"... the potential for over-interpretation of results and generation of spurious findings is ever present."

across GP practices in the UK[9] and there is considerable variation in data quality in hospital-acquired infection surveillance.[10] Measurement bias (where errors in data measurement are associated with healthcare organisation performance) can also be a concern even using standardised publicly reported data. Further, where data is sparse, confidentiality requirements in the public reporting of data means that information is suppressed in public sources where it may be individually identifiable; for example, data may be disproportionately more likely to be missing for single-handed GP practices.

FURTHER CONSIDERATIONS: POWER AND RELIABILITY

Other methodological questions should also be considered. The statistical reliability of the measures in question at the organisational level are important to consider.[11] Additionally, if several comparisons are being made then statistical tests should be adjusted for multiple testing. The temptation to start correlating everything with everything else, just because the data are freely available and accessible, should be avoided and analyses should be hypothesis-led wherever possible.

Analyses also need to be adequately powered. For example, given there are only around 160 hospitals in England, a study using all of these would have 80% power to detect a correlation of 0.22. While this would not be described as a strong correlation it is larger than values often found in ecological studies. The fact that only relatively strong associations will ever be detected by ecological studies of this sample size potentially encourages the publication of false-positive results as any statistically significant finding accompanies a large effect size. Similar cautions apply to ecological studies in general practice settings when only a small geographical area is considered (for example, within a CCG). Additionally, if the measurement of organisation performance does not have high reliability then power will be further decreased.

BEST PRACTICE AND CONCLUSIONS

The need for good practice in working with and reporting health services research carried out using routine health data are clearly wider than the epidemiological concerns about the ecological study design alone. The RECORD (the REporting of studies Conducted using Observational Routinely-collected Data) statement, an extension of STROBE, (STrengthening the Reporting of OBservational studies in Epidemiology) is in development, defining reporting guidelines for observational studies using health data routinely collected for non-research purposes.

Ecological studies in health services research are a powerful tool and with the wealth of organisational level data now available, there are increasing numbers of research questions where they are the study design of choice. However, the potential for over-interpretation of results and generation of spurious findings is ever present. Good practice in the use of routine health data for research and the use of standard epidemiological precautions are necessary when carrying out and interpreting these studies.

Catherine Saunders,
Research Associate — Statistician, University of Cambridge, Cambridge Centre for Health Services Research, Institute of Public Health, Cambridge.

Gary Abel,
Senior Research Associate — Statistician, University of Cambridge, Cambridge Centre for Health Services Research, Institute of Public Health, Cambridge.

Acknowledgements
We thank Dr Georgios Lyratzopoulos (Cambridge Centre for Health Services Research) for helpful comments and his critical review of the manuscript.

Provenance
Freely submitted; not externally peer reviewed.

Competing interests
The authors have declared no competing interests.

DOI: 10.3399/bjgp14X676979

ADDRESS FOR CORRESPONDENCE

Catherine Saunders
Cambridge Centre for Health Services Research, Institute of Public Health, Forvie Site, Addenbookes Hospital, Cambridge, CB2 0SR UK.

E-mail: ks659@medschl.cam.ac.uk

REFERENCES

1. Bottle A, Gnani S, Saxena S, *et al.* Association between quality of primary care and hospitalization for coronary heart disease in England: national cross-sectional study. *J Gen Intern Med* 2008; **23(2):** 135–141.
2. Levene LS, Baker R, Bankart MJG, Khunti K. Association of features of primary health care with coronary heart disease mortality. *JAMA* 2010; **304(18):** 2028–2034.
3. UK Government Cabinet Office. *Unleashing the potential.* CM8353 Open Data White Paper. 2012. http://www.data.gov.uk/sites/default/files/Open_data_White_Paper.pdf (accessed 13 Jan 2014).
4. Llanwarne NR, Abel GA, Elliott MN, *et al.* Relationship between clinical quality and patient experience: analysis of data from the English Quality and Outcomes Framework and the national GP Patient Survey. *Ann Fam Med* 2013;**11(5):** 467–472.
5. Rowan K, Harrison D, Brady A, Black N. Hospitals' star ratings and clinical outcomes: ecological study. *BMJ* 2004; **328(7445):** 924–925.
6. Messerli FH. Chocolate consumption, cognitive function, and Nobel laureates. *N Engl J Med* 2012; **367(16):** 1562–1564.
7. Cooper Z, Gibbons S, Jones S, McGuire A. Does hospital competition save lives? evidence from the English NHS patient choice reforms. *Econ J* 2011; **121(554):** F228–F260.
8. Bloom N, Cooper Z, Gaynor M, *et al.* In defence of our research on competition in England's National Health Service. *Lancet* 2011; **378(9809):** 2064–2065; author reply 2065–2066.
9. Doran T, Fullwood C, Reeves D, *et al.* Exclusion of patients from pay-for-performance targets by English physicians. *N Engl J Med* 2008; 359(3): 274–84.
10. Tanner J, Padley W, Kiernan M, *et al.* A benchmark too far: findings from a national survey of surgical site infection surveillance. *J Hosp Infect* 2013; **83(2):** 87–91.
11. Lyratzopoulos G, Elliott MN, Barbiere JM, *et al.* How can health care organizations be reliably compared? Lessons from a national survey of patient experience. *Med Care* 2011; **49(8):** 724–733.

