

Varying uses of the ABCD2 scoring system in primary and secondary care: a qualitative study

Duncan Edwards,¹ Simon R Cohn,¹ Nahal Mavaddat,¹ Satnam K Virdee,² Daniel Lasserson,³ Siobhan Milner,² Matthew Giles,⁴ Richard McManus,³ Jonathan Mant¹

To cite: Edwards D, Cohn SR, Mavaddat N, *et al*. Varying uses of the ABCD2 scoring system in primary and secondary care: a qualitative study. *BMJ Open* 2012;**2**:e001501. doi:10.1136/bmjopen-2012-001501

► Prepublication history and additional material for this paper are available online. To view these files please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2012-001501>).

Received 13 June 2012
Accepted 18 October 2012

This final article is available for use under the terms of the Creative Commons Attribution Non-Commercial 2.0 Licence; see <http://bmjopen.bmj.com>

For numbered affiliations see end of article.

Correspondence to

Dr Duncan Edwards;
dae31@medschl.cam.ac.uk

ABSTRACT

Objectives: To explore the usage of the ABCD2 risk stratification score by general practitioners (GPs) and hospital staff during the referral of patients with suspected transient ischaemic attack (TIA) or minor stroke.

Design: Qualitative study using semistructured interviews.

Setting: Nine general practices and two hospital sites in England (Birmingham and Cambridge).

Participants: Nine GPs and nine hospital staff (two consultants, four nurses, two ultrasonographers and one administrator).

Results: In both sites, clinicians used a referral proforma based around the ABCD2 scoring system for a range of purposes including self-education, to assist emphasising urgency to the patient, as a referral pathway facilitator and as a diagnostic tool. Negative views of its role included potential medicolegal threats, that it was a barrier to appropriate care, and led to misdiagnoses. Despite having differing uses by different clinicians, the ABCD2 proforma was the central means of interprofessional communication in TIA referrals across both sites.

Conclusions: Understanding how prediction rules are used in practice is key to determining their impact on processes of care and clinical outcomes. In practice, GPs and their colleagues use the ABCD2 score in subtly different ways and it functions as a 'boundary object' by both accommodating these multiple purposes, yet still successfully aiding communication between them.

INTRODUCTION

The ABCD2 score is a clinical prediction rule developed in 2007 to predict the risk of recurrent stroke soon after a transient ischaemic attack (TIA).^{1 2} The score has rapidly become an integral part of the referral process for TIA internationally^{3–7} and often forms part of a 'proforma'—a form which integrates standardised protocols and

ARTICLE SUMMARY

Article focus

- How do primary and secondary care health professionals use the ABCD2 score while making and receiving referrals of suspected transient ischaemic attack?
- Does the ABCD2 score help interprofessional communication?

Key messages

- The ABCD2 score is used in multiple ways beyond its original evidence-based purpose of risk stratification.
- Despite (or because) of its multiple differing uses by different clinicians, the ABCD2 score successfully facilitates communication across clinical domains as a 'boundary object.'
- Clinical prediction rules which have become boundary objects within referral pathways could become an important mechanism to improve patient care.

Strengths and limitations of this study

- This is the first study exploring real-world effects of this widely used clinical prediction score.
- No patients were included.
- Small study across two sites.

frequently clinical prediction rules—for referrals to secondary care. Such proformas are increasingly common for primary to secondary care communication: in April 2011, Addenbrookes Hospital in Cambridge, UK, requested the use of a proforma for 48 conditions ranging from early inflammatory arthritis to suspected renal colic.

Despite the increasing use of proformas, there is only limited research into their use or impact.⁸ For example, the ABCD2 score was derived and validated in secondary care as a prognostic score, yet the UK's National Institute for Health and Clinical Excellence³ recommends its use in all referrals of suspected TIA by general practitioners (GPs)

and accident and emergency (A&E) departments despite evidence of substantial disagreement between specialist and generalist scores.^{9 10} We studied the ABCD2 score's use across different parts of the health service to analyse how the score and its associated proforma are used in everyday clinical practice (table 1).

