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ORIGINAL RESEARCH

Atrial Fibrillation Screening in the Elderly

A Cost-Effectiveness Analysis for Public Health Policy

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ABSTRACT

BACKGROUND Atrial fibrillation (AF) screening identifies undiagnosed patients who can benefit from anticoagulant therapy, thereby reducing the risk of ischemic stroke. However, the long-term outcomes and costs related to population screening for this purpose in the Asian elderly remain unknown.

OBJECTIVES This study aimed to evaluate the cost-effectiveness of population screening for AF in the elderly in Taiwan and explore the optimal screening strategy from the health care sector's perspective.

METHODS Using a Markov decision-analytic model, we simulated lifetime outcomes and costs of AF screening in a cohort of 10,000 individuals aged 75. Comparative analyses with a nonscreening approach assessed prevented ischemic strokes, quality-adjusted life years (QALYs), costs, and incremental cost-effectiveness ratios (ICERs). Sensitivity analyses were conducted to address model uncertainty, while scenario analyses were performed to determine the optimal age and frequency of screening.

RESULTS One-time population screening for AF among 75-year-olds prevented 45 ischemic strokes and gained 47.42 QALYs, with an additional cost of $592,450 (ICER: $12,493 per QALY gained). The cost-effectiveness of screening remained robust in sensitivity analyses, with anticoagulant effectiveness in ischemic stroke prevention being the most influential factor. Similar ICERs were observed for individuals aged 65 to 80 years. Implementing annual screening for individuals aged 65 to 80 years yielded an ICER of approximately $18,000 per QALY gained.

CONCLUSIONS Both one-time and annual population screening for AF in individuals aged 65 to 80 years appear to be cost-effective. Further research is needed to assess budgetary and feasibility aspects to establish an optimal screening program. (JACC Asia. 2025;5:160–171) © 2025 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

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The incidence of atrial fibrillation (AF) is increasing among the elderly population, raising significant concerns.[1] AF is a significant risk factor for ischemic stroke (IS), and anticoagulant therapy could effectively mitigate this risk.[2] Nevertheless, a considerable proportion of patients with AF remain undiagnosed.[3] Undiagnosed AF places patients at risk of preventable stroke, resulting in poor outcomes and increased health care costs associated with acute stroke management, rehabilitation, and long-term care.[4]

Screening for undiagnosed AF can identify individuals who could benefit from anticoagulant therapy, facilitating early intervention to reduce stroke risk. Several studies have evaluated population-based AF screening for the detection of undiagnosed cases.[5-8] The STROKESTOP (systematic screening for atrial fibrillation among 75-year-old subjects in the region of Halland and Stockholm, Sweden) study demonstrated that population screening for AF reduced the occurrence of stroke, systemic embolism, bleeding requiring hospital stay, and death.[6,7] Moreover, economic evaluations employing simulation models have advanced our understanding of the lifelong clinical benefits and associated costs linked to the implementation of screening programs.[9]

Despite previous positive findings and recommendations from leading organizations regarding population screening for elderly individuals,[10,11] uncertainty persists regarding the optimal approach to AF screening. Most studies evaluating the clinical and economic outcomes of AF screening have been conducted in Europe and North America, where AF risk, stroke risk, and treatment outcomes differ notably compared with those in Asia. In Asia, the reported prevalence and incidence of AF are slightly lower than in other parts of the world. Still, they are rapidly increasing because of the aging of the population.[1,12] The prevalence of AF in the elderly Asian population (those aged 65 years and older) ranges from approximately 1.6% to over 4%, with higher rates observed in older subgroups (eg, over 75 years).[13,14] Additionally, the incidence rates in individuals aged 75 years and older are significantly elevated, often exceeding 6 per 1,000 person-years.[12] Furthermore, Asians with AF face a higher risk of IS and mortality compared with non-Asian counterparts.[12] Although the effectiveness of anticoagulant treatment in stroke prevention is similar for Asians, they face a higher risk of treatment-related bleeding.[15] The Asia Pacific Heart Rhythm Society (APHRS) advocates for systematic screening for AF in individuals aged 75 years and older;[11] yet, in Taiwan and most other Asian countries, routine health screenings for adults over age 65 years generally do not include AF screening. Therefore, there is a need to study the impact of population screening for AF in the Asian elderly population.

Hence, we conducted a cost-effectiveness analysis of population-based AF screening based on screening data from Taiwan and incorporating studies specific to the Asian population. We performed scenario analyses to investigate the optimal age for screening initiation and explore whether repeat screening would improve health benefits at a reasonable cost.

