DIVERGENT NEEDS OF LEARNERS IN EVIDENCE BASED MEDICINE

Karen L. Smith
Centre for Statistics in Medicine, University of Oxford, United Kingdom
Karen.Smith@csm.ox.ac.uk

Those who are actively engaged in health research expand the evidence base which, it is hoped, is used by all. In contrast, end-users of that evidence base must appropriate it, with some critical appraisal and interpretation for patients. Therefore, the statistical needs of researchers and users of evidence are not always the same. But the statistical education all too often is. Initial statistics teaching is typically focused on the demands of undergraduate degree courses. The mismatch of this education and later needs is a problem that grows in significance during a career, with many healthcare researchers having limited opportunity to undertake further training in statistics, and practitioners getting none. The diverse statistical needs of these two groups, and the challenges to how and what we might teach are discussed, drawing on experiences teaching undergraduate students, providing training to practitioners, and active involvement in health research.

INTRODUCTION

The increasing emphasis on evidence based medicine has led to change in the undergraduate curriculum with recognition that either to generate the evidence base or to put it into practice a level of statistical understanding is required. This applies not only to those studying medicine but also to other allied health professionals such as physiotherapists. But there is also ackowledgement that not everything that might be needed throughout a career can be taught in an initial course and there is high demand for further training.

There is much discussion of the difficulties of teaching statistics to non-specialists and the need for statisticians to input to the curriculum and work collaboratively with subject specialists to develop learning materials that are meaningful to the students. But further training attracts little attention, and there are questions that the statistics community needs to address. Some initial thoughts are given here based on personal experience.

UNDERGRADUATE EDUCATION

In considering what we should cover in professional development courses and how we should teach we must first be aware of what is covered at undergraduate level, which is often the only time that health professionals receive any training in statistics.

The aim of undergraduate education in medicine and other health related subjects is to equip those who complete the course to practice their particular discipline safely and effectively. In doing this it's necessary to ensure that needs are met for registration following completion of the degree. However there are a number of issues that can and do arise which may affect statistical competence of graduates, who all too often are nervous of statistics at the outset. In many health related courses in the UK, the statistical component is included in a module on research methods, enabling students to complete the course with poor statistical understanding. And pressure on the curriculum can often result in the statistical component being squeezed. For example, one undergraduate Physiotherapy course in the UK allows for only 4 hours of lectures in statistics with 2 practical sessions focused on the use of software.

From discussion with those leading the curriculum it is apparent that it's not always clear as to where the focus should be. Amongst comments received are:

"The students need to be able to critically appraise the literature";

"We expect students to be able to conduct primary data collection and analyse their data for their final year dissertation";

"Students should be able to conduct a systematic review".

In C. Reading (Ed.), *Data and context in statistics education: Towards an evidence-based society. Proceedings of the Eighth International Conference on Teaching Statistics (ICOTS8, July, 2010), Ljubljana, Slovenia*. Voorburg, The Netherlands: International Statistical Institute. www.stat.auckland.ac.nz/~iase/publications.php

It's hard to see how all these requirements can be met using just a few of hours of lectures, and what the content of such lectures would need to be in order for any one of these aims to be met. And in many cases any primary data collection conducted for such projects is naïve and literature reviews seldom meet the high standards of a systematic review. Some lecturers have unrealistic expectations of undergraduate students suggesting that they produce work of publishable quality, exerting high pressure on students and leading them to the unrealistic belief that they have conducted, and will be able to conduct, high quality research.

Having previously run a statistical advisory service for undergraduate dissertation students and postgraduate students, in common with the experience of others (Cobb and Moore 1997 and Moore 1997) I found a considerable mismatch between what students are required to know and what they are required to do. And if that applies to students it also applies to graduates.

Many would argue that medical students receive better training than in other health related courses, but from my experience of teaching medical students and working with medical professionals conducting research it's clear that statistical training is still limited. This is not to criticise those with responsibility for such teaching as again, a crowded curriculum means that adequate time for statistics teaching is seldom available.

There are of course some excellent texts (Greenhalgh 2006, Sackett et al 2004 and Strauss et al 2005 for example) to guide beginners, as well as the more experienced, in the methodologies used in evidence based medicine. And indeed these are often recommended to both students and practitioners. But good texts are not always enough.

TRAINING FOR RESEARCHERS AND PRACTITIONERS

Many statisticians working in health research are aware of the limited statistical understanding of the health professionals with whom they work. And those health professionals are also aware of their limitations. The series of Statistics Notes in the *British Medical Journal* is invaluable, as are other similar resources, although some statistical confidence is needed to really make the most of them. Consequently many researchers are keen to attend further statistical training.

If researchers are aware of their lack of knowledge we might assume that the problem for practitioners is at least as great. But practitioners get fewer opportunities to undertake further training of this nature. And even when they do their needs are somewhat different, not least because increasingly health researchers work with a statistician whereas practitioners seldom have that luxury.

In response to the demand for further training there are numerous courses available, some specialist and some general. In many cases these courses claim to be suitable for both researchers and practitioners, but can this ever really be the case? There is clearly some common ground in the needs of these two groups but there are also some distinct differences, which results in different participants finding parts of the course to lack relevance at best and at worse to actively lose concentration.

There is virtually no literature on the differing statistical needs of healthcare practitioners as opposed to healthcare researchers and the following comments are based solely on personal experience.

The Statistical Needs of Healthcare Researchers

The statistical needs of healthcare researchers are of course diverse. There is a core of statistical techniques that all will need, but then further detail is often dependent upon the medical specialism. Increasingly researchers will work with a statistician. In the UK for example, it is increasingly difficult for anyone to conduct research without funding and the majority of funders are now expecting a statistical collaborator or co-applicant.

