Cost-Utility Study of Warfarin Genotyping in the VACHS Affiliated Anticoagulation Clinic of Puerto Rico

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Objective: To evaluate the cost-utility of the pharmacogenetic-guided dosing of warfarin (PGx), when compared to the current dosing strategy.

Methods: A Markov model was developed to assess the impact of the genotyping-guided warfarin dosing in a hypothetical cohort of patients. The model was based on the percentage of time patients spent within the therapeutic international normalized ratio (INR) range (PTTR). PTTR estimates and genotype distribution were derived from a cohort of patients (n = 206) treated in the Veteran Affairs Caribbean Healthcare System (VACHS) and from results of other research study. Costs, utilities and event probability data were obtained from the literature. Probabilistic and one-way sensitivity analyses were performed to explore the range of plausible results. Willingness to pay was established at $50,000 per Quality Adjusted Life Year (QALY) gained.

Results: According to our model, the PGx strategy showed a QALY increase of 0.0021, with an increase in total cost of $272. This corresponds to an incremental cost-utility ratio (ICUR) of $127,501, ranging from $95,690 to $148,611. One-way sensitivity analysis revealed that the ICURs were more sensitive to the cost of genotyping and the effect of genotyping on the PTTR.

Conclusion: Our model suggests that the warfarin PGx was not superior to the standard of care dosing strategy in terms of cost-utility. [*P R Health Sci J 2017;36:165-172*]

Key words: Warfarin, Pharmacogenomics, Cost-utility, Puerto Rico

Warfarin is the most commonly prescribed oral anticoagulant, a group of pharmacologic agents used to treat and prevent thromboembolic events (TEs), especially in patients with atrial fibrillation and mechanical heart valves (1). Although it has been proven to reduce the risk of such events, its narrow therapeutic index can lead to an increased risk of serious bleeding events, TEs and cause substantial morbidity and mortality (2). In the US National Surveillance of Emergency Department Visits for Outpatient Adverse Drug Events, warfarin was the second leading drug-related reason for emergency department visits (3). In order to decrease the morbidity and mortality associated with warfarin, it is necessary to improve the methods currently employed to reach a therapeutically effective dose. Dose-dependent factors include age, weight, diet, concurrent medications and genetic variability (4, 5). Multiple genetic polymorphisms that affect the pharmacokinetics and pharmacodynamics of warfarin have been identified, with common findings on the cytochrome P450 isoform 2C9 (CYP2C9)-encoding gene, which encodes a drug-metabolizing enzyme responsible for the major elimination pathway of S-warfarin. *CYP2C9* is classified as a wild-type and variant genotype, the latter metabolizing warfarin less efficiently, resulting in drug remaining in circulation for a longer time, thus lower doses are required to achieve anticoagulation (2, 6). The *VKORC1* gene (another common polymorphic locus), encodes vitamin K-dependent epoxide reductase enzyme subunit C1, a primary target of warfarin activity (6). *VKORC1* has been classified into three haplotypes, AA, AB and BB, ranging from low, to average and high warfarin dose requirements respectively

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(2). Patients carrying multiples polymorphisms on the *CYP2C9* and *VKORC1* genes have shown higher frequency of clinical visits and more frequent dose adjustments, lengthening the time to reach warfarin dose stability (7, 8). Laboratory tests to determine the *CYP2C9* and *VKORC1* polymorphic profile are commercially available and can be utilized to perform pharmacogenetic-guided dose determination (PGx) (5).

