COST-EFFECTIVENESS OF INSERTABLE CARDIAC MONITORS VERSUS STANDARD OF CARE OR DELAYED INSERTABLE CARDIAC MONITORING TO IDENTIFY ATRIAL FIBRILLATION AFTER CRYPTOGENIC STROKE

Reynolds MR[1], Sawyer L[2], Grimsey Jones F[2], Witte KK[3], Yaghi S[4], Ziegler PD[5], Kaplon R[5], Rosemas S[5], Mittal S[6]

INTRODUCTION

Insertable cardiac monitors (ICMs) are more likely than standard of care (SoC) intermittent external ECG monitors to detect atrial fibrillation (AF) in patients with cryptogenic stroke (CS). Anticoagulation is proven to decrease recurrent stroke risk in patients with documented AF.

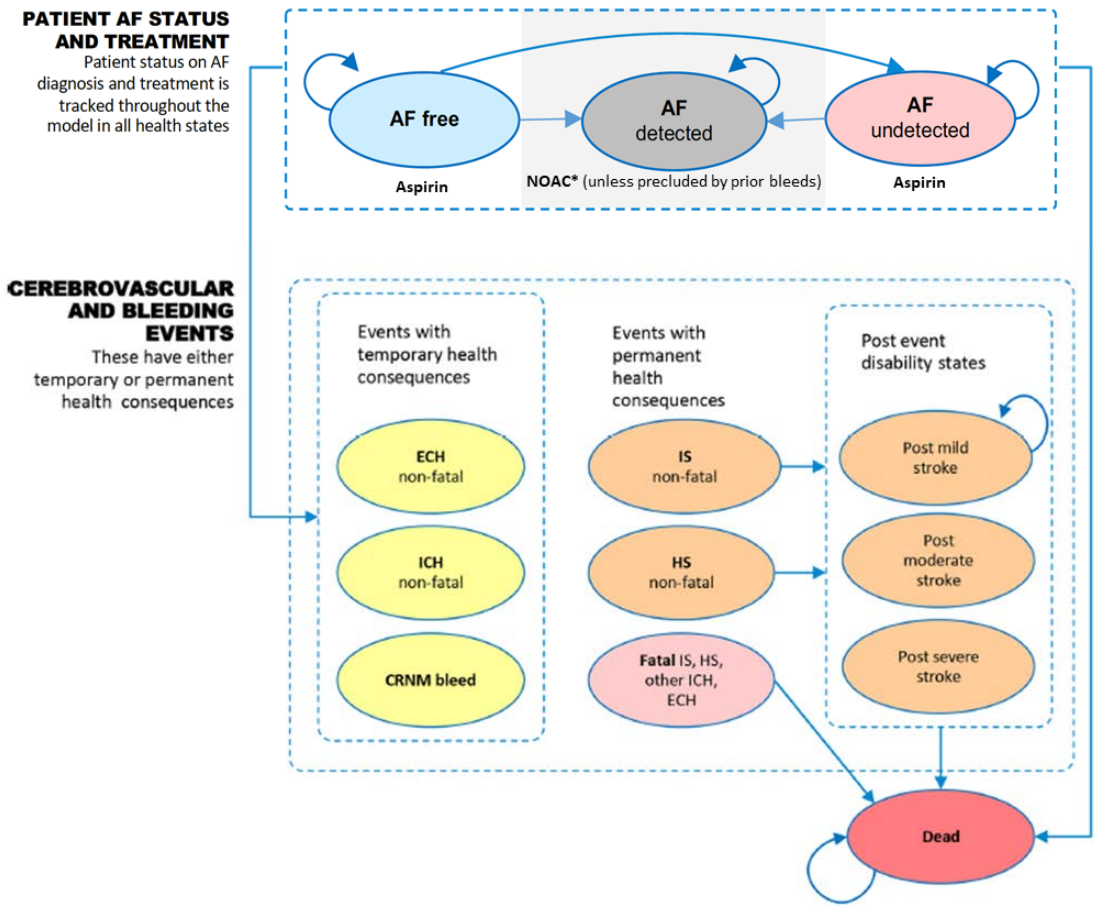
We aimed to evaluate the cost-effectiveness of immediate ICM at hospital discharge versus two alternative approaches of care in a CS population: 1) delayed ICM (7-day ECG monitor followed by ICM in patients remaining undiagnosed), and 2) SoC.