Our theoretical background comes from an area of social science research that looks at the increasing role of forms and other systems of standardisation in medical practice. Although protocols are frequently criticised because they constrain and dictate practice, rendering individual decision-making redundant, Timmermans and Berg¹¹ argue that this criticism is misplaced. Rather, an inherent aspect of any useful protocol is that it can accommodate local deviation. Individuals invariably 'tinker' with them, while ensuring they are not undermined, such that they are workable for each specific circumstance. As a result, a protocol often becomes what has been termed a 'boundary object'.¹² This term refers to any item or procedure that is sufficiently standardised to ensure a common meaning or action is established across different specialist fields, yet also is sufficiently flexible to allow for adaptation to make it useful and meaningful in local contexts. As a result, though there may well be significant differences between various locations or areas of expertise, boundary objects serve to provide common ground, and are thus a way of establishing overall coherence and integration.

METHODS

Participants and procedures

This study was a prelude to a randomised controlled trial of a novel method for stroke prevention in primary care. Participants were recruited from two locations (Cambridgeshire/Addenbrookes hospital and West Midlands/Queen Elizabeth hospital) to permit exploration of variation between sites. The TIA clinics in both areas had independently created proformas which they requested to be completed for all referrals, in which the ABCD2 score was central.

Table 1 Description of the ABCD2 clinical prediction rule for stroke risk after TIA

Age \geq 60	1 point
Blood pressure \geq 140/ 90 mm Hg at acute evaluation	1 point
Clinical features	1 point for speech disturbance without weakness; 2 points for unilateral weakness
Duration	1 point for 10–59 min, 2 points for \geq 60 min
Diabetes	1 point

Patients scoring 4 or more points are deemed as high risk.³
TIA, transient ischaemic attack.

Eligible GPs had to be within the catchment area of Addenbrooke's or Queen Elizabeth hospital TIA clinic while staff members included any within these hospitals who regularly encountered patients with suspected TIA. GPs were approached by e-mail using the mailing lists of local research networks with one sampling criteria, that there should be a mix of GPs from Birmingham and Cambridgeshire (these GPs had an obligation and/or interest in participating in research generally, and so this convenience sampling method greatly increased our response rate and reduced the chance of exclusively recruiting stroke enthusiasts), and 9 of 10 volunteer GPs contacted were interviewed: in total we interviewed six Cambridgeshire GPs and three Birmingham GPs. We identified our sample of secondary care informants by adopting a 'snowball method', starting with a consultant interview at each site and then progressively identifying key players in the TIA referral process: as a result we identified a cross section of staff involved in many potential TIA management pathways. Interviewees were approached by e-mail, telephone or in person, often with the assistance of the previous interviewee; all approached interviewees consented to interview: in total we interviewed two stroke consultants; three stroke nurses; two ultrasonographers involved in assessing TIA patients; one stroke team administrator (who liaised with patients, GPs and ensured ABCD2 score proformas were actioned) and one A&E triaging nurse. Five of the hospital staff came from Queen Elizabeth Hospital and four from Addenbrookes, with an equal number of doctors (one) and nurses (two) from each site.

Interviews

Face-to-face interviews followed a topic guide generated by the research team that was initially piloted. The focus was not specifically on the ABCD2 form, but rather to establish a qualitative understanding of experiences along the pathway from GP consultation to TIA clinic referral, inviting professionals to draw on past cases they had referred or been referred. Written consent was confirmed prior to interview, and interviews lasted for on an average 1 h. They were audio-recorded and then transcribed verbatim by a professional transcription service. DE, NM (both GPs), SC (medical anthropologist) and SV (qualitative researcher) conducted the interviews at the hospital site (hospital staff members) or at the GP's practice (GPs). The interviewer checked the full transcription against the audio-recording for accuracy. Question prompts are provided as an appendix.

Analysis

DE, SC and NM read through the transcripts and established central themes that were raised. An initial sample of transcripts was coded independently by DE and SC (using NVivo) to ensure reliability and to revise codes where necessary. Subsequent themes that emerged as these were applied to the remaining transcripts were

Table 2 Interviewee characteristics

Role	Use the ABCD2 score?
3 GPs, Cambridgeshire	Yes
3 GPs, Cambridgeshire	No
3 GPs, West Midlands	Yes
2 Consultants	Yes
2 Stroke specialist nurses	Yes
1 Stroke staff nurse	No
1 A&E department triage nurse	No
2 Ultrasonographers	No
1 Clinic administrator	Yes

A&E, accident and emergency; GP, general practitioner.

always discussed within the team, and if adopted, coded across the entire dataset.