From experience of working with researchers there is still a lot of misunderstanding and the key to a successful collaboration is communication, involving statisticians developing rudimentary understanding of the clinical issues and clinicians developing an understanding of the statistical issues. Here I will mention just two particular examples to illustrate the potential that professional development courses could have in improving this from the statistical perspective.

All too often the belief is that there is only one way to do a sample size calculation and that the statistician can determine the clinically relevant difference to detect. Beyond one example to show how the different elements going in to the calculation impact on the required sample size, time would be well spent discussing different outcomes and trial designs and the information that a statistician would need in order to perform a calculation.

Regression methods are quite rightly being used more often than clinical researchers might anticipate based on what they are taught about this approach. Frequently though researchers think that model fitting is purely statistical. In teaching about regression we tend to focus on the mechanics and increasingly on interpretation but not about the choice of variables to include and how we might determine which models to explore.

The Statistical Needs of Healthcare Practitioners

The focus for healthcare practitioners is on appraising the literature and putting evidence into practice. As such the same issues relating to a common core of statistical understanding with specialist techniques relating to the medical area apply. However practitioners seldom have access to a statistician and in many ways this makes development of statistical understanding all the more important. And critically practitioners need to appreciate the boundaries of their own understanding.

In critically appraising the literature, a practitioner needs to ask whether or not the approach to analysis is appropriate, but without clear understanding of statistics this is not a question they can answer. When working with inexperienced researchers I've often had a response of *"but this must be the correct analysis – I've seen it analysed this way in a published paper"*. If only it were the case that everything published was analysed appropriately! I haven't worked with those who don't do any research but this common response leads me to think that we have a lot to do to improve the statistical thinking of health practitioners. And as a patient this is a major cause for concern.

Interpretation of results is equally problematic, although many professional development courses do address the issue of how to describe the size of effect, particularly emphasizing the difference between relative and absolute effect. But without opportunity to attend such courses even this can be poorly understood and consequently inadequately or incorrectly described to patients.

DO CURRENT COURSES MEET THE NEEDS OF PARTICIPANTS?

I've taught on, and helped to develop, a number of training courses in statistics. On all such courses it has been claimed that the course is suitable for both researchers and practitioners. Feedback has been variable on such courses, although largely positive as participants are grateful for the opportunity to learn more, particularly from those actively engaged in health research. Comments have ranged though from *"too technical"* to *"not enough technical detail"*. Whatever the content of the course though there has always been someone who has commented that it didn't include the one specific statistical technique they wanted. For example, following a recent introductory course one participant complained that factor analysis wasn't covered, despite the fact that the pre-course material listed the topics to be covered and that was not on the list.

Other comments included *"too many formulae"*, *"I didn't expect to have to do any calculations"*, and *"there should have been opportunity to practice using software"*, all of which give rise to some debate on what, and how, we should teach. And this debate is likely to give rise to differing answers dependent upon the role of the course attendees as either researcher or practitioner.

As statisticians it's all too easy to teach using formulae, after all we all learnt from these. To a certain extent these formulae can really help people to understand what is being done. A particular example here is with calculation of standard deviation. However their use can actually be detrimental to the learning of statistical concepts, particularly when formulae appear complex, or for those with a fear of mathematics. Similarly expecting course participants to perform calculations can be off-putting.

At undergraduate level, where students need to be able to conduct their own analysis, there is good argument for teaching students to use statistical software. There is some argument for those

who are engaged in research, since a rudimentary understanding of software can assist understanding of data collection needs. But it is much harder to make any case for those who are healthcare practitioners needing to put evidence into practice.

CONCLUSION

From my varied experience teaching undergraduate and postgraduate students, teaching on professional development courses and working in health research I think that statisticians need to have still greater influence on the undergraduate curriculum and work increasingly with subject specialists to tailor the learning experience to the student need.

Professional development courses often try to appeal to all but then risk failing all. Researchers, who increasingly work with statisticians, need to understand the language of the statistician, in much the same way as the statistician needs to learn the language of the researcher. Practitioners are tasked with putting research into practice. In many countries healthcare providers give guidance on appropriate treatment routes, but this isn't always the case. At the very least practitioners need to interpret the research so that they can adequately explain to patients for informed consent. But they may also need to be able to evaluate the evidence.

So we need to consider the type of course needed for a differing audience. Is there still a place for courses in which many formulae are taught? Should we ask participants on the courses to conduct calculations? How do we provide a focus on working with statisticians? Should we be teaching the use of statistical software in a professional development course? And importantly is it time to run two different courses, accepting that the demand for researchers at present will be higher than for practitioners? There is a need for both debate amongst those providing such courses and research to really understand the needs of these two groups in order to answer these questions.

Regardless as to the answers to these questions, as statisticians we should also strive to highlight the importance of professional development courses for both groups. And of course we need to manage the expectations of those who attend such courses.

REFERENCES

Cobb, G. W., & Moore, D. S. (1997). Mathematics, Statistics and Teaching. *American Mathematical Monthly*, 104, 801-823.

Greenhalgh, T. (2006). *How to Read a Paper: The Basics of Evidence-Based Medicine* (3rd edition). Oxford: WileyBlackwell.

Moore, D. S. (1997). New Pedagogy and New Content: The Case of Statistics. *International Statistical Review*, *65*(2), 123-165.

Sackett, D. L., Haynes, R. B., Tugwell, P., & Guyatt, G. (2004). *Clinical Epidemiology: How to do Clinical Practice Research* (3rd revised edition). Philadelphia: Lippincott, Williams & Wilkins

Strauss, S. E., Richardson, W. S., Galsziou, P., & Haynes, R. B. (2005). *Evidence Based Medicine: How to Practice and Teach EBM* (3rd edition). Oxford: Churchill Livingstone.