Statistics in Primary Care: The Generalist's Domain?

November 15th 2pm to 5.30pm
At the Royal Statistical Society, 12 Errol Street, London EC1Y 8LX

Session Notes by Toby Prevost

Methodology in primary care
Chair: **Kerry Hood**, *Department of General Practice*
University of Wales College of Medicine (Cardiff).

Kerry introduced herself as a medical statistician who has moved from working in secondary care to primary care, and introduced the speakers in this session on Methodology in primary care.

What designs and statistical analyses are used in primary care?
Mike Campbell, *Institute of General Practice and Primary Care, University of Sheffield.*

In order to address issues wider than analytical issues, Mike re-titled his talk to **Statistics in Primary Care: What are the priorities?** He began by speaking about statistics in primary care, and then presented findings from a review of designs and statistical methods used in recent publications in general practice journals.

Statistics in primary care

Mike commented on the tendency for General Practitioners engaged in research not to have access to statisticians, due to differences of location in different academic departments. Generalist properties of Practitioners were that they will take on anyone who comes through their door, that they are a jack of all trades and that they hold clinics. Mike remarked that these generalist properties were shared by statisticians, and that really practitioners and statisticians have quite a lot in common.

Generally, 'statistics' is far more than just data analysis; it also includes involvement of statisticians in the design of studies, in sample size estimation, in quantitative thinking, in communicative data display, and in risk communication. In the latter area in particular, Mike believed that General Practitioners would be increasingly involved.

Review of survey of designs and statistical methods in primary care research

Three statisticians reviewed all papers appearing in the year 2000 in the GP section of the BMJ, Family Practice, and the BJGP. Designs and statistical methods were extracted. (The appropriateness of designs and methods was not assessed.)

Designs

The most popular design was the cross sectional survey (used in 1 in 3 papers), followed by Qualitative studies, Cohort, RCT and Reviews (each 1 in 10) and less common designs included Reliability/diagnostic, and Cluster RCT (8 out of the 307 total).

Statistical methods
The most common statistical method used was "No statistics or simple summaries" ('used' in 1 in 3 papers). This was followed by methods used for binary outcomes: chi-squared test (1 in 4), logistic regression (a surprisingly high 1 in 7), odds ratios & relative risks (1 in 9). Methods used less commonly (1 in 10) were: the t-test (surprisingly low), non-parametric methods and linear regression.

Mike observed that the common use of logistic regression and other methods for binary outcomes seemed to be consistent with the desire by practitioners to dichotomise data. For example, the proportion of patients with hypertension would be more clinically useful than a mean blood pressure with standard deviation.

Methods that were used even less commonly: confidence interval (1 in 13), kappa, sensitivity and specificity, Pearson correlation (each used in 1 in 20 papers), multiple comparisons, ANOVA, relative risk / odds ratio, survival analysis (each used less than 1 in 30 papers).

Mike wondered whether the less commonly used methods were those not taught in medical statistics courses.

Comparison with other reviews
Mike compared the review results with a review of 1978/9 papers in the New England Journal of Medicine and a review of a Chinese journal. Relative to 1978/9, t-tests are less common and logistic regression is more common in primary care now. Mike noted that, twenty years ago, logistic regression was less well known and less available in accessible software.

Conclusions from the review

Conclusions for Design:
- Cross sectional questionnaires/surveys are most the common designs in use.
- The cohort design is popular.
- There are a substantial number of RCTs including Cluster RCTs.

Conclusions for Analysis:
- Primary Care researchers use logistic regression and binary outcomes more commonly than the t-test and continuous outcomes.

Teaching Implications:
- In cross-sectional studies, the main point would be concerned with getting a representative sample.
- Additionally, encourage the reporting of nonresponse rates and characteristics of nonresponders.
- In cohort studies, encourage the reporting of subjects' follow-up.

- In RCTs, recognise the commoner use of pragmatic trials in primary care.
- In RCTs, awareness that the cluster CTS is more common in primary care.
- Focus teaching on odds ratios relative risks, logistic regression.
- Be aware that binary data analysis methods are not well covered by many current elementary textbooks and that wider understanding of methods should increase practitioners' ability to understand and appraise papers.

Comments specific to primary care research

Mike ended with some comments to raise awareness of specific trial designs in relation to primary care research.

Patient Preference Trial

A trial with a Patient reference design would require co-operation of patients. The therapy itself may not be optimal if the patient does not receive the therapy of choice. A variation on the design included the screening of patients for preference and randomisation. Potential problems of this include the possibility that all of the patients would want the new treatment. How much information should be given to patients and by whom? An alternative is not to tell pre-randomised control group patients of the trial - a Zelen design.