Applications of warfarin pharmacogenomics can be controversial and are weighted heavily on economic practicality. The current high cost of the pharmacogenomic testing begs the question whether PGx of warfarin is economically viable when implemented to warfarin treatment (1, 4, 8-11). The cost of pharmacogenetic screening for *CYP2C9* and *VKORC1* range from $300-$800 (12). Current understanding of the cost-effectiveness of PGx testing in warfarin treatment is unclear (4, 10, 12, 13). The current cost per INR test (CPT 85610) at the VACHS-affiliated anticoagulation clinic in San Juan, PR is approximately $4.54 per test (personal communication). Usually, a patient taking warfarin is tested at least nine times per year, for a total cost of $41 per year (14). To assess the real-world cost of pharmacogenetic testing it is important to consider the cost of adjusting warfarin dose, the cost of treating its adverse drug reactions (ADR), and the effect on the patient's quality of life (4, 8, 10, 12). Although some studies have concluded that warfarin PGx is unlikely to be cost-effective for general patients at present (12), other authors have found different influential factors to improve the cost-effectiveness of warfarin genotyping, including low genotyping cost, faster turnaround time, high effectiveness in improving anticoagulation control/event rate, and applying warfarin pharmacogenetic to patients with high bleeding risk or poor anticoagulation control (1, 2, 4, 5, 8-10, 15). Moreover, the combined prevalence of multiple warfarin-related polymorphisms is higher in Puerto Rican patients than in other early studied populations, limiting the extrapolation of their results to this admixed Hispanic population (6, 16). Accordingly, this study was aimed to determine economic viability of the PGx of warfarin in the VACHS-affiliated anticoagulation clinic in San Juan, PR through a cost-utility analysis in warfarin-treated Puerto Rican patients, utilizing an Incremental Cost Utility Ratio (ICUR) and establishing a willingness to pay of $50,000 per QALY gained, as well as to explore the range of potential outcomes using sensitivity analysis.

Methods

Overview

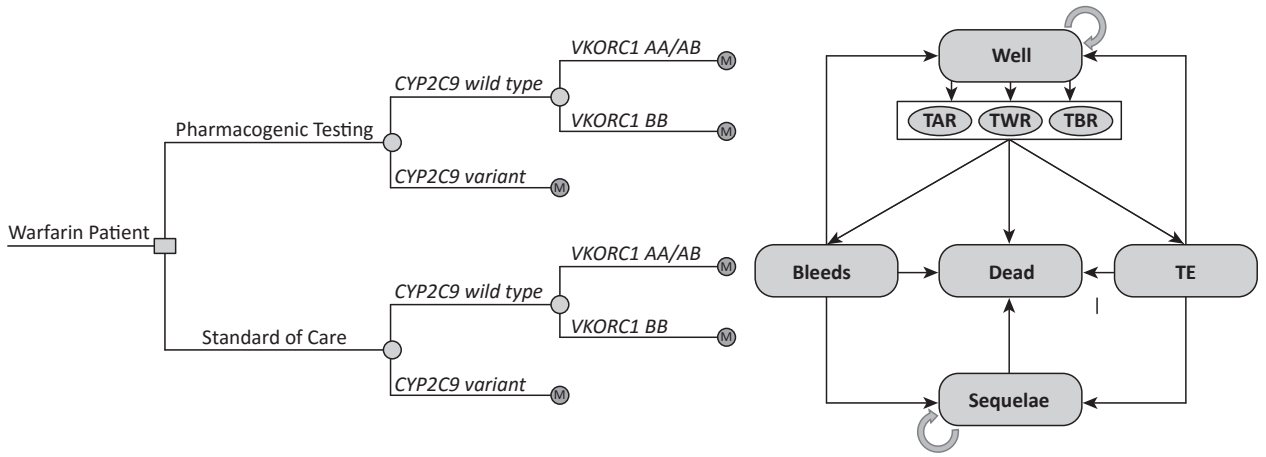
In order to perform a cost-utility analysis, an analytical Markov model was created in which one hypothetical cohort of Puerto Rican patients were treated with warfarin in order to predict the direct medical care cost of the treatment (e.g. drug, monitoring, costs associated with adverse drug events, etc.). One of the arms in this cohort was composed of patients initiated on PGx-guided warfarin therapy, while the other was composed of patients started on warfarin therapy guided by the standard empirical dosing strategy (a.k.a., the standard of care, SOC). A Markov model was used to project the incidence of TEs, bleeds, deaths, costs and QALYs. The percentage time on INR therapeutic range (PTTR) was utilized in this study as an anticoagulant measure to project the incidence of bleeds and TEs associated with warfarin therapy, as previously described by Meckley et al (2). The prevalence of warfarin polymorphisms in Puerto Rico and the PTTR for the branch receiving the standard empirical dosing was calculated from 275 warfarin-treated Puerto Rican patients in the VACHS-affiliated anticoagulation clinic. Since the warfarin PGx has not been implemented in Puerto Rico, the PTTRs on this treatment branch were estimated using data from the literature (1, 4). All costs assessments were obtained from a healthcare provider perspective and costs were discounted at 3% per year. In order to construct the analytical decision model, we used Tree-Age Pro Suite Software, from TreeAge Software Inc. The protocol was approved by the UPR-MSC Institutional Review Board (IRB approval protocol #A4070115).

