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Original article

Warfarin monitoring economic evaluation of point of care self-monitoring compared to clinic settings

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Abstract

Objective:
To determine the cost-effectiveness of home-based point-of-care self-monitoring compared to clinic-based care for patients managed on long-term warfarin medication. Current evidence is inconsistent; results should reduce uncertainty and inform service delivery.

Methods:
A Markov model compared self-testing and self-management, using point-of-care devices to usual care in patients with atrial fibrillation and mechanical heart valves. The primary clinical end-points were stroke and mortality avoided; costs and utilities were associated with these events. The costs of warfarin monitoring were included in the model.

Results:
Over 10 years, self-monitoring saved £1187 per person compared to usual care. Patients who self-monitored had notably fewer strokes and deaths. The results were sensitive to life-years gained and cost of the device. If the NHS purchased the device, financial break-even was achieved at the end of the second year; if the patient bought the device the NHS saved money every year. If 10% of the current 950,000 patients switched to point-of-care devices for 10 years, the NHS could save over £112million.

Limitations:
Clinical studies had a relatively short duration and only data on composite end-points were reported.

Conclusions:
With training, self-testing and self-management are safe, reliable, and cost-effective for a sizable proportion of patients receiving long-term warfarin. Compared to clinic-based services, self-monitoring offers the NHS the potential to make cost savings and release bed-days by reducing the number of strokes experienced by these high-risk patients.

Introduction

Warfarin has traditionally been the drug of choice to manage the effects of vitamin K[1], reducing blood clots which cause thrombolytic events, particularly strokes. Most patients prescribed long-term warfarin have atrial fibrillation (AF) or a mechanical prosthetic heart valve (MHV); both indications are associated with a higher risk of thromboembolic events. It is estimated that there are over 950,000[2] people taking warfarin in the UK The 2012/13 Quality Outcomes Framework incentivizes GPs to identify patients with AF and prescribe anti-coagulants[3], potentially increasing the use of warfarin.

Warfarin has a narrow therapeutic window to balance the risk of adverse events. Each person taking warfarin has their international normalized ratio (INR) tested regularly; INR measures time for blood to clot and target INRs vary by indication[4]. Clinicians determine dosage by comparing an individual's INR to the relevant target; maintaining the INR close to target achieves better clinical outcomes[5].

In England, INR testing is typically clinic-based, at either a hospital or GP practice, often referred to as usual care. A recent study found that under this model of care the average time in the therapeutic range (TTR) was 63%[5].

Point-of-care (POC) testing devices provide an alternative to usual care. Patients perform a simple finger-prick blood test at home (patient self-monitor; 'PSM') and can either report results to a clinician who decides on dosage (patient self-test; 'PST') or who are trained to adjust warfarin dose themselves (self-manage).

Since 2005, six meta-analyses[2,6–10] compared clinical effectiveness of self-management or self-testing to clinic-based services. Evidence shows that, whilst not all patients are able to test at home, those who do have improved INR control, leading to fewer thromboembolic events and deaths, with no increase in bleeding.

Three health technology assessments (HTA)[2,11,12] undertook primary economic modeling comparing point-of-care tests with usual care. Results differed widely. The most recent Belgian HTA[12] reported self-management compared to usual care generated savings and increased life years. In the other two HTAs self-care options were not cost-effective. Given this uncertainty an economic model was developed using the latest clinical and cost evidence from a UK perspective, to inform commissioners of the relative value of self-monitoring compared to clinic-based services.

The objective was to evaluate the cost-effectiveness of INR self-monitoring for patients on long-term warfarin compared to usual care in the UK. This paper, therefore, excludes comparisons between warfarin and newer oral anticoagulants.

Comparators, patients, and model

A Markov model compared self-testing, self-management, and usual care for a cohort of 10,000 patients requiring long-term warfarin therapy, reporting cost consequences and incremental cost per quality adjusted life-year (QALY). Each month a patient was placed within one of seven clinical event states or viewed as healthy, depending on test results (see Figure 1). Patients remained in stroke, myocardial infarction (MI) and systemic embolism states until death, incurring costs and utility decrements. For hemorrhages, patients returned to the event-free state in the next cycle.

Minor stroke, minor haemorrhage, and systemic embolism events were included in the model, but are not discussed further, to simplify tables and provide focus on the events that drive the model.

A National Health Service (NHS) and Personal Social Services perspective was adopted over a 10-year time horizon. Costs and benefits were discounted at 3.5%.