Editorials

Cauda equina syndrome:

implications for primary care

BACKGROUND

Back pain is common in primary care. A practice with a population of 10 000 patients will have 610 patients (6% of the practice population) consulting per year, and while poor outcomes are common (around 60% will still suffer pain at 12 months) GPs need to remain vigilant and actively consider more sinister complications.

Cauda equina syndrome (CES) is a nasty complication of disc herniation, and sometimes, low back surgery, and rarely spinal tumours (both primary or secondary). While this may be considered a rare condition, Hospital Episode Statistics (HES) data recorded 800 CES related operations in England in 2010–2011.[1] It is one of the major causes of litigation in the NHS, both for primary and secondary care. This is not surprising, as a previously fit individual is rendered, in various combinations, and often in perpetuity, incontinent of urine and faeces, with loss of perineal, penile, and vaginal sensation, and major disturbance of sexual function. Self-catheterisation, chronic back and leg pain are often added in to the mix.[2]

TYPES OF CAUDA EQUINA SYNDROME

There are two main types of CES: CES-R and CES-I. R is for retention, where there is established retention of urine, and I is for incomplete, where there is reduced urinary sensation, loss of desire to void or a poor stream, but no established retention and overflow. Both need immediate referral for urgent surgery, but CES-R is less likely to be reversible. In CES-I, the time window from onset of cauda equina symptoms to surgical decompression should be <48 hours (some say 24 hours) to have a reasonable chance of reversal. In practice it is not as simple as this. Some slow onset cases reverse after longer delays, but from the legal point of view, these times are widely accepted criteria. CES-R with retention and overflow may not be identified for what it is by patients and their doctors, making careful questioning and clarification of responses essential. Even if it is suspected, the patient may have reached this stage via CES-I. There may be reasonable grounds for complaint for not spotting this process sooner or failure to warn. It is helpful to record when symptoms and signs first started, as this has management and medico-legal implications.

"It is one of the major causes of litigation in the NHS, both for primary and secondary care."

ANATOMY OF CAUDA EQUINA

The spinal cord terminates at L1. Below this emerges a 'horse's tail' of rootlets (hence its name) that supply not only the lower limbs, but also bladder, bowel and sexual functions. A critical feature of CES is the loss of perineal sensation, unilateral or bilateral. Loss of sensation may be first noticed when cleaning the perineum after voiding or defaecation. In trying to prevent CES, it is reasonable to warn patients with disc herniation to look out for this symptom and to report any disturbance of normal urinary function. Highlighting this in any written patient information provides a useful prompt to patients. This may precipitate inappropriate attendances, but it is probably better to err on the side of safety. As is so often the case, the GP is damned if they do and damned if they don't warn. Other risk factors are not well established. If the patient has already had a scan showing a developmentally narrow vertebral canal, then even a small disc prolapse can threaten the cauda equina. In most cases there is a massive lumbar disc prolapse that fills a normal sized vertebral canal, compressing the rootlets of the cauda equina. CES can occur in people with a long history of recurrent disc prolapse when a further and larger prolapse occurs. GP's have been caught out by cries of despair from a patient with a long history of disc prolapse without CES or with an excessive 'out of hours' complaint record. There is some evidence that obesity is a risk factor for CES.[3] The question 'can you feel your bottom when you wipe yourself?' is a useful screening that is easily incorporated into the back pain consultation. A specific change in bladder function relating to the evolution of back and leg symptoms is another. Many patients have a significant increase in back pain with CES. Some get relief from sitting up (presumably because flexion of the lumbar spine widens the vertebral canal).

Intimate examinations are not always practical in primary care settings, but if perineal sensation is tested, then the sharp end of an unravelled paperclip is a useful tool, and better tolerated than a disposable needle or cotton wool. Make sure both sides are tested and results documented.