Model structure and Clinical inputs

Our analytical model was based on the Markov model proposed by Meckley et al. (2) and began with a decision tree representing two strategies: PGx of warfarin and the standard empirical dosing method or SOC (Figure 1). Patients were then stratified by genotype, first by the CYP2C9 status and further stratified by *VKORC1* status. *CYP2C9* variants were not subdivided by *VKORC1* status because of the small number of subjects that would result (2). Subjects subsequently entered a Markov model depicting the risk of bleeding events, TEs and death (Figure 1). Patients moved through these health states on monthly cycles, and the transitional probabilities of events were based on large cohort studies, clinical trials and national data sources (2, 4). The probability of moving from a "no-event" state to a bleeding event or TE was solely based on the PTTR.

TEs were classified as myocardial infarction (MI), ischemic strokes and transient ischemic attacks (TIAs). Ischemic strokes represented 41% of the TEs, TIAs represented 29% of TEs and MIs represented the rest. Patients that suffered from an MI had a 7% mortality risk. If they suffered an ischemic stroke they had a 9% chance of dying and 47% chance of having a sequelae. If the patient entered the health state of sequelae, they remained in that health state until death, with a monthly mortality rate of 5.6%. TIA patients were assumed to recover within the next month. The model is lifetime horizon.

Bleeds were simplified and only classified as gastrointestinal (GI) bleeds or intracranial hemorrhage (ICH). GI bleeds represented 83% of bleeds and the patients were assumed to recover within the next month. ICH represented 17% of bleeds, had a 43% chance of recovery with long term sequelae and a 56% chance of death. The background mortality was based solely on the patient's age.



TAR stands for % time above the therapeutic (target) INR range; TWR means % time within the therapeutic range; TBR stands for % time below the therapeutic INR range.

Figure 1. Decision tree and State diagram

Health state utility and Cost data

The utility estimates were obtained from published literature (2). Acquisition of medical costs for warfarin pills, anticoagulation clinic management and INR tests were obtained from the VACHS-affiliated anticoagulation clinic at San Juan, Puerto Rico (Pharmacy Service Department). Genotyping costs were obtained from multiple laboratories (i.e., Genomas Inc. Laboratory of Personalized Health, CT; Hato Rey Pathology Labs, PR) and for the base case it was established to be $300. This model assumed an average of one medical appointment and one INR testing per month for all patients. The costs associated with hospitalization, bleeding and thromboembolism management were obtained from the literature (Table 1) (2, 17). Only direct medical costs were included in this study from the perspective of the healthcare provider. Costs for anticoagulation-related clinical visits were estimated from the salary of a clinical pharmacist and 30 minutes per intervention (Table 1). The base-year of the sequelae cost was 2007, taken from Meckley et al. (2); the base-years of the genetic tests, INRs, and warfarin costs: 2015-2016, obtained from Genomas Inc. and VACHS Pharmacy Service department. Base-year of other costs was 2014, taken from Nguyen E. et al. (2, 17).

Modeling clinical events using the international normalized ratio

The desired INR range for most warfarin indications is between 2 and 3. The more time spent below INR range increases the risk of TEs while the more time spent above INR range will increase the risk of bleeds. Relationships between PTTR, bleeds and TEs were based on data from literature (2). The PTTR for the standard empirical dosing strategy was calculated from the INR data collected from the 275 Puerto Rican patient cohort using the Rosendaal method, followed by determining percentage of time during which the INR values lie between 2 and 3, above 3, and below 2 (18). The PTTR results were subdivided into the corresponding *VKORC1* and *CYP2C9* genotypes (Figure 2).

The PGx, when compared to the SOC, is expected to decrease the time to achieve the stable warfarin dose (2, 8, 10). However, the difference between the standard warfarin dosing and pharmacogenomics dosing is expected to be minimal after reaching dosage stability. In some patients, the time to achieve a stable maintenance dose could take as long as 6 months (2). Based on these observations, the PTTR was calculated for the SOC dosing strategy branch at month 1 and averaged for months 2-6. For the PGx branch, an increase in the time within the INR therapeutic range was assigned to the results obtained for the SOC branch, and this linear increase weaned until month 6, where both treatment groups had the same PTTR from that point on. The PTTRs for the PGx treatment branch were estimated from the literature, including clinical trials and prior cost-effectiveness studies (1, 4). Considering the findings reported on these studies, an 8.0% increase in the time within therapeutic INR range with the PGx strategy was chosen for the base case.