It was clear that much discussion regarding suspected TIAs—when it was appropriate to refer, whether they should be considered as urgent cases, and possible patient pathways that could be followed—centred on the current use of the ABCD2 proforma. This was therefore identified as a pivotal issue that would serve to capture many of the more general comments made, and provides a specific focus to explore how a suspected TIA is negotiated in referral pathways. As a result, DE and SC

undertook further analysis of the transcripts; any direct or indirect mention of the ABCD2 scoring system, or practical use of a proforma in the referral pathway, was consequently noted in every transcript in a thematic analysis. Further coding allowed a detailed typology of varying roles associated with the ABCD2 score and the proforma itself (if used); this included both positive and negative features of its use.

RESULTS

Nine GPs and nine hospital staff took part in the study (see [table 2](#) for interviewee characteristics).

Use of ABCD2 among health professionals

Even though a relatively small sample of GPs and secondary care staff who use the score were interviewed, a surprising variety of different uses for the proforma/ABCD2 score were described (see [tables 3](#) and [4](#)).

Use of the ABCD2 in general practice

For those GPs who use the scoring system, it was clear that they both liked and complied with its use as it offers a tangible means to navigate the referral system. Most did not ever consider their scoring as inaccurate. However, they primarily regard it as the key mechanism

Table 3 Roles of the ABCD2 proforma with exemplar quotes

1. Might generate medicolegal threat	"You might have to justify in the future why you haven't followed a guideline" (901, Cambridgeshire GP)
2. Demonstrates need for urgency to patient	"it sometimes provokes a little bit of alarm" (701, Cambridgeshire GP)
3. Educates the patient	"when things have sometimes had the hospital stamp of approval, it's easier to explain things, so they see a clear-cut pathway basically" (702, Cambridgeshire GP)
4. Diagnostic tool	"you've got the tick box, it helps define what is a TIA and that score thing is very helpful" (605, Birmingham GP)
5. Prognostic tool	"a lower score makes it okay to send it to the next TIA clinic and a higher score you send it urgently" (702, Cambridgeshire GP)
6. Demonstrates need for urgency to the GP	"It didn't feel right to send somebody to hospital very urgently who seems perfectly alright... Having the score there sort of gives you a bit of confidence to do just that" (703, Cambridgeshire GP)
7. Facilitates smoother patient pathway	"It's just simpler because we know what they need and it's a way of getting it" (610, Birmingham GP)
8. Educates/reminds the GP what to do	"I usually dig it out if I'm thinking to refer somebody to that clinic just to remind myself... it's always useful to have something in front of you" (605, Birmingham GP)
9. Distils a complex history	"you simply go 'Okay, you fit a number, you need to go in, we need to refer you, there's a degree of urgency'" (701, Cambridgeshire GP)
10. Obscures a complex history	"You get an idea from the actual GP, the history and what the patient's told you more than you can from the score really" (606, specialist nurse)
11. Misleading GPs about diagnosis	"If you start from the right places, that this was a TIA, it's fine, but as I say, just because you're 80, you've got diabetes and hypertension, you automatically score three... so it has no diagnostic value, the ABCD2 score" (711, consultant)
12. Prevents inappropriate referrals	"Some GPs lie to get them into clinic. Not so much now that we've changed the pro forma" (710, specialist nurse)
13. Barrier to appropriate care	"Our vision... would be to have a TIA hotline... and using that system I wouldn't bother using the ABCD2 score" (602, consultant)

GP, general practitioner; TIA, transient ischaemic attack.

Table 4 Comparing roles of the ABCD2 score by GPs and by hospital staff

	Primary care staff (nine GPs and one A&E triage nurse)	Specialist doctors, nurses and administrator	Hospital support staff (technicians and staff nurse)
Never use the score	40% (n=4)		100% (n=3)
Do use the score	60% (n=6)	100% (n=5)	
Might generate medicolegal threat	X		
Demonstrates need for urgency to patient	X		
Educates the patient	X		
Diagnostic tool	X		
Prognostic tool	X	X	
Demonstrates need for urgency to the GP	X	X	
Facilitates smoother patient pathway	X	X	
Educates/reminds the GP what to do	X	X	
Distils a complex history	X	X	
Obscures a complex history		X	
Misleading GPs about diagnosis		X	
Prevents inappropriate referrals		X	
Barrier to appropriate care		X	

Note: X indicates this theme was raised by at least one of the participants of the subgroup.
GP, general practitioner; TIA, transient ischaemic attack.

to access services on behalf of a patient, at which point a more definitive diagnosis be made based on specialist expertise and technological procedures:

It was just a case of looking, getting the score and then speaking to the medical liaison sister.... I think it's quite useful, I really quite like that scoring system because it does give you a bit of confidence about what to do, because otherwise it can be a bit nebulous.