ABBREVIATIONS AND ACRONYMS

AF = atrial fibrillation

DOAC = direct oral anticoagulant

GDP = gross domestic product

ICER = incremental cost-effectiveness ratio

ICH = intracranial hemorrhage

IS = ischemic stroke

OWSA = one-way sensitivity analysis

PSA = probabilistic sensitivity analysis

QALY = quality-adjusted life year

WTP = willingness-to-pay

METHODS

COHORT POPULATION, SCREENING, AND DATA COLLECTION. Our study was based primarily on a community-based AF screening program conducted in 3 counties (Chiayi, Keelung, and Yilan) in Taiwan, the main goal of which was to assess the feasibility of integrating AF screening into the pre-existing government-endorsed adult preventive health checkup. In this program, participants aged 20 years and above as of the year 2020 were included. The initial screening used a portable device to record a single-lead 30-second electrocardiogram (ECG). This device could automatically classify the ECG recording as non-AF, AF, or unreadable, and an experienced cardiologist verified the classification results. Individuals identified with AF were informed and referred to cardiology outpatient clinics for evaluation for further treatment. We maintained contact with these individuals through telephone interviews to gather information on the confirmation of their AF diagnosis, previous history of arrhythmia, prior use of anticoagulant treatment, and new prescriptions of anticoagulants. This information was used to report the prevalence of AF and the number of newly identified AF cases. Additionally, we assessed the sensitivity, specificity, and positive predictive value (PPV) of screening. Details about the program can be found elsewhere.[16]

MODEL OVERVIEW. We developed a Markov decision-analytic model to assess the cost-effectiveness of a 1-time population-based AF screening strategy in comparison to the standard of care (no AF screening) over a lifetime. To evaluate long-term outcomes and costs, we utilized a hypothetical cohort of 10,000 elderly individuals. This selection of 75 years as the initial screening age in the base-case analysis aligns with the 2021 guidelines

from the APHRS, which recommend systematic screening for individuals aged 75 years and older.[11] We adjusted the screening start age and frequency in subsequent scenarios to explore the outcomes under different screening strategies. The analysis was conducted from the perspective of the Taiwan health care sector.

The model consists of a decision tree (**Figure 1A**) that depicts the outcomes of screening and Markov models that simulate the occurrence of clinical events subsequent to screening (**Figure 1B**). We developed the model using TreeAge Pro 2022 R2 software (TreeAge Software, Inc) and followed the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) for model development and reporting (Supplemental Table 1).

Screening-related parameters utilized in this study are listed in Supplemental Table 2. As anticoagulant agents reduce the risk of ischemic stroke but increase the risk of major bleeding events, the clinical events considered in the Markov model for individuals with AF included IS, intracranial hemorrhage (ICH), and death. Each model cycle represented a 3-month period. Transition probabilities within the model were established based on factors such as age, stroke prevention treatments, and prior clinical event history. Only 1 event could occur within each model cycle; however, our model accounted for the possibility of recurrent events or different events over time. Following a stroke occurrence, individuals transitioned to a postevent state (post-IS or -ICH). The model simulation continued until either the individual's death or reaching age 100 years.

MODEL PARAMETERS. Clinical parameters. Our model incorporated a range of clinical parameters to capture AF epidemiology, screening accuracy, risk of clinical events, rate of anticoagulant treatment, and outcomes associated with anticoagulant therapy. Because anticoagulants reduce the risk of ischemic stroke while concurrently increasing the risk of major bleeding events, the model incorporates both ischemic stroke and ICH as key clinical outcomes.

Newly developed AF cases over time were assumed to be detected either through case-finding in routine practice or screening during the year of screening, and only through case-finding in routine practice in the absence of screening. The annual incidence rates of newly diagnosed AF in regular practice were derived from a nationwide retrospective cohort study in Taiwan (Supplemental Table 3).[12] During the years with repeat screening implemented, the numbers of additional new AF cases detected through screening were calculated based on the attendance rate on rescreening and the proportion of cases detected through case-finding (in routine practice) among patients with newly developed AF reported in the published data (Supplemental Table 2).[5,6,8,17,18] Additionally, patients with pre-existing undiagnosed AF could only be identified through screening or after a stroke event.