Sensitivity and Scenario analysis

A one-way sensitivity analysis was performed for each parameter included in table 1, which graphically depicts how parameter variations alter the outcome. The ranges for the effect of the variables were obtained from previous cost-effectiveness studies (2) and were compared to previous clinical trials.(4) Moreover, a Monte Carlo simulation was performed using a hypothetical cohort of 1,000 patients to model cost, utility and ADR between treatment groups.

Results

Table 1 shows the baseline values for the corresponding model parameters, representing probabilities, costs and utilities, as

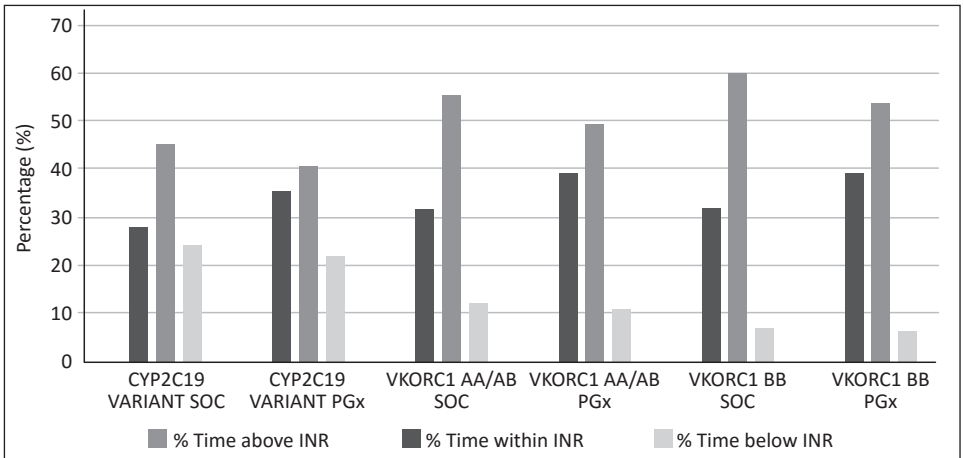
Table 1. Probabilities, costs ($US) and utilities and the source of the parameters used in the analysis.

Parameter		Baseline Values	Range	Reference
Genotyping Prevalence (%)				
CYP2C9 variant		28.4		†
VKORC1 AA,BB		38.46		†
VKORC1 AA,AB		61.54		†
Annual Incidence of Adverse Events (%)				
Above Therapeutic INR range	Major Bleeds	15.7	12–20	Meckley et al (2010)
	TE	2.4	2–3	Meckley et al (2010)
Within Therapeutic INR range	Major Bleeds	5.7	4–7	Meckley et al (2010)
	TE	3	2–4	Meckley et al (2010)
Below Therapeutic INR range	Major Bleeds	6.5	5–8	Meckley et al (2010)
	TE	16.2	12–20	Meckley et al (2010)
Bleeding Event (%)				
ICH		16	13–21	Meckley et al (2010)
death		56	42–70	Meckley et al (2010)
sequelae		43	32–54	Meckley et al (2010)
recovery		1	N/A	Meckley et al (2010)
death/month*		5.6	4–7	Meckley et al (2010)
TE Event (%)				
TIA		29	22–36	Meckley et al (2010)
Ischemic Strokes		41	31–51	Meckley et al (2010)
death		9	7–11	Meckley et al (2010)
sequelae		47	35–59	Meckley et al (2010)
recovery		44	N/A	Meckley et al (2010)
death/month*		5.6	4–7	Meckley et al (2010)
MI		30	23–38	Meckley et al (2010)
Death		7	5–9	Meckley et al (2010)
Utilities				
ICH bleed		-0.1385	-0.1182 to -0.1602	Meckley et al (2010)
Extracranial bleed		-0.0600	-0.02 to -0.1	Meckley et al (2010)
TIA		-0.1032	-0.0881 to -0.1189	Meckley et al (2010)
Ischemic Strokes		-0.1385	-0.1184 to -0.1600	Meckley et al (2010)
MI		-0.1247	-0.10645 to -0.1436	Meckley et al (2010)
Atrial Fibrillation		0.8100	0.7784–0.8430	Meckley et al (2010)
Warfarin		-0.1385	N/A	Meckley et al (2010)
Cost (US$)				
Cost of INR (per analysis)		4.54		‡
Cost of Pharmacogenetic test		300		*
Cost of Warfarin medication (per unit)¶		0.45	0.32-0.59	‡
Cost of management per event (US$)				
Extracranial Hemorrhage		9683	4841-14518	Nguyen et al (2016)
Intracranial Hemorrhage		25976	12987-38964	Nguyen et al (2016)
TIA		9932	4966-14898	Nguyen et al (2016)
Ischemic Stroke		11515	5758-17274	Nguyen et al (2016)
MI		19079	9540-28618	Nguyen et al (2016)
Sequelae		3858	2000-8000	Meckley et al (2010)

