Retrospective Costing of Warfarin

Abstract:
C Walsh1, A Murphy2, A Kirby2, C Vaughan3 1Cork University Hospital, Wilton, Cork 2School of Economics, University College Cork, Cork 3Mercy University Hospital, Grove Lane, Cork In Ireland, there are four anticoagulants available for prescribing to patients with atrial fibrillation for stroke prevention. A key feature of the three most recent anticoagulants is that monitoring is redundant. This despite, there is continued prescribing of the incumbent anticoagulant, warfarin, which requires monitoring. Lack of information regarding the cost of monitoring, and the extra burden it places on health budgets and patients, motivated this costing study. Using micro costing, the costs of warfarin treatment (including monitoring) was disaggregated and isolated from both the patients and health care provider perspectives in a Cork hospital. Costs to the health care provider per patient per clinic visit were €21.57. Patient costs incurred per patient per clinic were €48.50. Thus, the total costs per patient per visit were €70.07. This result reveals that while the pharmaceutical cost of warfarin is low; it is not an inexpensive therapy when monitoring costs are considered.

Methods
A bottom up approach, using micro costing, is employed to estimate the costs associated with monitoring warfarin per incidence in a Cork based clinic. This requires identifying, measuring and valuing the resource impact of the treatment in monetary terms. A probabilistic sensitivity analysis (PSA) was performed as a means of addressing these uncertainties in the parameters. This required characterising uncertainty in input parameters pertaining to the probability of measuring uncertainty through the model using a Monte Carlo simulation and presenting the implications of parameter uncertainty.

Results
Patient Costs
The results of the semi-structured interview revealed that there are three categories of patient costs: travel, waiting time and additional costs (including food). The average age of the patients in the sample was 70 years. From examining previous literature this age profile is typical of a population prescribed warfarin. The average distance travelled to the clinic was 11.44km, with an associated standard deviation of 15.16km. The results revealed that 31% used public transport and the remainder used private transport as a means of travelling to the clinic. The average travel cost for using private transport was €14.03 with an associated standard deviation of €5.93. Using public sector mileage rates of €0.64 per km, the average travel cost for using private transport was €5.02 (given that 69% of patients utilised private transport). In addition, 44% incurred parking expenses averaging at €4.25, with an associated standard deviation of €7.89.

Health Care Provider Costs
The costs to the health care provider were classified as laboratory, staffing and overhead costs. With regard to laboratory costs, the consumables identified were: syringes, test tubes, sample plates, reagent tubes and analysers. The observational study revealed one of each consumable is utilised per patient, per clinic visit. The costs for each consumable were sourced from the Finance Department in the hospital, shown on Table 1, averaging €0.64 per patient, per clinic. There are also wage costs associated with the laboratory analysis. Using the Department of Health salary scales the median point on the scale for a senior laboratory technician was selected, PRSI and pension costs were added (as per HIQA guidelines see Table 2, as per Government guidelines). The observational study revealed that there are 25 patients per clinic and technicians can analyse 15 samples per hour. Therefore, the average cost of the laboratory analysis per clinic was €46.29 or 1.85 per patient, per clinic visit.

Staff costs were also incurred for nursing and administrative staff. The observational study conducted provided the
estimates of staffing resources and time. An administrator is employed for five hours per clinic at an hourly rate of €20.47 per hour (estimated as per HIQA guidelines, Table 2). The costs per clinic were 102.37 and €102.37 if 25 patients were scheduled per clinic; the average cost per patient, per visit was 4.09 (see Table 2). Similarly, at an hourly rate of 22.95 for a nurse (see Table 2) the cost per clinic was 344.25 with three nurses, which increased to 133.78 per patient, per clinic visit. Overheads were estimated at 40% of basic wage costs, as per HIQA guidelines. As shown in Table 3, overheads were 30.35 per clinic (assuming one hour of overhead cost per clinic). This equates to 1.21 per patient per clinic visit. The total health care provider costs incurred, per patient, per clinic attended was 21.57 (the probabilistic sensitivity analysis revealed a standard deviation around this of 5.06).

With respect to assigning distributions to the parameters for the probabilistic sensitivity analysis: Beta distributions were used to model the number of days hospitalization and waiting time parameters from the literature. Gamma distributions were applied to the cost parameters as they were positive and continuous. The input parameters and 95% confidence intervals surrounding the outputs are presented on Table 4.

### Discussion

Owing to population growth, aging populations and rising health care costs (including prescription drugs), health budgets worldwide are coming under increasing pressure to deliver value for money health care. Changing demographics lead to a shift in health care demand. One condition which has received attention in this respect is thromboembolic disease (TIA or a stroke). It is estimated that common causes of death worldwide and responsible for 10% of deaths. While for those who survive there is a significant degree of disability resulting in dependence. In Ireland it is estimated that 10,000 individuals with stroke are admitted to hospitals per annum and strokes account for 7% of mortality. Furthermore it is estimated that the total cost of managing stroke patients in Ireland is in excess of 1,044 million Euros. In light of this increased risk, AF patients are treated with anticoagulants like warfarin to reduce the risk of stroke. The monthly pharmaceutical cost of warfarin is 2.13 per patient, with additional monitoring warranted to ensure clinical effectiveness. Lack of information regarding monitoring costs, and the extra burden on health budgets and patients, motivated this costing study. Using micro costing the costs of warfarin treatment was disaggregated and isolated from both the patients and health care providers perspectives in a Cork hospital.

This study using micro costing estimated the total cost of monitoring (including total patient and health care provider costs) per patient, per visit at 70.07 (the probabilistic sensitivity analysis revealed a standard deviation around this of 1.15). In addition, patients have on average two clinic visits per month and require in the first year of therapy an in-patient stay of 4-5 days at an estimated cost of 4,747 (given an average cost per bad day of 945, increased to 1478 for every bad day, this is adjusted for inflation 3). In contrast, novel anticoagulants do not incur these monitoring costs. Although the pharmaceutical cost of warfarin is low; our study reveals it is not an inexpensive therapy when monitoring costs are considered. This study highlights the significant costs of monitoring warfarin, both for warfarin provider, which were not previously measured. With an aging population and an increased risk of the incidence of strokes, health care budgets are under increased pressure. This retrospective, single centre costing study demonstrates how by broadening the perspective of cost analyses the full costs of warfarin can be considered. Given their significance, such monitoring costs should be incorporated into adoption decisions at patient level and when considering the cost effectiveness and budget impact of alternative anticoagulants nationally.

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### References


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