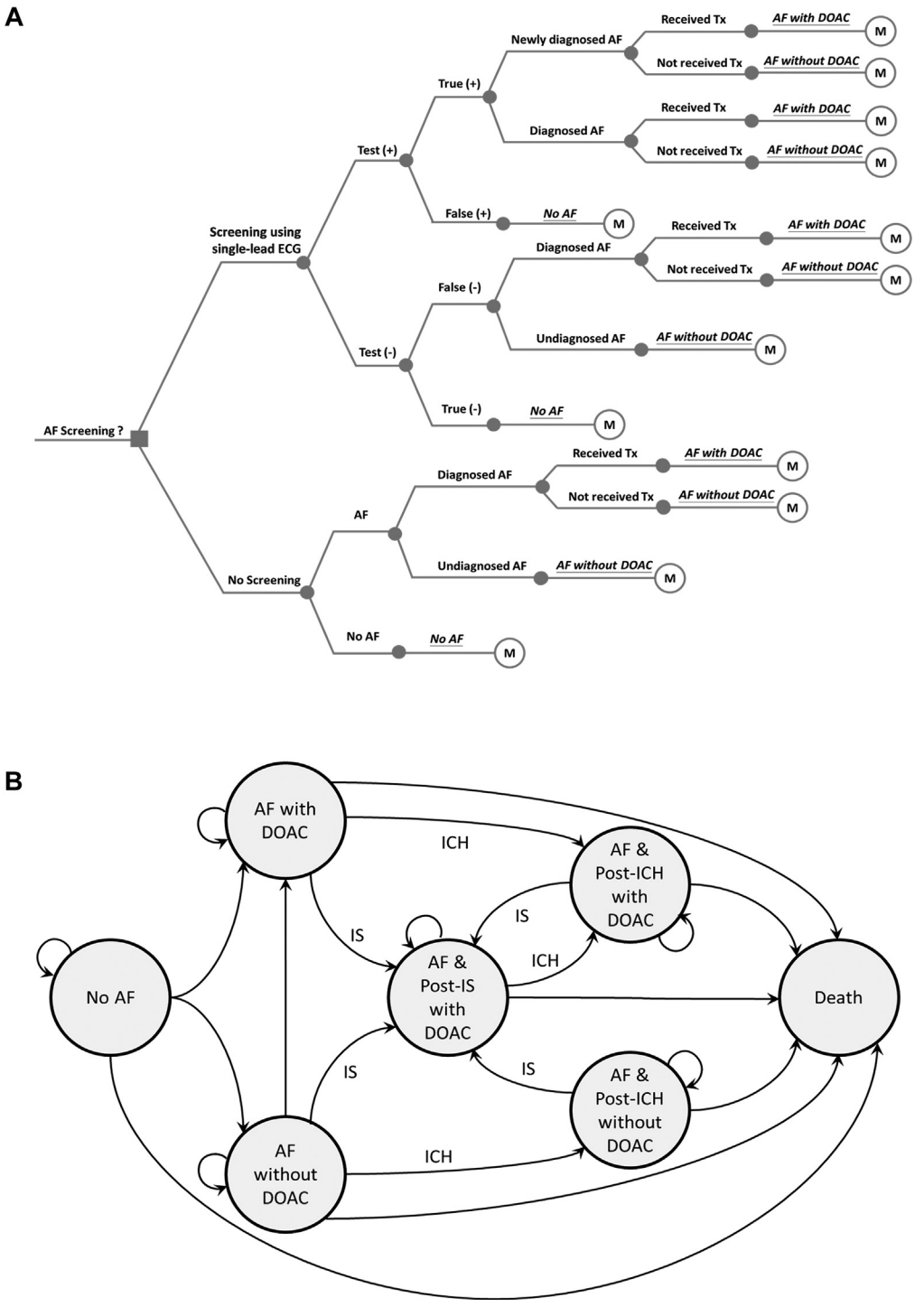
Anticoagulant therapy prescription rates were determined based on the AF screening program findings. Anticoagulant therapy was assumed to consist of treatment with a direct oral anticoagulant (DOAC), namely apixaban, dabigatran, edoxaban, or rivaroxaban. To estimate event probabilities and associated fatality rates of DOAC-treated AF patients, we conducted a retrospective cohort analysis using Taiwan's National Health Insurance Research Database (NHIRD). Additional details regarding the analysis are provided in the Supplemental Materials (Supplemental Methods, Supplemental Figures 1 and 2). The study with NHIRD was approved by the Research Ethics Committee of the National Taiwan University Hospital (No. 202001096RINA). Furthermore, clinical outcomes associated with DOAC use among AF patients were determined based on risk estimates reported in systematic reviews.[2,15,19,20] Because of the lack of direct comparisons between DOAC treatment and no treatment (or placebo) in previous studies, we derived the HR of DOAC treatment vs no treatment using warfarin as a common reference point. We assumed consistent efficacy and safety profiles across all 4 DOACs.