(†) Adjudicated by authors; (‡) Obtained from VA Caribbean Healthcare System of San Juan, Puerto Rico; (*) Obtained from Genomas Inc. Laboratory of Personalized Health, and Hato Rey Pathology Labs in Puerto Rico. ¶Warfarin oral tablet (mg) medication cost depends on dosage unit (i.e., cost of tablet units with 2.5 mg dosage strength differ from that of 5 mg strength) and insurance plan.

well as the source of data/evidences used in the analysis that supports assumptions considered for the model. In the analysis performed, the PGx increased QALYs by 0.0021 (p=0.631), and costs by $271.6 (p<0.001) when compared with the SOC, for an incremental cost of $127, 501 per QALY (Table 2). With the assumption of a 8% increase in the time within INR range provided by the PGx testing, the Monte Carlo performance did not show a significant difference between the PGx testing and the SOC in terms of bleeds (700 vs 702, p=0.922), and TEs (462 vs 463, p=0.964). As depicted in table 2, the costs-effectiveness results were not homogeneous between genotyping groups. During the first year, no substantial differences were observed between the groups for bleeds, TEs or deaths. Nevertheless, when the results are compared at the lifetime horizon, a greater increase in QALYs was observed for the *CYP2C9* variant group, resulting in a favorable ICUR ($95,690 per QALY) when compared to the other groups.

Probability distribution ranges (values in parentheses) are presented in the one-way sensitivity analysis (Figure 3, legend). This probabilistic sensitivity analysis was performed to represent parameter uncertainty in modeling. After performing the Tornado analysis (Figure 3), it revealed that the ICUR was more sensitive to the cost of the pharmacogenomic testing, followed by the increase in PTTR offered by the PGx. Figure 4, panels A and B, depict the results of one-way sensitivity analyses over a range of uncertainty for the effect of genotyping cost on cost/utility and ICUR, respectively. The ICUR was then compared to a willingness-to-pay threshold of $50,000 per QALY to determine whether the more effective strategy can be afforded. Figure 4, panel A, identifies a threshold of $40 (break-even point). If genotyping cost is less than or equal to $40, then cost/utility is better for the PGx strategy; whereas, the SOC prevails if it is greater than $40. One-way sensitivity analysis on this parameter also revealed that if the test had a cost equal or less than $37.5, the PGx would be



The source of all data depicted in this figure is the computerized patient record system (CPRS) of the VACHS at San Juan. SOC stands for Standard of Care; PGx means pharmacogenomics; *CYP2C9* stands for the gene encoding the enzyme cytochrome P450 isoform 2C9; *VKORC1* stands for the gene encoding the vitamin K-dependent epoxide reductase enzyme subunit C1; A and B correspond to the haplotypes A and B for *VKORC1*, respectively. INR is the international normalized ratio.

Figure 2. Percentage Time within, above and below Therapeutic Range for all Patients under both Treatment Modalities, Stratified by Genotype.

cost-effective with a willingness to pay of $50,000 per QALY (Figure 4, panel B). Meanwhile, if the test had a cost equal or less than $29, the PGx would dominate. On the other hand, the increase in PTTR offered by the PGx would have to be equal or greater than 63.7% in order to achieve an ICUR below $50,000.

Discussion

In order to assess the cost-effectiveness of the PGx of warfarin in the Puerto Rican population, we developed a decision tree model populated with data retrieved from the literature. Our results showed that although the PGx was somewhat favored in terms of effectiveness, due to the increase in costs in the PGx, the SOC strategy was favored in terms of the incremental cost-effectiveness ratio (ICER). A tornado sensitivity analysis showed that the ICER was more sensitive to changes in the cost of the pharmacogenomic testing and changes in the increase in time within INR range offered by the PGx. Nevertheless, the cost for the pharmacogenomic test has to be less than or equal to $37.5 or an increase in time within INR range equal or greater than 63.7% are needed in order to meet the $50,000 per QALY threshold.