METHODS

A lifetime Markov model assessed the cost-effectiveness of immediate ICM vs. delayed ICM vs. SoC, from a U.S. payer perspective. SoC was based on the frequency of ECG/Holter monitoring observed in the trial. Patient characteristics and AF detection rates were based on the CRYSTAL-AF trial[1,2]: three-year diagnostic yield was 30% with ICM, and 3% in SoC; 1% of delayed ICM patients are diagnosed with the initial 7-day monitor.

AF detection resulted in a change from aspirin to non-vitamin K antagonist oral anticoagulant (NOAC), unless precluded by prior bleeds (Figure 1). Subsequent risks of ischemic strokes and bleeding events were based on patients' AF status, baseline $CHADS_2$ risk score, age, and treatment.

Figure 1. Model structure



*NOACs are administered in base case analysis, warfarin is substituted in sensitivity analysis. Abbreviations: AF: atrial fibrillation; NOAC: non-vitamin-K oral anticoagulants; HS: hemorrhagic stroke; ICH: intracranial hemorrhage; CRNM: clinically relevant non-major bleed; ECH: extracranial hemorrhage; IS: ischemic stroke.

Utilities were sourced from multiple existing U.S. publications and a prior economic evaluation of Reveal ICMs in patients with cryptogenic stroke.[3-6]

All costs related to diagnostic testing, medications, and the acute and follow-up treatment of strokes and major/minor bleed events were included. Costs were based on published U.S. data and national average payer payment data.[7] Costs and effects were discounted at 3% annually.[8]

RESULTS

Incremental Analysis:

Immediate ICM vs. SoC: Immediate ICM was associated with a 0.20 quality-adjusted life year (QALY) gain compared to SoC, 60 fewer strokes per 1,000 patients, and an incremental cost-effectiveness ratio (ICER) of $32,568 per QALY gained (Table 1). The ICER remained cost-effective across a wide range of scenarios. Expected value of ICM improved with increased recurrent stroke risk ($CHADS_2$ score).

Immediate ICM vs. Delayed ICM: Compared to delayed ICM, immediate ICM was associated with lower costs ($55,220 vs. $55,320), and a modest benefit in outcomes (gain of 0.0011 QALYs) making it the economically dominant strategy. In the delayed ICM strategy, 7-day monitor costs totaled $233,300 per 1,000 patients but identified AF in only 1% of patients (capturing 3% of patients ultimately diagnosed, as the remaining 97% were detected via ICM). In sensitivity analysis, the immediate ICM approach remained cost-saving when varying the duration of initial short-term monitor (1-, 2-, 21-, and 30-days).