Cambridgeshire GP, 703

GPs described how they did not feel the need to make a definitive diagnosis, but rather used the form to defer this to the hospital. Thus, the scoring system serves as a tool to systematise their evaluation of a patient within their consultation, yet also ensures a referral to secondary care happens swiftly.

When completing the form, GPs consider potentially relevant patient history to be a broad category. Beyond the specific clinical focus that might relate to a suspected TIA, many express how they cannot simply ignore a wide range of other factors that might possibly be central to the patients' current health status. These aspects, which are not part of the scoring system, can consequently influence how scores are eventually arrived at as GPs try to assess what the consequence of an overall score is likely to be:

Obviously each patient's not the same, so sometimes you do need a little bit of adaption.

Birmingham GP, 608

GPs also adapted their own management in response to the form, for example using it to remind them about TIAs, to educate the patient or to persuade patients that

the problem was urgent and that referral needed to be carried out urgently.

ABCD2 use by hospital staff

Hospital staff viewed the score more restrictively as a reliable record of the clinical event itself. As a result, they sometimes view the GPs approach as problematic or even careless, since it leads to what they view as inaccuracies and inappropriate referrals:

If we all did what we're meant to, it would be great.

Stroke consultant, 711

Unlike the GPs, who view the score within their own consultations as a checklist to ensure sufficient scope of questioning and externally as a mechanism to justify referral, staff in the hospital see the score as ideally an objective evaluation of severity of prognosis.

Our protocol I think it is quite clear... it's about a three or four page document, it gives them (GPs) advice on which medications to start, how to administer the ABCD2 score, and then lots of ways for different people.

Stroke consultant 711

As a natural consequence of this perspective, patients who, it turns out, have not had TIAs but satisfied the scoring to some degree are said to 'mimic' genuine TIA patients according to the criteria set out in the ABCD2 form:

We get so many mimics referred to the clinic, making sure you're dealing with the right diagnosis is probably the first issue.

Specialist nurse, 602

Various negative terms including 'uneducated', 'inappropriate', 'challenging' and 'dubious' are also

used for describing referrals or patients in similar circumstances.

Many of the interviews with hospital staff acknowledged that a GP or emergency doctor may 'misbehave' or 'use (the TIA clinic) as a place to send patients they don't know what to do with' and refer patients that they know cannot be a 'genuine' TIA. The ABCD2 score is also seen as potentially misleading when used inappropriately:

I think we would say if you start from the right place, the ABCD2 scores would discriminate between the high risk and the low risk and people who need urgent and maybe less urgent investigations, but... a lot of people that we see in the clinic I'd imagine their age is probably somewhere in their 80s, then they inappropriately score high than other conditions. So it had no diagnostic value, the ABCD2 score, but it's got some prognostic value in relation to high risk, low risk stuff. So I think people are using it as a sort of diagnostic tool for TIA, that's how it's used inappropriately.

Stroke consultant, 711

This concern about reliability, however, is most relevant if the ABCD2 proforma system is meant to serve exactly the same single purpose within both primary and secondary care. Secondary care users of the ABCD2 score emphasised the original intended use of the ABCD2 score (prognostication) more and discussed a greater number of negative alternate roles of the ABCD2 score (diagnostically confusing, obscuring the history, a barrier to appropriate care) versus primary care users of the ABCD2 score.

ABCD2 non-users

Our interviews revealed that hospital staff not involved in triaging referrals—two radiographers and a nurse involved in scanning and caring for patients with TIA on a weekly basis—were unaware of the ABCD2 score. Similarly, a proportion of primary care staff interviewed also do not currently use the ABCD2 proforma (40%, $n=4$, three GPs and one A&E triage nurse). All cited lack of knowledge, but gave differing interpretations as to why this is so. One GP was 'ashamed' but three interviewees felt they did not use the score or proforma with good reason:

I'm not familiar I have to say, but I think it would be mostly in my history already.

Cambridgeshire GP, 801

I don't think I was aware of it really, I imagine this is some sort of guideline system is it?... you wouldn't believe how many guidelines there are.

Cambridgeshire GP, 901

If you're going to use a scoring system it needs to be universal... everybody needs to be aware of it for it to be an effective tool.

A&E triage nurse, 714

Overall our findings describe both the varied use of the form, and also the way it functions to provide a simple linkage between primary and secondary care. When the ABCD2 proforma is not adopted, GPs rely on methods such as referral letters and sending patients directly to A&E, communication and contact is largely one way and is not shaped by the expectations of secondary care.