Probabilities of background mortality were derived from age-specific probabilities of death, excluding cardiovascular-related causes, obtained from the life table of the Taiwanese population (Supplemental Table 4).[21,22] Patients with AF have additional mortality risk caused by fatal IS and ICH (the proportion of fatal events is provided in Supplemental Table 3). The model did not account for deaths from cardiovascular causes that are not directly linked to AF.

Cost parameters. Direct medical costs, including costs related to screening, anticoagulant treatment, and clinical event management, were considered (Supplemental Table 5). All cost estimates were converted to U.S. dollars using an exchange rate of 1 USD ≈ 30.68 New Taiwan dollars and further adjusted for inflation to reflect 2018 values.[23]

Screening costs comprised expenses associated with equipment, staff involved in screening administration, ECG confirmation, and cardiologist referrals for newly detected AF cases. Administration costs were estimated based on the cross-sectional screening, while costs related to confirmation of AF diagnosis were derived from the National Health Insurance reimbursement prices.[24]

FIGURE 1 **Model Structure**



The model consists of 2 components: the decision tree and the Markov model. (A) Decision tree illustrating outcomes of atrial fibrillation (AF) screening. The decision tree output serves as input for the Markov model. Test (+)/(−) indicates the initial screening results from a single-lead electrocardiogram (ECG), with cardiologists subsequently verifying the presence or absence of AF (validating true or false test results). (B) Markov model depicting the progression after AF screening. DOAC = direct oral anticoagulant; ICER = incremental cost-effectiveness ratio; ICH = intracranial hemorrhage; IS = ischemic stroke; Tx = treatment.

Anticoagulant treatment costs encompassed drug costs and expenses associated with physician visits every 3 months. The costs of anticoagulants were calculated based on the average unit cost of all available DOACs using the National Health Insurance reimbursement prices in 2018. Anticoagulant prescription rates were determined from the results of the cross-sectional screening. Treatment discontinuation and switching were not considered in the model, and 100% treatment adherence after initiation was assumed.[25] Rate and rhythm control medications were not included.

The costs associated with the management of clinical events consisted of acute event costs and long-term costs. Estimates were derived from the analysis of NHIRD. Additional details are provided in the Supplementary Materials (Supplemental Methods, Supplemental Figure 2). Furthermore, the long-term costs in the first year were converted to 3-month costs based on the distribution of proportions reported in a previous study of AF patients.[25] The 3-month costs in subsequent years were assumed to be one-quarter of annual costs.[25]

Utility parameters. Utility values, representing the quality of life associated with different health states, were sourced from the published data (Supplemental Table 6).[26] Baseline utilities were calculated based on EQ-5D scores and adjusted with cohort age.[27] Patients experienced a disutility associated with clinical events in the model. The use or choice of anticoagulant treatment was assumed not to affect health state utility.

BASE-CASE ANALYSIS. For comparing 1-time population screening for AF vs no screening, our target population consisted of a hypothetical cohort of 10,000 individuals aged 75 years. In the cost-effectiveness analysis, quality-adjusted life years (QALYs) were computed by multiplying the duration spent in each health state by the corresponding utility value and summing these products over the study period. Both costs and QALYs were computed over a lifetime horizon and discounted at an annual rate of 3%. Incremental cost-effectiveness ratios (ICERs) were derived by dividing the difference in total costs by the difference in QALYs gained between the compared screening scenarios. ICER values were assessed against willingness-to-pay (WTP) thresholds of 1 ($25,838) and 3 times ($77,514) gross domestic product (GDP) per capita per QALY.[28,29] Credible intervals (CIs) were derived from 10,000 Markov chain Monte Carlo simulation iterations using Bayesian methods to estimate parameter uncertainties.

SCENARIO ANALYSES. Scenario analyses were conducted to assess the impact of various screening strategies on cost-effectiveness outcomes. These scenarios included variations in the initial screening age and screening frequency. In repeat screening scenarios, participants would undergo AF rescreening until the age of 95 years, with a participation rate assumed to be 50%, regardless of screening frequency.[7,17,18]

SENSITIVITY ANALYSES. Sensitivity analyses were conducted to evaluate the robustness of our findings and assess the influence of parameter uncertainty on the overall results. One-way sensitivity analyses (OWSAs) were performed, involving variations of all model inputs within the predetermined ranges. In probabilistic sensitivity analyses (PSAs), a Monte Carlo simulation comprising 10,000 iterations was executed. All model parameters were simultaneously sampled based on their respective distributions. Probabilities and utilities followed beta distributions, costs were modelled by gamma distributions, and the discount rate was sampled from a uniform distribution. Detailed information on the range and distribution for the sensitivity analyses is provided in Supplemental Tables 2, 3, 5 and 6. The PSA results are presented via cost-effectiveness acceptability curves, illustrating the probability of the intervention being cost-effective at various WTP thresholds.