N of 1 Trial

With this design, a single patient is randomised in periods (usually paired) to receive treatments over a number of episodes of time. This design is useful for chronic diseases and where there are competing but established treatments. Drawbacks were that there may be too few periods, the patient's condition may improve or deteriorate contributing to carry-over effects; a crossover design may be more appropriate. A practical drawback is that it may be difficult to justify randomisation of the patient's episodes to the practitioner.

Further comments specific to primary care

PCGs aim to improve the health of the population they serve and their role is changing. As a result, General Practitioners' responsibilities are changing and they will need new skills in Public Health methods. Should GPs have epidemiology and statistics training/exams or join relevant bodies?

Mike gave an example from the Diabetes from diagnosis project (BMJ 1998) where practitioners in the intervention arm identified more newly diagnosed diabetics than their counterparts in the control arm.

Primary Care professionals are the gatekeepers and consequently patients are not as clearly labelled as those let through the gate to secondary care. "This makes statistics more interesting."

What you should know about cluster randomised trials

Sandra Eldridge, *Department of General Practice and Primary Care, Barts and The London, Queen Mary's School of Medicine and Dentistry*

Sandra began with an introduction to cluster randomised trials and an outline of the implications of using clustered designs. The main part of the talk was concerned with the results of a review of cluster randomised trials, which was based on the work done in the initial year of Sandra's three-year NHS R&D primary care researcher development award working on cluster randomised trials.

Implications of using a Cluster Randomised design

Sandra began by explaining that cluster randomised trials (CRTs) were trials where groups (or clusters) of patients are randomised to trial arms. A group could consist of patients seeing the same General Practitioner or patients attending the same Practice. Sometimes, the cluster randomisation could be the most sensible option. The consequences of choosing a cluster randomised design generally involve an addition to the complexity of a study in the areas of design, execution and analysis.

Loss of power

A major implication of randomising patients in clusters rather than individually is the loss in power due to the presence of between cluster variation in outcomes. Sandra indicated that adequate power could be ensured by accounted for between cluster variation at the design stage of a trial by estimating an increased required sample size.

Practical issues need consideration at multiple levels

A fundamental characteristic of clustered designs was the presence of at least two levels of hierarchy, for example: patients and general practices. Implications of cluster randomisation were that in the execution stage of a study, all levels need to be considered. The issues of recruitment and compliance apply to both patients and practices. Non-compliance of a cluster could result in the loss of a substantial number of individuals from the trial.

Ensuring a fair comparison between treatments

The nature of the clusters often leads to there being a small numbers of clusters. This means that the clusters are unlikely to be randomised to ensure equal numbers of individuals in the arms of the trial. This could influence power. Greater consideration of the use of stratification is needed for cluster randomised trials to ensure a fair comparison between treatment groups.

Appropriate analysis of clustered data

At the analysis stage of a trial, appropriate methods for clustered data would need to be used. Otherwise there would be an underestimated Type I error rate.

CRT is common in primary care

Despite these and other implications associated with the CRT design, and unanswered methodological questions, the design is used relatively commonly in Primary Care research.

Results of review of primary care trials

Searching

Sandra's experience was that use of the Cochrane Controlled Trials Register 1997-2000 was found to be not possible. Electronic searching for cluster randomised trials relies on keywords whereas trials do not consistently report clustering in identifiable phrases and that the phrases used are commonly split at either end of sentences. Primary care trials were searched in order to identify whether a cluster randomised design was used.

Study size characteristics

In the 68 trials identified, the level of clustering ranged from clinicians, to general practices, to clinics, to communities and towns. Sample sizes ranged from 54 to over 100,000 with a study median size of 737. The number of clusters ranged from just 4 to as many as 719 with a study median of 42 clusters.

Adequacy of power

Out of the 68 trials, just 5 certainly took account of clustering in power calculations, a further 12 may have done so, 10 took no account and 41 provided no information about power. (These findings did not include an assessment of whether clinical importance was considered appropriately and whether the power was actually adequate.)

Ensuring a fair comparison

A means of ensuring a fair comparison between treatment groups is the use of stratification in the randomisation. Out of the 68 trials, 35 gave no information about stratification. In 18 trials, cluster size was used as a stratifier. In 13 studies, a characteristic of the cluster was used as stratifier. In 7 studies, a characteristic of individuals within clusters was used.

Practical issues

In as many as 18 of the 68 trials, compliance of clusters was an issue. Typical examples were clinicians not attending pre-trial education or clinicians failing to comply with the intervention.

Analysis of clustered data

In half of the trials, the method of statistical analysis that was used was appropriate to the clustered design. Analysis of cluster level data was employed in 13 of the trials, and other analyses (e.g. multilevel modelling or Generalised Estimating Equations) was used in 26 of the trials.