DISCUSSION

While it might be argued that this study is limited by the number of interviews conducted, it nevertheless is based on a commitment to capture as broad a set of views from relevant actors as possible. The choice to focus on just two centres of practice (Birmingham and Cambridge), brings the advantage of being able to elicit some specific and subtle descriptions but inevitably limits the generalisation of findings. Nevertheless, the overall argument concerning the multiple function of the ABCD2 score, and the adoption of protocols more generally, is robust given the general consistency of the data collected.

Our interviews with a range of health professionals clearly show that the apparently simple ABCD2 scoring system adopted within GP referral proformas serves a variety of different roles. We identified 13 functions, both positive and negative; of these, five were shared, four were specific to GPs and four were specific to hospital staff. While we are not claiming that the classification is definitive or exactly defined, this variety suggests that the proforma does not only standardise but can also sustain sufficient flexibility to serve a range of local purposes. This suggests that efforts to improve prognostic accuracy of clinical prediction rules (including current controversies over the prognostic accuracy of the ABCD2 score and proposed alternatives)^{2 13–22} should be accompanied by research and development of the other aspects of their usefulness.

Complex scientific fields such as medicine inevitably involve multiple domains of expertise, each of which has its own perspective and priorities that shapes the way things being studied are conceived and dealt with.²³ In order for pluralism across different subfields not to lead to fragmentation, there has to be what contemporary philosopher Hacking calls conceptual 'unifiers' that span and integrate any discontinuities.²⁴ In this vein, the notion of a 'boundary object' describes those things, whether material or theoretical, that are both sufficiently stable to be treated as the same thing by different groups of scientists, and yet also flexible enough for them to operate and make sense with each of the different subfields.¹²

In our study of the referral of suspected TIA patients from GP practices to the TIA clinic, one might have initially assumed that the 'boundary object' is the patient, since she obviously moves from one site to another and apparently aligns primary and secondary services. However, our interviews reveal that the patient is not

considered the chief means by which the two sites connect and establish a common point of reference, rather, it is the completed ABCD2 form.

Clinical prediction research needs to have a postimplementation phase to understand how the original research is used in practice, since this will determine its ultimate effect on processes of care and clinical outcomes. In current clinical practice, GPs could utilise a greater awareness of how clinical prediction rules practically function to improve referrals and referral pathways, and should consider communicating their significance to patients.

Author affiliations

¹Department of Public Health and Primary Care, University of Cambridge, Cambridge, UK

²Department of Primary Care Clinical Sciences, University of Birmingham, Birmingham, UK

³Department of Primary Care Health Sciences, University of Oxford, Oxford, UK

⁴Stroke Prevention Research Unit, University of Oxford, Oxford, UK

Contributors DE, SC, NM, SM and JM developed the original idea and protocol. DE, SC, NM and SV conducted the interviews. DE and SC led the qualitative analysis and draughted the paper. DE, SC, NM, SV, DL, SM, MG, RM and JM contributed to the writing of the final version of the paper. DE is the guarantor.

Funding Funded by National Institute for Health Research.

Competing interests All authors have completed the Unified Competing Interest form and declare that this article presents an independent research commissioned by the National Institute for Health Research (NIHR) under the Research for Patient Benefit Programme. The views expressed in this publication are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health. JM has undertaken consultancy work for and received speakers' fees from Boehringer Ingelheim. SC has undertaken consultancy work for Ingenda Communications. The authors have no other financial relationships with any organisations that might have an interest in the submitted work in the previous 3 years, and no other relationships or activities that could appear to have influenced the submitted work.

Ethics approval This study was reviewed and approved by the Coventry and Warwickshire research ethics committee. Role of the funder and statement of independence of researchers from funders. This article presents an independent research commissioned by the National Institute for Health Research (NIHR) under the Research for Patient Benefit Programme. The views expressed in this publication are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health. The study sponsor was the University of Birmingham.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement There are no additional data available.