RESULTS

STUDY COHORT AND SCREENING OVERVIEW. A total of 23,356 participants were initially included in the screening program.[16] Following the exclusion of 247 individuals caused by unreadable ECG results, the screening performance analysis was conducted with 23,109 remaining subjects. Among them, 40.6% were aged 65 years and older, and 16.5% were aged 75 years and older. The gender distribution showed that 56.3% of those aged ≥65 years were women, slightly higher than the 54.4% in the general population of the same age range, according to 2020 statistics.[30] For those aged ≥75 years, 54.0% were women, compared with 56.8% in the general population. Overall, the screening process identified 237 individuals with AF, with 136 being new cases, resulting in a prevalence rate of 1.18% among participants of all ages. Specifically, the prevalence was 2.38% among those aged 65 years and older, and 3.71% among those aged 75 and older. The screening demonstrated a sensitivity of 95.2%, and the PPV was 75.8% (Supplemental Table 2).

BASE-CASE ANALYSIS. In a hypothetical cohort of 10,000 individuals aged 75 years, 1-time population screening for AF detected 132 undiagnosed AF cases,

TABLE 1 Base-Case and Scenario Analysis for 10,000 Individuals

Screening Age, y	Strategy	Total Costs (95% CI) (USD)	Total QALYs (95% CI)	ICER (95% CI)[a] (USD/QALY)
65	No AF screening	9,920,127 (7,937,115-27,519,328)	151,235.84 (125,120.72-208,656.16)	–
	One-time AF screening	**10,266,047 (8,206,315-28,056,128)**	**151,261.48 (125,139.23-208,705.08)**	**13,493 (3,647-35,246)**
	Repeat screening–every 5 y	11,431,699 (9,004,472-31,491,410)	151,335.72 (125,217.83-208,901.43)	15,702 (3,763-40,965)
	Repeat screening–every 3 y	11,928,325 (9,339,333-32,984,097)	151,366.77 (125,247.89-208,994.30)	15,991 (3,973-40,452)
	Repeat screening–every y	13,095,829 (10,095,735-36,022,628)	151,435.89 (125,316.12-209,169.39)	16,892 (4,345-41,272)
70	No AF screening	9,812,331 (8,763,027-26,251,149)	130,443.15 (110,179.49-171,145.55)	–
	One-time AF screening	**10,264,658 (9,075,920-26,850,726)**	**130,478.79 (110,203.41-171,197.68)**	**12,689 (3,161-34,015)**
	Repeat screening–every 5 y	11,312,651 (9,918,611-30,022,704)	130,540.72 (110,270.30-171,425.68)	Under extended dominance
	Repeat screening–every 3 y	11,772,664 (10,262,370-31,251,304)	130,569.31 (110,295.00-171,425.68)	16,660 (3,883-42,053)
	Repeat screening–every y	12,915,001 (11,142,461-34,197,827)	130,634.73 (110,371.36-171,580.35)	17,462 (4,283-41,977)
75 (Base-case)	No AF screening	10,312,991 (8,005,872-22,286,343)	109,045.81 (94,640.99-137,191.51)	–
	One-time AF screening	**10,905,441 (8,427,759-23,096,922)**	**109,093.23 (94,674.73-137,268.95)**	**12,493 (2,874-34,614)**
	Repeat screening–every 5 y	11,924,727 (9,116,280-25,634,188)	109,148.65 (94,732.67-137,415.64)	Under extended dominance
	Repeat screening–every 3 y	12,352,753 (9,368,792-26,684,011)	109,175.48 (94,766.93-137,453.23)	17,596 (4,348 -45,770)
	Repeat screening–every y	13,550,816 (10,041,491-29,489,965)	109,241.16 (94,818.12-137,581.78)	18,241 (4,746-45,662)
80	No AF screening	11,797,634 (7,950,128-19,876,839)	87,808.76 (78,396.42-106,524.33)	–
	One-time AF screening	**12,535,919 (8,471,964-20,726,340)**	**87,867.80 (78,443.86-106,346.69)**	**12,505 (2,646-35,658)**
	Repeat screening–every 5 y	13,644,095 (9,083,382-22,897,346)	87,923.65 (78,487.29-106,494.58)	Under extended dominance
	Repeat screening–every 3 y	14,156,473 (9,335,963-23,960,685)	87,951.08 (78,511.80-106,524.33)	Under extended dominance
	Repeat screening–every y	15,439,845 (9,973,244-26,536,467)	88,022.56 (78,443.86-106,400.06)	18,764 (5,300-53,132)
85	No AF screening	7,946,258 (5,464,107-12,782,808)	68,699.03 (62,801.70-79,659.85)	–
	One-time AF screening	**8,547,410 (5,890,393-13,550,736)**	**68,737.61 (62,832.40-79,701.73)**	**15,585 (3,642-44,018)**
	Repeat screening–every 5 y	9,265,598 (6,296,968-14,942,063)	68,763.59 (62,855.69-79,741.43)	Under extended dominance
	Repeat screening–every 3 y	9,574,433 (6,466,071-15,562,562)	68,777.38 (62,867.57-79,758.72)	Under extended dominance
	Repeat screening–every y	10,564,227 (6,968,483-17,521,618)	68,816.53 (62,906.42-79,810.15)	25,556 (7,450-70,808)
90	No AF screening	5,652,800 (3,840,471-8,905,757)	49,744.04 (46,501.36-55,347.99)	–
	One-time AF screening	**6,233,098 (4,190,107-9,758,315)**	**49,767.59 (46,524.43-55,369.05)**	**24,636 (6,837-69,194)**
	Repeat screening–every 5 y	6,706,722 (4,455,337-10,687,472)	49,779.42 (46,541.38-55,383.55)	Under extended dominance
	Repeat screening–every 3 y	6,756,348 (4,484,214-10,796,656)	49,783.07 (46,544.89-55,387.39)	Under extended dominance
	Repeat screening–every y	7,604,048 (4,905,976-12,447,562)	49,805.45 (46,566.95-55,411.84)	36,217 (10,282-92,050)