Given the fact that under no scenario the PGx demonstrated a higher cost-utility than the SOC (i.e., if the cost of genotyping is $300 and the effectiveness of the PGx is found to be limited to an 8% increase in the PTTR), pharmacogenetic testing should not be routinely recommended in current practice for every single patient at VACHS. However, it could still be useful for certain high-risk patients when clinical management of warfarin therapy is often troublesome and stabilization takes longer than expected. Moreover, taking into consideration that the two most critical variables are the cost of genotyping and the effectiveness of the pharmacogenetic test, the future of this intervention looms promising. It is due to the fact that the cost of this test is expected to decrease as time and testing techniques progress, as well as more pharmacogenomic dosing determinants are identified. Furthermore, since the second largest uncertainty of the cost-utility test is the effectiveness, clinical trials should be conducted to establish the difference in PTTR in a population with a high prevalence of combinatorial warfarin-related polymorphisms such as the Puerto Rican population. If the effectiveness is found to be higher in this population versus other reports, this could decrease the incidence of bleeds, TEs, costs and increase QALYs, thus increasing its cost-effectiveness.

After analyzing the results of this study, it was found that the PGx increased QALYs by 0.0021 when compared with the SOC. This result was consistent with Meckley et al (2) findings (QALYs net increase of 0.0027 or 1 day). Verhoef et al (1) found similar results since they estimated that PGx strategy increased the QALYs by 0.0057 or 2 days. However, when the ICUR were compared, the $127,501 per QALY estimated in this study was significantly higher than those earlier reported by Verhoef et al and Meckley et al. (1-2), who obtained ICURs of $2,980 and $60,750, respectively. A possible explanation for these findings is that in our base-case analysis, we assumed a higher cost

Table 2. Bleeds, Thromboembolic Events (TEs), Deaths, Costs, QALYs and Incremental Cost-Utility Ratios (ICUR).

Population	Strategy	Bleeds	TEs	Deaths	QALYs (years)	Costs (US$)	ICUR (US$)
All patients	PGx	10.51	4.83	3.21	7.1261	35,751.43	127,501
	SOC	10.69	4.87	3.24	7.1240	35,479.83	
	Change	-0.18	-0.04	-0.03	0.0021	271.60	
CYP2C9 Variants	PGx	10.21	5.16	3.23	7.2002	35,425.60	95,690
	SOC	1.35	5.25	3.26	7.1974	35,159.34	
	Change	-0.14	-0.09	-0.03	0.0028	266.26	
VKORC1 BB	PGx	10.80	4.55	3.21	7.1219	35,791.96	148,611
	SOC	11.00	4.56	3.24	7.1200	35,518.02	
	Change	-0.19	-0.02	-0.03	0.0018	273.94	
VKORC1 AA/AB	PGx	10.26	5.04	3.20	7.0781	35,927.51	129,014
	SOC	10.44	5.08	3.23	7.0760	35,65.72	
	Change	-0.18	-0.04	-0.03	0.0021	271.79	

*Bleeds, TEs and deaths were determined as events for the first year only.