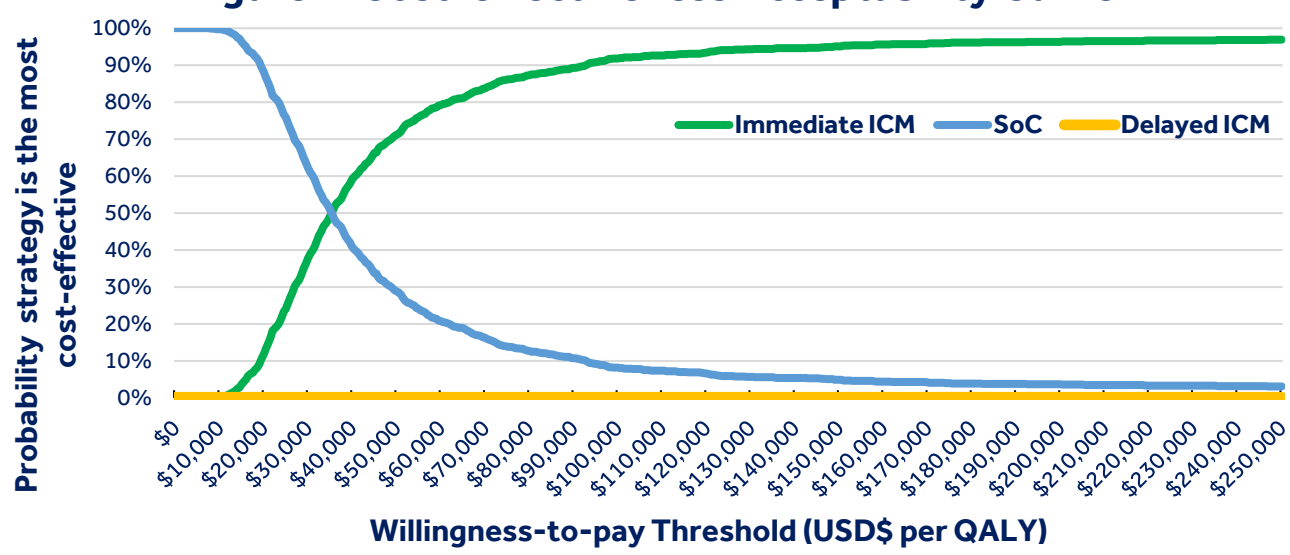
Table 1. Deterministic Cost-effectiveness Results

Strategy	Total costs	Ischemic Strokes	QALYs	ICER
Standard of Care (SoC)	$48,766	0.639	6.7864	-
Delayed ICM	$55,320	0.580	6.9834	-
Immediate ICM	$55,220	0.579	6.9845	-
Incremental: Immediate ICM vs. SoC	**$6,454**	**-0.060**	**0.1981**	**$32,568**
Incremental: Immediate ICM vs. Delayed ICM	**-$100**	**-0.001**	**0.0011**	**Dominates**

Probabilistic Sensitivity Analysis:

In probabilistic sensitivity analysis (1,000 simulations), immediate ICM was the strategy most likely to be cost-effective at each of the accepted cost-effectiveness thresholds of $50,000, $100,000, and $150,000 per QALY gained in the U.S. (Figure 2). At all thresholds, the delayed ICM approach had a 0% probability of being the most cost-effective strategy.

Figure 2. Cost-effectiveness Acceptability Curve



CONCLUSIONS

ICMs are a cost-effective diagnostic tool for the prevention of recurrent stroke in a U.S. cryptogenic stroke population compared with SoC. Immediate ICM was cost-saving compared to delayed ICM, due to the cost and low diagnostic yield of short-term monitoring and delay in AF detection.

REFERENCES

1. Sanna T, Diener HC, Passman RS, et al. N Engl J Med 2014; 370: 2478–2486.
2. Choe CC, Passman RS, Brachmann J et al. Am J Cardiol 2015; 116(6):889-93.
3. Samsa GP, Reutter RA, Parmigiani G, et al. J Clin Epidemiol 1999; 52(3):259-271.
4. Keun-Sik H, Jeffrey LS.. Stroke 2009; 40(12):3828-3833.
5. Gage BF, Cardinalli AB, Owens DK. Arch Int Med 1996;156(16):1829-1836.
6. Diamantopoulos A, Sawyer LM, Lip GY, et al. Int J Stroke 2016; 11(3):302-312.
7. Miller JD, Ye X, Lenhart GM, et al. CEOR 2016; 8:215–226.
8. Sanders GD, Neumann PJ, Basu A, et al. JAMA 2016; 316(10):1093-103.

[1]Baim Institute for Clinical Research, Boston, MA and Lahey Hospital & Medical Center, Burlington, MA, USA; [2]Symmetron Limited, London, UK; [3]Leeds Institute for Cardiovascular and Metabolic Medicine, University of Leeds, Leeds, UK; [4]Department of Neurology, New York Langone Hospital, Brooklyn, NY, USA; [5]Medtronic, Mounds View, MN, USA; [6]The Valley Health System, Ridgewood, NJ, USA.