The strategy highlighted in **bold** is the most cost-effective screening approach in each screening age group. [a]ICER was calculated by comparing associated costs and QALYs to the most relevant alternative strategy. The calculation process is detailed in Supplemental Table 7.

AF = atrial fibrillation; CI = credible interval; ICER = incremental cost-effectiveness ratio; QALY = quality-adjusted life year; USD = U.S. dollar.

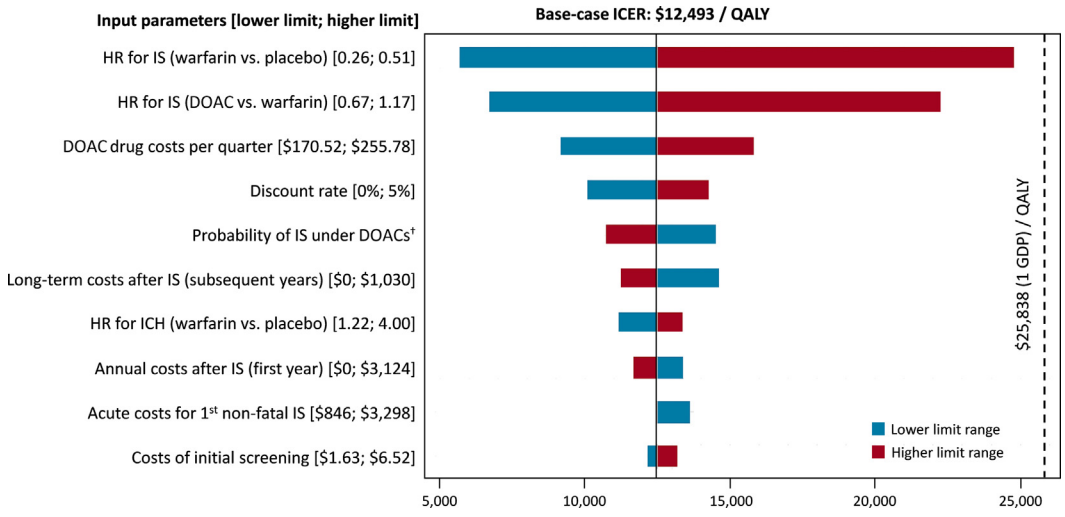
resulting in an increase of 47.42 (95% CI: 33.74-77.44) QALYs and prevention of 45 (95% CI: 29-61) IS events at an additional cost of $592,450 (95% CI: $421,887-$810,579). The ICER of screening vs no screening was $12,493 (95% CI: $2,874-$34,614) per QALY gained (Table 1).

SCENARIO ANALYSES. Across diverse scenarios involving varying initial ages for AF screening, ICER values, when comparing 1-time screening to no screening, were relatively similar for individuals aged 65 to 80 years. Notably, initiating screening at age 75 years yielded the lowest ICER value (Table 1). Although the cost-effectiveness of screening persisted even at the most advanced age evaluated (ie, age 90 years), 1-time screening for that age group incurred significantly higher additional costs per QALY gained.