Clinical effectiveness

The base-case adopted clinical event rates from Heneghan *et al.*[6], the most recent systematic review and meta-analysis

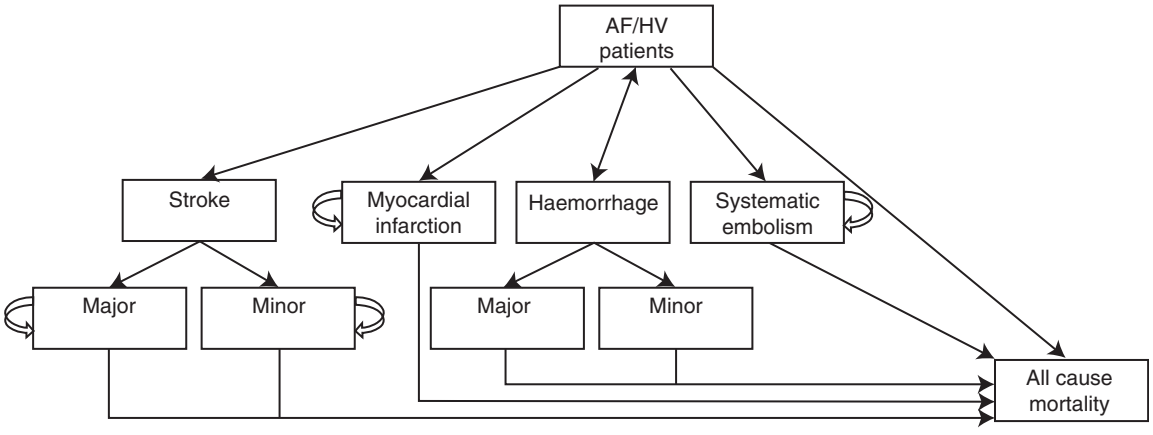

Figure 1. Structure of economic model.

Table 1. Two-year clinical event rates for all patients, AF only, and MHV only[a].

	PST/PSM			Usual care		
	n	Cohort	Rate	*n*	Cohort	Rate
All patients						
Thrombosis	114	3053	3.7%	152	2939	5.2%
Major hemorrhage	230	3216	7.2%	244	3101	7.9%
Died	247	3071	8.0%	274	2956	9.3%
AF-only patients						
Thrombosis	70	1629	4.3%	69	1623	4.3%
Major hemorrhage	126	1676	7.5%	119	1677	7.1%
Died	138	1555	8.9%	156	1549	10.1%
MHV-only patients						
Thrombosis	36	1132	3.2%	63	1040	6.1%
Major hemorrhage	78	1111	7.0%	91	1015	9.0%
Died	64	1101	5.8%	75	1002	7.5%

[a]Source: Heneghan *et al.*[6]

including individual patient data from 11 trials. The analyses included 6417 patients with AF (53%), MHV (35%), and other disorders (12%); trials had a mean follow-up of 1.99 years. The usual care groups in the trials were a mixture of monitoring in primary care, anticoagulation clinics, or both settings, with the comparator being either self-management or self-testing.

Heneghan *et al.*[6] reported results grouped by thrombolytic events, major hemorrhages, and deaths for all patients and as sub-groups of AF and MHV patients.

The modeled base-case used the Heneghan *et al.*[6] data on clinical events for all patients in the usual care and PST/PSM groups, thereby comparing outcomes for all AF, MHV, and other patients to reflect the population competent to use self-monitoring or self-testing devices. Scenario analyses were conducted for AF and MHV only patients. The event rates for the total population and sub-groups are reported in Table 1.

For AF patients only, Heneghan *et al.*[6] reported no statistically significant differences in the results for usual care compared to PST/PSM for any end-point. Clinical equivalence is, therefore, assumed between the two forms of monitoring and a cost minimization analysis was adopted. Event rates for usual care in the AF cohort of patients were used as the base-case.

For the sub-group of patients with a MHV and for all patients there were statistically significant differences in thromboembolic events in the meta-analysis[6]. Cost utility analysis was, therefore, adopted for all patients as the base-case, with sub-group analyses for those with MHVs.

In order to cost adverse events, the composite clinical end-points were disaggregated. A literature search was undertaken, but no disaggregated data were found for patients with MHV. The NICE submission from Bayer plc of rivaroxaban[13] reported secondary end-points for the following outcomes for a population with AF (Table 2).