REFERENCES

1. Johnston SC, Rothwell PM, Nguyen-Huynh MN, *et al.* Validation and refinement of scores to predict very early stroke risk after transient ischaemic attack. *Lancet* 2007;369:283–92.
2. Giles MF, Rothwell PM. Systematic review and pooled analysis of published and unpublished validations of the ABCD and ABCD2 transient ischaemic attack risk scores. *Stroke* 2010;41:667–73.
3. National Institute for Health and Clinical Excellence. *Stroke: the diagnosis and initial management of acute stroke and transient ischaemic attack*. London: National Institute for Health and Clinical Excellence, 2008.
4. Royal College of Physicians. *National sentinel stroke audit; organisational audit*. London: RCP, 2010.
5. Easton JD, Saver JL, Albers GW, *et al.* Definition and evaluation of transient ischaemic attack: a scientific statement for healthcare professionals from the American Heart Association/American Stroke Association Stroke Council; Council on Cardiovascular Surgery and Anesthesia; Council on Cardiovascular Radiology and Intervention; Council on Cardiovascular Nursing; and the Interdisciplinary Council on Peripheral Vascular Disease. The American Academy of Neurology affirms the value of this statement as an educational tool for neurologists. *Stroke* 2009;40:2276–93.
6. National Stroke Foundation. *Clinical guidelines for stroke and TIA management. A guide for general practice*. Melbourne: National Stroke Foundation, 2008.
7. Stroke Foundation of New Zealand. *For the assessment and management of people with recent transient ischaemic attack (TIA)*. Wellington: Stroke Foundation of New Zealand, 2008.
8. Akbari A, Mayhew A, Al-Alawi MA, *et al.* Interventions to improve outpatient referrals from primary care to secondary care. *Cochrane Database Syst Rev* 2008;(4):CD005471.
9. Kinsella JA, Tobin WO, Cogan N, *et al.* Interobserver agreement in ABCD scoring between non-stroke specialists and vascular neurologists following suspected TIA is only fair. *J Neurol* 2011;258:1001–7.
10. Wong J, Fotherby M, Eveson D. Comparison of ABCD2 scoring between first healthcare-contact and stroke-specialist physicians for transient ischaemic attack in a rapid-access clinic. *Age Ageing* 2012;41:115–18.
11. Timmermans S, Berg M. Standardization in action: achieving local universality through medical protocols. *Stud Sci* 1997;27:273–305.
12. Leigh Star S. This is not a boundary object: reflections on the origin of a concept. *Sci Technol Human Values* 2010;35:601–17.
13. Giles MF, Greg AW, Amarenco P, *et al.* Addition of brain infarction to the ABCD2 score (ABCD2I). A collaborative analysis of unpublished data on 4574 patients. *Stroke* 2010;41:1907–13.
14. Calvet D, Touze E, Oppenheim C, *et al.* DWI lesions and TIA etiology improve the prediction of stroke after TIA. *Stroke* 2009;40:187–92.
15. Asimos AW, Rosamond WD, Johnson AM, *et al.* Early diffusion weighted MRI as a negative predictor for disabling stroke after ABCD2 score risk categorization in transient ischaemic attack patients. *Stroke* 2009;40:3252–7.
16. Ay H, Arsava EM, Johnston SC, *et al.* Clinical- and imaging-based prediction of stroke risk after transient ischaemic attack: the CIP model. *Stroke* 2009;40:181–6.
17. Johnston SC. Stroke prediction after TIA: avoiding an alphabet soup. *Lancet Neurol* 2010;9:1039–40.
18. Tsvigoulis G, Heliopoulos I. Potential and failure of the ABCD2 score in stroke risk prediction after transient ischaemic attack. *Stroke* 2010;41:836–8.
19. Perry JJ, Sharma M, Sivillotti ML, *et al.* Prospective validation of the ABCD2 score for patients in the emergency department with transient ischaemic attack. *CMAJ* 2011;183:1137–45.
20. Raser JM, Cucchiara BL. Modifications of the ABCD(2) score do not improve the risk stratification of transient ischaemic attack patients. *J Stroke Cerebrovasc Dis* 2011;21:467–70.
21. Amarenco P, Labreuche J, Lavalley PC. Patients with transient ischaemic attack with ABCD2 <4 can have similar 90-day stroke risk as patients with transient ischaemic attack with ABCD2 ≥4. *Stroke* 2012;43:863–5.
22. Sanders LM, Srikanth VK, Blacker DJ, *et al.* Performance of the ABCD2 score for stroke risk post TIA: meta-analysis and probability modeling. *Neurology* 2012;79:971–80.
23. Mol A. *The body multiple: ontology in medical practice*. Durham: Duke University Press, 2002.
24. Hacking I. The disunity of the sciences. In: Galison P, Stump D, eds. *The disunity of science: boundaries, context and power*. Palo Alto: Stanford University Press; 1996.