Conclusions: What should you know

Sandra ended with a useful summary of her conclusions

- There are lots of cluster randomised trials in primary care (15% to 35%).
- They are more complex to design, execute and analyse.
- They need adequate power.
- Stratification can be used to ensure balanced groups.
- Cluster compliance can be a problem.
- Statistical analysis strategies are very varied.
- Reporting of these trials could be improved.

Methodology Session Questions:

Should cluster size be included as a stratifying variable without considering how strong a predictor of outcome it actually is?

Stratification by cluster size promotes balance and maintains power.

Have guidelines for cluster randomised trials been recently published? Is there a role for statisticians in reviewing? Should there be a requirement of statistical reviewing for journals in order to affect design and analysis?

In an issue devoted to cluster randomised trials in Statistics in Medicine (2001, Vol. 20 no. 3), Diana Elbourne included a discussion paper on extending the CONSORT statement to cluster randomised trials.

One audience member had been asked by a reviewer to report cluster means in a study with hundreds of clusters. It would be impractical for a guideline to request this without considering study size.

Statisticians serving on ethics committees are involved in approving research.

Comment echoing extra complexity in design: Sample size estimation is often harder for cluster randomised trials where more parameters are unknown, sometimes requiring sensitivity analysis.

Comment: clustering should be taken account of more frequently in survey studies.

Question 1: Where do we go from here?

"It would be good to hear about other people's experiences of working on projects and find out who's doing what, and find out which software packages other people are using."
Lady from Wales who had earlier asked how we could raise political awareness of the need for funding statisticians.

"As a freelance researcher, I'd like to find out how to target people who need some statistical help, perhaps primary care trusts for example. It would be good to team up with other people who'd like to do the same. Together we would have more sway."
A freelance researcher!

"I would like to see more use made of the existing networks of people, for example I've just found out that there is an R&D statistician in each healthcare trust…do these people get together across regions? Also, what about the Public Health Observatories, perhaps this group [people at the meeting today] should link up with them?"
Morris Marchant?, East Brighton and Hove Health Authority

Reply: "The R&D statisticians in the healthcare trusts may well be working in isolation. It certainly would be good for them to link up with others."
Mike Campbell

"I've noticed that the majority of the people here today seem to work in the public sector. To what extent would we like to interact with the commercial sector?"
Martin Underwood

Reply: "Drug companies have been starting to want access to primary care networks, for commercial purposes."
Mike Campbell

Question 2: Which funding sources are available?

Mike Campbell described the Primary Care Award structure, in order to make people aware of this possibility for funding. He described the three levels and emphasised that these awards are available to statisticians. This round will be advertised at the end of November and the closing date will be at the end of January. People are welcome to e-mail Mike for more information.

Question 3: Which routine data sources are available?

"There is a Primary Care Groups and Trusts database which is available for downloading over the web from Manchester University. This provides data at several levels, for example practice, primary care group, health authority. For example, the 1991 census data is available at several different levels. The website address is http://www.primary-care-db.org.uk. Information on hospital episode statistics is available. Soon there will be social services data and (?) prescribing data. All in a very easy-access form. For more details and for information on how to register, e-mail the database manager, andrew.wagner@man.ac.uk."

"The Royal College of General Practitioners website (http://www.rcgp.org.uk) provides a number of basic information sheets on e.g. prescribing in general practice, consulting rates, workload of practitioners, training. These can be readily downloaded."

"ONS are currently working to produce the next volume. Anyone is welcome to contact cathy.hodgson@ons.gov.uk for more information on this."
Cathy Hodgson

General comment

“I would like to emphasise that people who would like to use routine data must keep in touch with those groups who are planning to collect such data, in order that it is collected and published in the most useful form. Otherwise there is a high risk that unusable data will be collected.”

Working in Primary Car Session Questions

*Should a statistician have any input in **qualitative research**?*

Replies were that (1) results from qualitative studies would be useful in deciding which aspect to study quantitatively; (2) when put alongside quantitative work, qualitative work can be supportive in the interpretation of results.

A related later question concerned the involvement of a statistician in analysing quantitative data that had been generated from the Nudist software for qualitative analysis. A reply was that the original qualitative data ought to be sent to a social scientist to be analysed properly in a qualitative framework.

As PCTs role will extend responsibilities to social care, will statisticians be more generalist?

How do we feel about General Practitioners who want to do their own analysis?
Replies were that (1) statisticians ought to be supportive, and (2) there are not enough statisticians around so that statisticians are needed in a design role and in supporting analysis.

How can politicians understand that you cannot generate research without generating statisticians?