Table 2. Event rates with warfarin.

	n	%
Stroke fatal	71	19.1%
Major stroke	60	16.2%
Minor stroke	92	24.8%
Systemic embolism	22	5.9%
MI	126	34.0%
Total	371	100.0%
Major bleed non-fatal	331	22.8%
Non-major bleed	1063	73.4%
Total	1394	100.0%

These rates were used to disaggregate the composite end-point of thrombolytic events into major stroke, minor stroke, fatal stroke, MI, and systemic embolism (Table 3).

These 2-yearly rates were converted to monthly transition probabilities using the following equation:

$$1 - EXP\left(\frac{LN(1 - two\_year\_rate)}{24}\right)$$

Cost

Monitoring warfarin: Usual care

Annual costs for monitoring warfarin were adapted from those in the National Institute of Health and Clinical Excellence (NICE) Costing Template for dabigatran etexilate[14] and were higher in outpatients' clinics (£318) than primary care (£231) (Table 4). Relative usage was informed by the clinical studies[9,15]. In addition it was assumed the NHS pays transport for 5% of those attending outpatients[16] at a mean cost of £24 per attendance[17].

The model assumes that 34% of patients in usual care will be seen in a secondary care setting, with the remaining 66% seen in primary. This is consistent with UK practice[13].

Monitoring warfarin: self-test or self-manage

Patients self-testing or self-managing their INR levels were assumed to receive an initial 2 and 4 h education and training, respectively, from a GP-practice nurse, bi-annual reviews for 15 min (80% at outpatient clinic and 20% with GP-practice nurse), and for those self-testing, telephone calls (10 min per month) with the practice nurse to review INRs.

The most widely used POC device in the UK, the Roche CoaguChek XS costs £399[18], plus £67.39 for 24 testing strips (Roche Diagnostics Limited, June 2013). Currently the patient buys the device, but the base-case assumed the NHS incurred this cost. The cost of a

Table 3. Two-year clinical events for total population, MHV patients only, and AF patients by PST/PSM and usual care.

	Total population		MHV only		
	PST/PSM	Usual care	PST/PSM	Usual care	AF PST/PSM and usual care
Major stroke	0.44%	0.84%	0.52%	0.98%	0.69%
Minor stroke	0.67%	1.28%	0.79%	1.50%	1.05%
Fatal stroke	0.51%	0.99%	0.61%	1.16%	0.81%
Myocardial infarction	0.92%	1.76%	1.08%	2.06%	1.44%
Major hemorrhage	1.48%	1.90%	1.57%	2.00%	1.67%
Minor hemorrhage	4.76%	6.10%	5.05%	6.42%	5.38%
Systemic embolism	0.16%	0.31%	0.18%	0.36%	0.25%
All cause mortality	7.44%	9.30%	3.87%	9.30%	9.29%

Table 4. Warfarin monitoring costs, usual care 2012/13 prices.

Warfarin monitoring	Cost	Patients
Primary care	£231.33	20%
Secondary care	£317.90	80%

Table 5. Annual warfarin self-monitoring costs, 2012/13 prices.

	Self-test costs		Self-manage costs	
Patient pathway item	First year	Later years	First year	Later years
Education and training by practice nurse, £43 per hour[19]	£86.00	£0.00	£172.00	£0.00
CoaguChek XS device	£399.00	£0.00	£399.00	£0.00
Test strips: self-test every 2 weeks plus QA	£78.50	£78.50	£78.50	£78.50
Clinic review every 6 months (20% of self-manage see GP-nurse; 80% a clinic nurse)	£17.90	£17.90	£17.90	£17.90
Monthly call to adjust dose	£66.00	£66.00	£0.00	£0.00
Total cost	£647.20	£162.40	£667.20	£96.40

Table 6. Costs of adverse events, 2012/13 prices.

Adverse event	Cost	Source
Major stroke year 1	£15,594	Minor stroke[17] plus 34.4 days in hospital[20] and 14 days rehabilitation[13]
Minor stroke year 1	£3,082	NHS Reference Costs for AA22A and AA22B non-elective admissions[17]
Stroke years 2–5	£2,430	Costing template NICE[14]
Fatal stroke	£400	NICE submission[13]
Major bleed	£1,173	Costing template NICE[14]
MI	£1,967	NHS Reference Costs for EB10Z non-elective admissions[17]

GP-practice nurse was £43 per hour[19], and a nurse at an outpatient clinic £34 per hour[19]. At each review, quality control of the POC device was assumed by comparing readings with the clinic or practice device. Base-case costs in the first and following years are stated in Table 5.