When examining the outcomes associated with different screening frequencies, 1-time screening remained the most cost-effective strategy across all age groups (Table 1). Despite the potential for higher screening frequencies to contribute to increased QALYs, the corresponding additional costs per QALY rose progressively. Repeat screening every 5 years was found to be an extended-dominated option in patients aged 70 years and older, and repeat screening every 3 years was an extended-dominated option in patients aged 80 years and older. With the exception of annual repeat screening in the age 90 years cohort, all screening approaches were deemed cost-effective at a WTP threshold of 1 or 3 GDP per QALY gained (Supplemental Table 7).

SENSITIVITY ANALYSES. Results of the OWSA comparing 1-time screening with no screening in a population aged 75 years are illustrated in the tornado diagram (Figure 2). The most influential factors included the effectiveness of anticoagulants in preventing IS, costs of DOACs, and discount rate.

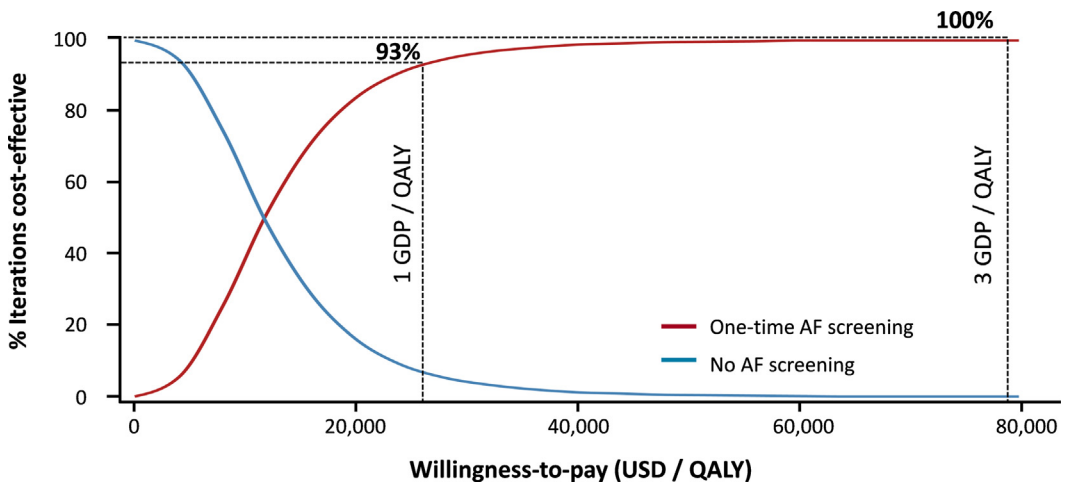
FIGURE 2 Tornado Diagram for Evaluating the Cost-Effectiveness of One-Time Population Screening



This diagram illustrates the results from One-way sensitivity analyses assessing the cost-effectiveness of One-time population screening for AF compared with no screening in 75-year-old individuals. All model parameters, with their corresponding ranges detailed in Supplemental Tables 2, 3, 5, and 6, were subject to variation in the One-way sensitivity analyses. However, only those parameters that influenced the ICER by more than $1,000 per QALY across their entire ranges are shown. Blue bars signify the lower end of the value range, whereas red bars represent the higher end. †Probability of IS under DOACs is an age-dependent variable and varied across the prespecified age-dependent range in the One-way sensitivity analysis. GDP = gross domestic product; QALY = quality-adjusted life year; USD = U.S. dollar; other abbreviations as in Figure 1.

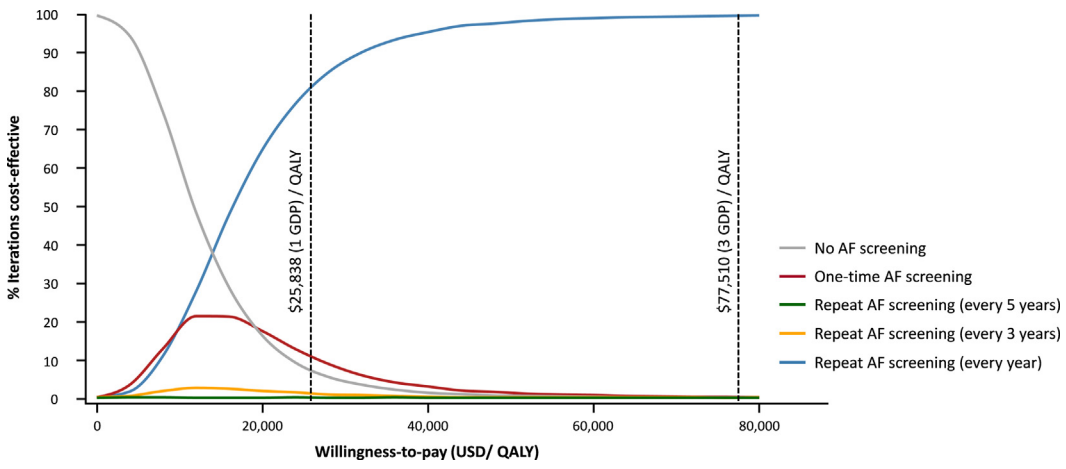
However, even with parameters at their highest range, population screening for AF remained highly cost-effective. Similar patterns of OWSAs were observed in subjects aged 65 years (Supplemental Figure 3). Likewise, the effectiveness of anticoagulants in preventing IS played a crucial role in influencing the cost-effectiveness of repeat annual screening compared with 1-time screening (Supplemental Figure 4).

