedure is acceptable for each individual human or animal.
- (d) assistance with details of study protocol and data recording, including helping to design questionnaires, checking coding schemes, providing randomisation plans, and sometimes setting up data entry schemes.

(ii) *Analysis of data and advice on analysis:* Biostatisticians carry out analyses and also advise or supervise researchers who are able to do their own analyses. Common types of analyses are:

- (a) simple descriptive statistics and parametric and nonparametric tests for two groups (independent or related);
- (b) analysis of variance, particularly with repeated measures, and often with analysis of covariance;
- (c) epidemiologic analyses - incidence and prevalence, trends, risk factors, and case-control analyses;
- (d) survival analyses, particularly for cancer studies but also for epidemiologic studies of onset;
- (e) regression/multiple regression/logistic regression.

There is some use of time series and principal components/factor analysis, although structural equation modelling remains largely the preserve of those few researchers who have developed competence in the area.

These analyses are carried out mainly within the framework of classical statistics. In the past, medical research has specialised in star charts of asterisks with keys saying, " $* p < 0.05$ $** p < 0.01$ ", but in recent years there has been a move to report confidence intervals, particularly for the major outcome variables in clinical trials. However, there are often so many variables involved, a number of which are not expected to differ (as with baseline variables for experimental and control patients in a randomised trial), that some kind of sifting procedure is required to eliminate unimportant variables from the discussion.

(iii) *Assistance with writing and revising papers:* For most research, whether or not biostatisticians will be joint authors, they will be asked to assist with writing papers,

particularly by writing the statistical methods sections and writing or carefully scrutinising the results sections. Therefore, the ability to write clearly and to comment constructively on other people's confused prose is very useful, in addition to statistical competence.

Consideration of the work of consulting biostatisticians shows that a good statistical background is essential but not sufficient. There is a need to develop a good practical knowledge of appropriate research designs and a good feel for the basic science of the projects presented. It is also important to be able to work well with many researchers and to understand quickly a wide variety of projects. However, there is also the opportunity to become part of a research team for some projects and to enjoy the rewards of sustained collaboration. Finally, an ability to assist in preparing and revising material for publication is very valuable.

4. Statistical education of biostatistics clients

Every consultation should be educational for clients but obviously biostatisticians hope that they will not have to begin at the very beginning every time. Nor do they have the time to do so. There is a wide range of statistical sophistication in these clients who come from three main groups: biomedical research scientists, medically or dentally trained researchers, and social scientists (plus the occasional physiotherapist or dietitian).

Most clients have had some contact with statistics in their undergraduate training and some have had statistics courses and experience at postgraduate level within their discipline. Generally, medically trained researchers have had less statistics training than other groups of researchers. The statistical background of many clients is well below that which biostatisticians would regard as appropriate: basic concepts may be poorly grasped or not known. Students who do want to go on in research should be encouraged to do more courses in statistics.

Statistics education for researchers is not readily available. Some researchers could cope with additional university courses but others need more basic help. Some need to learn only one or two relevant new techniques. Postgraduate instruction could perhaps be carried out by academic biostatisticians but consulting biostatisticians do not have the resources to provide much formal teaching outside of individual consultations. This issue of further statistical training for medical and health researchers needs to be dealt with. Furthermore, the continuing education of biostatisticians themselves warrants attention to strengthen and add to what already exists.

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