The annual cost of warfarin at £45.49 is included in both the PST/PSM group and the usual care group.

Cost of adverse events

Costs of adverse events, shown in Table 6, were taken from NICE Costing Templates and NHS Reference Costs[13,14,17].

Utilities

The key utilities used in the model are shown in Table 7. These were adopted in Bayer's submission of rivaroxaban[13] and accepted as appropriate by NICE.

Results and sensitivity analysis

Base-case: all patients

Base-case results for a cohort of 10,000 patients at 10 years reported incremental savings of £11.9 million (£1187 per person) from adopting self-monitoring compared to usual care. Patients in the self-monitoring group had better clinical outcomes, notably 612 fewer deaths and 89 fewer major strokes compared to usual care. The QALY gain was 0.276 per person. Self-monitoring dominated usual care, being cheaper and resulting in fewer adverse events (Table 8).

Probabilistic sensitivity analysis, applying distributions to modelled parameters and sampling these for 1000 runs, reported similar mean savings per person (£1101, 95% CI = £537–£1680) with a mean QALY gain of 0.261 (95% CI = 0.06–0.70) per person. For all runs, self-monitoring was cheaper and more effective than usual care.

A series of deterministic sensitivity analyses was performed and showed that results were sensitive to:

- Operational life of the device: If the life was only 1 year the NHS incurred a net cost of ~£314 per person. However, if the life was 5 years the net savings were over £476 per person. Financial break-even for the NHS was achieved at just over 2 years;
- Funding of the device: If people using POC buy their own device the NHS would make savings in the first year; the value released from clinic appointments avoided exceed the cost of education, training, the tests, and healthcare support. Net savings were estimated at £71 per person after 12 months; and
- Costs of INR monitoring in usual care: In the appraisal of dabigatran, NICE considered a sensitivity analysis with the costs ranging from £115–£414 per patient per year (base-case = £301). Assuming £115 in our model resulted in a saving of £412 per person and assuming £414 resulted in a saving of £2025 per patient self-monitoring over 10 years, respectively.

Table 7. Utilities associated with adverse events.

Event	Utility	Source
Stable AF	0.779	Berg *et al.* (2010)[21]
Major stroke	0.189	Robinson *et al.* (2001)[22]
Post-major stroke	0.482	Hallan *et al.* (1999)[23]
Major bleed	0.599	Sullivan *et al.* (2006)[24]
MI	0.683	Lacey and Walters (2003)[25]

Table 8. Ten-year results—total.

	PST/PSM	Usual care	Incremental
Total cost	£19,128,390	£30,998,975	−£11,870,585
Total cost (per patient)	£1,913	£3,100	−£1,187
Total QALYs (per patient)	4.470	4.194	0.276
Incremental cost per QALY			Dominant
Major stroke events	139	228	−89
Myocardial infarction	292	480	−188
Major hemorrhage	579	672	−93
Systemic embolism	51	84	−33
Died	3169	3781	−612

Table 9 provides one-way sensitivity analysis showing results were not sensitive to:

- Location of usual care testing;
- 25% change in disease costs; and
- Use of patient transport.

Scenario analysis: MHV or AF patients only

When a cohort of 10,000 patients with MHVs is modelled, the results show an incremental savings of £23.1 million (£2316 per person) from adopting self-monitoring compared to usual care. Patients in the self-monitoring group had better clinical outcomes, notably 507 fewer deaths and 130 fewer major strokes compared to usual care. The QALY gain was 0.258 per person. Self-monitoring dominated usual care, being cheaper and with fewer adverse events (Table 10).

When modelling a cohort of 10,000 patients with AF using a cost minimization approach (because there were no significant differences in event rates[6]), the results showed an incremental savings of £4.2 million (£423 per person) from adopting self-monitoring compared to usual care (Table 11).

Discussion

Over 950,000 people attend clinics for warfarin monitoring annually, and this number will rise as a result of increased diagnosis of atrial fibrillation and the move

Table 10. Ten-year results—MHV patients only.

	PST/PSM	Usual care	Incremental
Total cost	£21,128,506	£44,284,107	−£23,155,601
Total cost (per patient)	£2,112.85	£4,428.41	−£2,316
Total QALYs (per patient)	4.711	4.453	0.258
Incremental cost per QALY			Dominant
Major stroke	177	307	−130
Myocardial infarction	391	648	−257
Major hemorrhage	654	738	−85
Systemic embolism	71	122	−52
Died	2312	2818	−507

Table 9. Sensitivity analyses.