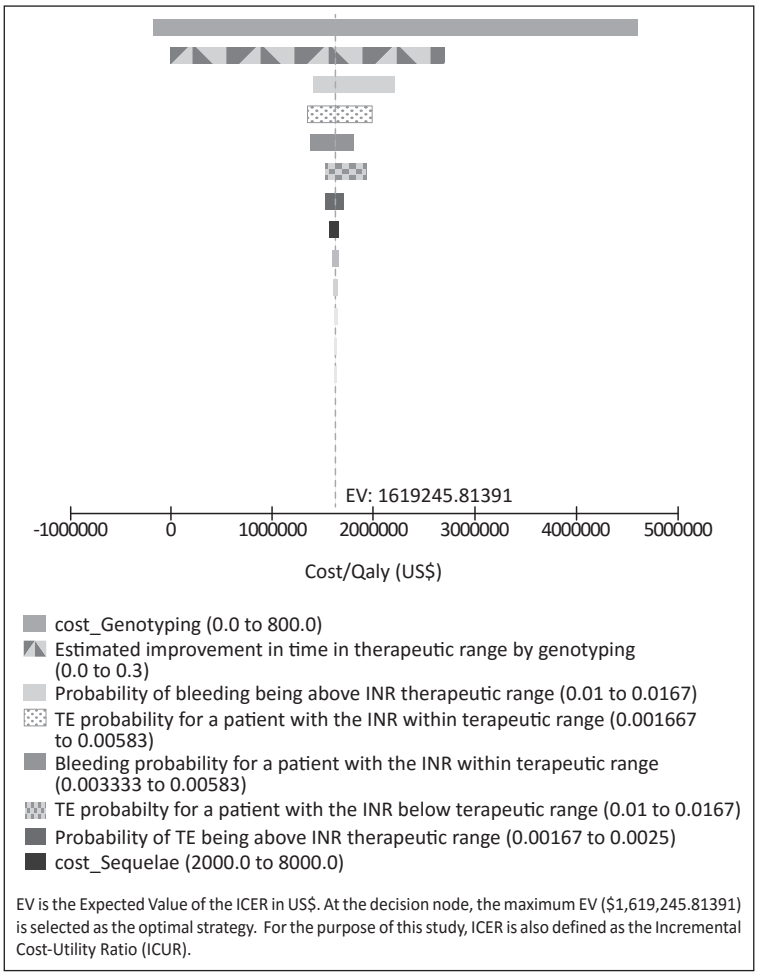


Figure 3. One-way sensitivity tornado analysis diagram of the incremental cost-effectiveness ratio (ICER).

for the PGx testing than in other studies. Additionally, Meckley et al (2) considered additional risk of bleeds in *CYP2C9* variant patients independent of the PTTR. In this study, a more conservative approach was taken, since the risk of bleeding was based solely on the PTTR. Due to the dissimilarity of these findings, we suggest that further PGx studies are required in order to determine the economic viability of this warfarin dosing method.

We based our study on the model proposed by Meckley et al, (2) thus the limitations of our study were very similar to theirs. We assumed that a cohort under the PGx method had the same probability to reach a certain INR range, regardless of the polymorphism frequency in that geographical area. Furthermore, one of the most important limitations of our study was that there is evidence suggesting that patients who are carriers of *CYP2C9* variants have a higher risk of bleeding at every INR range, when compared to non-variant patients (2). In a previous report of adverse events (mainly bleeding episodes) among warfarin-treated patients from VACHS (11), the probability of major bleedings in this cohort was higher (i.e., around 0.13) than that in the hypothetical cohort based on the proposed Markov model, which resulted in 0.01-0.02. Since the probability of moving from a "non-event" to a bleeding event in the proposed model was solely based on the PTTR (%), the difference might be a consequence of model specifications. In spite of the fact that the relationships between PTTR and bleeds were based on data from literature, the PTTR for the SOC was calculated from real INR data measured in the 275 Puerto Rican patient of the study cohort.

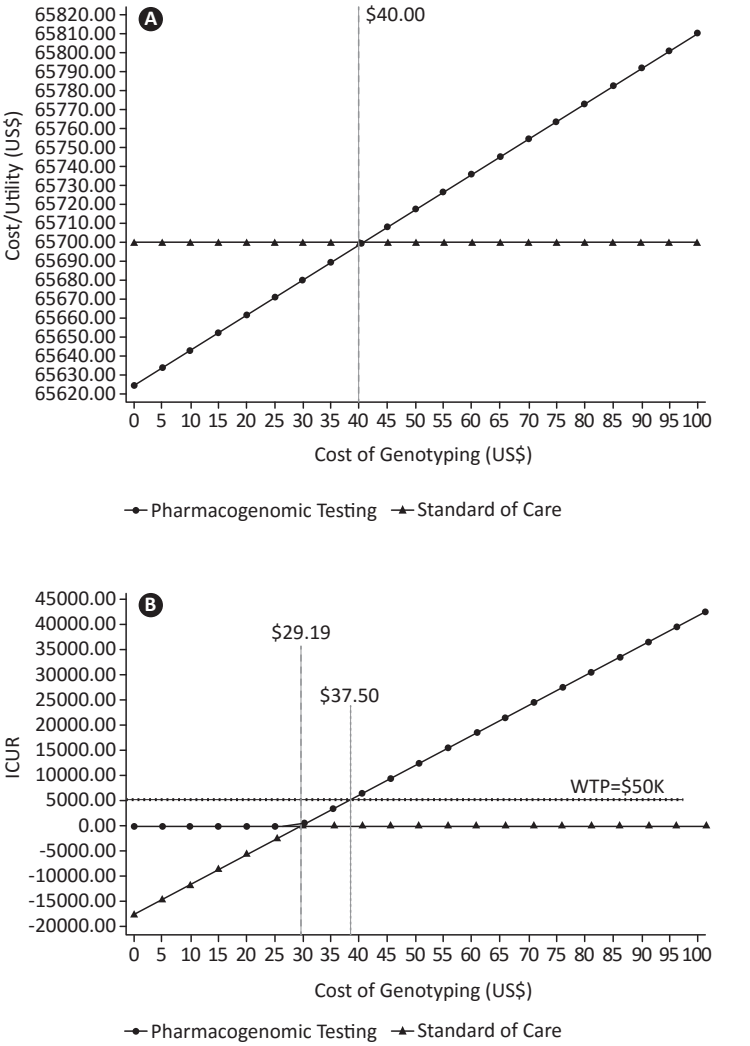
Studies have suggested that certain ethno-specific alleles occurring in Hispanics and other pharmacogenes (e.g., factor IX propeptide, *CALU*, *NQO1* and *CYP4F2*) may also influence warfarin dose, and they were not considered in this study (2, 19-20). Additionally, the sample utilized to estimate the PTTR in the Puerto Rican population was heterogeneous, since it included patients in the anticoagulation clinic from 1993 to 2012 (4). The estimation of the PTTR in the PGx branch of our analysis was based on data from small trials including non-Puerto Rican patients, whose genetic profile may differ significantly from our study population.