If a rectal examination is performed, it may be misleading because tone is maintained in CES-I. Recent work with a model suggests that most doctors are not good at assessing degrees of anal tone, so we should not be reassured that all is well if the anal tone seems strong.[4] These findings should be recorded, and these findings, positive or negative, are critical for later management of the patients and of establishing your good practice.

MRI SCANS AND CES

The only way to exclude the diagnosis of CES is get an emergency MRI scan, which may not be available to many clinicians working in primary care, especially outside of routine working hours. About 40% of requested scans show no evidence of cauda equina compression. The syndrome is then attributed to uncontrolled back pain. Expert secondary care clinicians cannot definitively confirm or deny a CES diagnosis without MRI, and so why should any other sort of doctor? Unfortunately the record of A&E departments is not good at spotting CES either; even when an experienced GP has made it clear that they suspect CES. Probably the only way to improve diagnosis is to improve access to out of hours MRI scanning. The National Spinal Task Force

"Always be alert to cauda equina syndrome. It is not as rare as you may think."

"The only way to exclude the diagnosis of CES is get an emergency MRI scan, which may not be available to many clinicians working in primary care, especially outside of routine working hours."

has made it clear that this service has to be improved[1] and access to out-of-hours MRI scanning should be available to all relevant clinicians.

Management and treatment is delivered by specialist spine surgeons, neurosurgical or orthopaedic surgeons. The technical aspects of decompressive surgery range from very easy to highly challenging. The pleasure of relieving prolonged symptoms in one patient is contrasted with the next where rapid surgery is followed by a disappointing outcome. If the CES persists, then there are units and consultants who specialise in the management of chronic CES, and it is worth seeking these out to help these most unhappy patients.

GPs care for large numbers of patients with back pain, the majority of whom will not be at risk of CES. Despite this being a relatively unusual diagnosis, a key message is that this diagnosis has to be considered in all patients with severe back and leg pain (for example, particularly if the back pain is deteriorating and when there may be bilateral leg pain, and loss of perineal sensation is uni- or bi-lateral). Do not be fooled by the patient who prefers to sit up. This condition can easily mislead.

BACK PAIN SERVICES FOR CES

The current organisation of services for patients with CES is problematic, and makes timely and accurate diagnosis challenging. Anecdotal evidence suggests this is a bigger problem in the UK than in countries with similar healthcare systems. An example is New Zealand where, in a publicly-funded health system, CES is not seen as a major litigation problem (personal communication, 2011). In the UK it is difficult to acquire data on CES Litigation.[2] There are no easily accessed international comparisons of litigation rates. The causes of these problems are speculative, but experience as an expert in nearly 50 CES litigation cases, suggests that barriers between primary and secondary care, and treatment delays in secondary care seem the most frequent factors, highlighting the importance of heightened awareness and careful assessment of patients in general practice.

A lateral view of the lumbar spine with a massive disc herniation at the L4/5 Level occluding the vertebral canal and compressing the cauda equina.

ADDRESS FOR CORRESPONDENCE

Jeremy Fairbank
Nuffield Orthopaedic Centre, NDORMS, Oxford University, Windmill Road, Oxford, OX3 7HE UK.
E-mail: jeremy.fairbank@ndorms.ox.ac.uk

Jeremy Fairbank,
Professor of Spine Surgery, Nuffield Orthopaedic Centre, Oxford.

Christian Mallen,
Professor of General Practice Research, Arthritis Research UK Primary Care Centre, Research Institute for Primary Care and Health Sciences, Keele University, Keele.

Provenance
Commissioned; not externally peer reviewed.

Competing interests
The authors have declared no competing interests.

DOI: 10.3399/bjgp14X676988

REFERENCES

1. Commissioning spinal services — getting the service back on track. A guide to commissioners of spinal services, January 2013. http://www.nationalspinaltaskforce.co.uk/pdfs/NHSSpinalReport_vis7%20 30.01.13.pdf (accessed 7 Jan 2014).
2. Lavy C, James A, Wilson-MacDonald J, Fairbank J. Cauda equina syndrome. *BMJ* 2009; **338:** b936.
3. Venkatesan M, Uzoigwe C, Periyanayagam G, Newey M. Is there a cauda equina syndrome body habitus? *Eur Spine J* 2012; **21(Suppl 2):** S236–S237.
4. Sherlock KE, Turner W, Elsayed S, *et al.* The evaluation of digital rectal examination for assessment of anal tone. *Global Spine J* 2012; **02:** P104.