	Value in sensitivity analysis	Incremental cost	Change from baseline (minus = increase saving)
Baseline		−£1,187	
Major stroke: −25% change cost	£11,695	−£1,163	£24
Major stroke: +25% change cost	£19,492	−£1,211	−£24
Stroke years 2–5: −25% change cost	£1,823	−£1,146	£41
	£3,038	−£1,228	−£41
Stroke years 2–5: +25% change cost			
Patient transport for:	0% of people	−£1,144	£43
	10% of people	−£1,230	−£43

Table 11. Ten-year results—AF patients only.

	PST/PSM	Usual care	Incremental
Total cost	£20,595,605	£24,828,663	−£4,233,058
Total cost (per patient)	£2,059.56	£2,482.87	−£423
Total QALYs (per patient)	4.222	4.222	0.000
Incremental cost per QALY			Cost saving

away from aspirin as a routine therapy. Adverse events are associated with poor management; improving TTR reduces thromboembolic and bleeding events. Several UK studies have shown that self-monitoring, accompanied by training and education, improves TTR, with patients achieving typical values of 70% compared to 63% for patients managed in clinics[5].

Existing economic evaluation of testing modes have produced conflicting results; the only UK HTA conducted in 2007[2] concluded self-management was unlikely to be cost effective. Subsequently, large studies of warfarin have measured the impact of improved TTR on reducing stroke and mortality risk. Recent meta-analyses of RCTs comparing self-monitoring with usual care also demonstrated that patients self-monitoring had fewer thromboembolic events with no increase in bleeding compared to usual care[6,7,9–11]. These effectiveness data have driven a new economic model which showed that, provided the CoaguChek XS is used for more than 1-year, it dominates usual care, being cheaper for the NHS and reducing adverse events for patients. This assumes the NHS buys the device; if the person purchases the device directly, with NHS paying for test strips only, the NHS breaks-even in the first year.

The potential savings are material; over a 10-year horizon, INR self-monitoring resulted in net savings of £1187 per person compared to usual care or ~40% of the usual care costs

With 950,000 people taking warfarin, if a tenth of these were assessed competent to use the POC device and were motivated to so do, then, over 10 years, the NHS could save over £112 million from adopting this technology.

For patients with a MHV the efficacy data came from a systematic review which included 10 studies, only one of which was set in the UK[6]. This included 97 patients with a MHV.

Other limitations include the relatively short duration of trials informing the model, with the longest trial being of 2-year duration. The trials have also not been able to capture the importance of factors such as increased test frequency with home monitoring, GP-support for self-monitoring, reimbursement arrangements and funding of strips, importance of quality education and training of all stakeholders, and robust quality assurance of the device. Moreover, studies have shown self-monitoring is not feasible for all patients requiring anti-coagulation (with assessments required after training to establish competency in conducting the test and interpreting the result) or patients may prefer usual care.

Barriers to adopting INR self-monitoring in the NHS setting warrant further examination, together with factors such as information on patient selection, training, and quality assurance of devices[20].

In conclusion, combining the efficacy data from relevant clinical studies with cost and quality-of-life information has shown that, with appropriate training, both patient self-testing and self-management are safe, reliable, and cost-effective for a sizable proportion of patients receiving long-term warfarin.

The UK healthcare system faces major strains as it seeks to deliver compassionate and sustainable services. Models of care that reduce people's dependence on health professionals and increase their sense of control and wellbeing are essential to manage the growing numbers with long-term conditions requiring support. INR self-monitoring should be offered to those who are motivated and demonstrate competency.

Transparency

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Declaration of financial/other relationships

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References

1. BMJ and Royal Pharmaceutical Society. Coumarins and phenindione. British National Formulary. UK, 2013. http://www.medicinescomplete.com/mc/bnf/current/PHP1485-coumarins-and-phenindione.htm. Accessed April 30, 2013
2. Connock M, Stevens C, Fry-Smith A, et al. Clinical effectiveness and cost-effectiveness of different models of managing long-term oral anticoagulation therapy: a systematic review and economic modelling. Health Technol Assess 2007;11:iii-iv, ix-66
3. Summary of 2012/13 QOF changes. United Kingdom: NHS Employers, 2012. http://www.nhsemployers.org/SiteCollectionDocuments/Summary%20of%20QOF%20changes%20for%202012-13%20-ja21111.pdf. Accessed April 30, 2013
4. Keeling D, Baglin T, Tait C, et al. Guidelines on oral anticoagulation with Warfarin, 4th edn. Br J Haematol 2011;154:311-24
5. Gallagher A, Setakis A, Plumb J, et al. Risks of stroke and mortality associated with suboptimal anticoagulation in atrial fibrillation patients. Thromb Haemost 2011;106:968-77