Conclusion

Our findings suggest that, under our model's assumptions, pharmacogenomic based warfarin initiation did not result in the improvement in QALYs necessary to establish cost-utility using $50,000 as the willingness to pay threshold. However, there is significant uncertainty in the results obtained and it could still be useful for certain high-risk patients. Clinical trials in the Puerto Rican population are needed to assess the effectiveness of the PGx of warfarin in routine clinical practice. Currently, a guideline for the implementation of the pharmacogenetic-guided warfarin dosing approach is available and makes actionable recommendations about the use of genotyping for optimal dose calculations in clinical practice (21). Although this clinical pharmacogenomic implementation consortium (CPIC) guideline does not include any specific recommendation for Hispanics, we seek to provide valuable information about Caribbean Hispanics in order to expand current recommendations to this underrepresented population.

Resumen

Objetivo: Evaluar la costo-utilidad de la dosificación de warfarina basada en farmacogenómica (PGx), comparada con a la estrategia tradicional de dosificación. Métodos: Un modelo de Markov fue desarrollado para evaluar el impacto del PGx de warfarina en un cohorte hipotético de pacientes. El modelo



The upper panel A identifies a break-even point between both strategies at $40 with regard to cost/utility. The lower panel B identifies a threshold at the parameter value of $37.5, below which the PGx strategy would be cost-effective given the WTP assumption. Another threshold of ~$29 is generated, below which the PGx dominates over the SOC.

Figure 4. One-Way Sensitivity Analysis for the Effect of Genotyping Cost on Cost/Utility (upper panel A) and the ICUR (lower panel B), using a willingness-to-pay (WTP) of $50,000/QALY

fue basado en el porcentaje de tiempo en que los pacientes se mantienen dentro del rango terapéutico de INR (PTTR). Estimados del PTTR y de la distribución de genotipos fueron obtenidas de un cohorte de pacientes (n = 206) tratados en el *Veteran Affairs Caribbean Healthcare System* (VACHS) y de resultados de otros estudios clínicos. Costos, utilidades y la probabilidad de que ocurrieran los eventos fueron obtenidas de la literatura. Se llevó a cabo un análisis de sensibilidad para explorar el rango de posibles resultados y se estableció una disposición a pagar de $50,000 por QALY ganado. Resultados: Según nuestro modelo, la estrategia basada en PGx demostró un aumento en QALY de 0.0021, con un aumento en costos total $272. Esto corresponde a un aumento en la relación de costo-utilidad incremental (ICUR) de $127,501, variando desde $95,690 a $148,611. El análisis de sensibilidad demostró que el ICUR fue más sensitivo al costo de genotipaje y al efecto del genotipaje en el PTTR. Conclusión: Nuestro modelo sugiere que el PGx de warfarina no fue superior a la estrategia tradicional de dosificación en términos de costo-utilidad.

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