6. Heneghan C, Ward A, Perea R, et al. Self-monitoring of oral anticoagulation: systematic review and meta-analysis of individual patient data. Lancet 2012;379:322-34
7. Bloomfield HA, Krause A, Greer N, et al. Meta-analysis: effect of patient self-testing and self-management of long-term anticoagulation on major clinical outcomes. Ann Intern Med 2011;154:472-82
8. Dolan G, Smith LA, Collins S, et al. Effect of setting, monitoring intensity and patient experience on anticoagulation control: a systematic review and meta-analysis of the literature. Curr Med Res Opin 2008;24:1459-72
9. Heneghan C, Alonso-Coello P, Garcia-Alaminio JM, et al. Self-monitoring of oral anticoagulation: a systematic review and meta-analysis. Lancet 2006;367:404-11
10. Garcia-Alamino JM, Ward AM, Alonso-Coello P, et al. Self-monitoring and self-management of oral anticoagulation. Cochrane Database Syst Rev 2010;14:CD003839
11. Brown A, Wells P, Jaffey J, et al. Point-of-care monitoring devices for long-term oral anticoagulation therapy: clinical and cost effectiveness. Technology report No 72. Ottawa: Canadian Agency for Drugs and Technologies in Health, 2007
12. Gailly J, Gerkens S, Van Den Bruel A, et al. Use of point-of care devices in patients with oral anticoagulation: a Health Technology Assessment. Reports vol 117C. Brussels: Belgian Health Care Knowledge Centre, 2009
13. Bayer Plc. Submission to NICE: Single technology appraisal of Rivaroxaban. London, 2011. http://www.nice.org.uk/nicemedia/live/13308/57753/57753.pdf. Accessed April 30, 2013
14. National Institute for Health and Clinical Excellence. Costing template: Dabigatran etexilate for the prevention of stroke and systemic embolism in people with atrial fibrillation. London, 2012. http://guidance.nice.org.uk/TA249/CostingTemplate/xls/English. Accessed April 30, 2013
15. Gardiner C, Williams K, Longair I, et al. A randomised control trial of patient self-management of oral anticoagulation compared with patient self-testing. Br J Haematol 2006;132:598-603
16. Parry D, Bryan S, Gee K, et al. Patient costs in anticoagulation management: a comparison of primary and secondary care. Br J Gen Pract 2001;51:972-6
17. Department of Health. NHS Reference Costs 2010/11. London, 2012. http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_131140. Accessed April 30, 2013
18. Roche Diagnostics. Coaguchek XS System. England, 2012. https://shop.coaguchek.com/buy/xs-system?language=en. Accessed April 26, 2013
19. Personal Social Services Research Unit. Unit Costs of Health and Social Care. UK, 2011. http://www.pssru.ac.uk/project-pages/unit-costs/2011/index.php. Accessed April 30, 2013
20. Saka O, McGuire A, Wolfe C. Cost of stroke in the United Kingdom. Age Ageing 2009;38:27-32
21. Berg J, Lindgren P, Nieuwlaat R, et al. Factors determining utility measured with the EQ-5D in patients with atrial fibrillation. Qual Life Res 2010;19:381-90
22. Robinson A, Thomson R, Parkin D, et al. How patients with atrial fibrillation value different health outcomes: a standard gamble study. J Health Serv Res Policy 2001;6:92-8
23. Hallan S, Asberg A, Indredavik B, Wideroe TE. Quality of life after cerebrovascular stroke: a systematic study of patients' preferences for different functional outcomes. J Intern Med 1999;246:309-16
24. Sullivan PW, Arant TW, Ellis SL, Ulrich H. The cost effectiveness of anticoagulation management services for patients with atrial fibrillation and at high risk of stroke in the US. Pharmacoeconomics 2006;24:1021-33
25. Lacey EA, Walters SJ. Continuing inequality: gender and social class influences on self perceived health after a heart attack. J Epidemiol Community Health 2003;57:622-7