FIGURE 3 Cost-Effectiveness Acceptability Curves of One-Time Population Screening vs No Screening



This figure displays the cost-effectiveness acceptability curves derived from probabilistic sensitivity analysis based on 10,000 simulation iterations for a cohort of 75-year-old individuals. The vertical lines denote willingness-to-pay thresholds of one and 3 times the GDP per QALY gained. Abbreviations as in Figures 1 and 2.

FIGURE 4 Cost-Effectiveness Acceptability Curves of Various AF Screening Strategies



This figure illustrates the cost-effectiveness acceptability curves of different AF screening strategies, derived from probabilistic sensitivity analysis using 10,000 simulation iterations in a cohort of 75-year-old individuals. The vertical lines denote willingness-to-pay thresholds of one and 3 times the GDP per QALY gained. Abbreviations as in Figures 1 and 2.

The PSAs revealed minimal fluctuations in cost-effectiveness under parameter uncertainty. When comparing 1-time screening to no screening for individuals aged 75 years, 93% and 100% of the iterations produced ICERs below the WTP threshold of 1 and 3 GDP per QALY, respectively (**Figure 3**). Evaluating various screening strategies, the acceptability of annual repeat screening was 81% at a WTP threshold of 1 GDP per QALY for subjects aged 75 years (**Figure 4**). Parameter uncertainty demonstrated similar effects on the cost-effectiveness in subjects of different ages (Supplemental Figures 5 and 6).

DISCUSSION

This study constitutes a significant contribution, representing the sole investigation into the cost-effectiveness of AF screening and optimal screening strategies in an Asian population. By first conducting a cohort study in Taiwan, we determined the prevalence of AF and assessed the performance of screening using a single-lead ECG. The observed overall prevalence of AF among participants of all ages was 1.18%, exceeding the estimates from a previous study based on the national claims database in Taiwan (1.07% in 2011).[12] Utilizing a Markov decision-analytic model, we systematically evaluated the lifelong clinical benefits and associated health care costs linked to AF screening. In concordance with research conducted in different health care systems,[9,31,32] our findings showed that 1-time population screening for AF at age 75 years was cost-effective from the perspective of the Taiwan health care sector, with robustness evident in sensitivity analyses (**Central Illustration**). This aligns with the recommendations of the APHRS, which advocates for systematic screening for AF in individuals aged 75 years and older.[11] Furthermore, our exploration into the cost-effectiveness of AF screening across different age groups revealed comparable ICER values for individuals aged 65 to 80 years, signifying the economic efficiency of screening in preventing strokes within this demographic range. Implementing a long-term screening strategy among individuals aged 65 to 80 years in Taiwan has the potential to significantly enhance patient outcomes through early detection and tailored treatments, while optimizing health care resource allocation by preventing advanced disease stages that require intensive treatment. These benefits support the development of informed public health policies and medical decision-making, ensuring that resources are effectively used and accessible. However, it remains crucial to consider the feasibility, affordability, and budgetary implications when planning the implementation of an AF population screening program.

Previous studies aiming to identify effective screening programs often focused on non-Asian populations.[6-8] Given the lower prevalence of AF in Asians compared with Westerns,[33] the optimal screening strategy may differ. Our investigation observed that while a single screening yielded the lowest ICER, repeat screening could yield higher QALYs gained at reasonable costs. Specifically,

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CENTRAL ILLUSTRATION **Cost-Effectiveness of Population Screening for AF in the Elderly**

Markov Decision-Analytic Modeling:
One-time screening for 10,000 individuals aged 75 years in Taiwan

- Detected **132** undiagnosed AF cases
- Prevented **45** ischemic strokes
- Gained **47.42** QALYs
- Additional cost **$592,450**

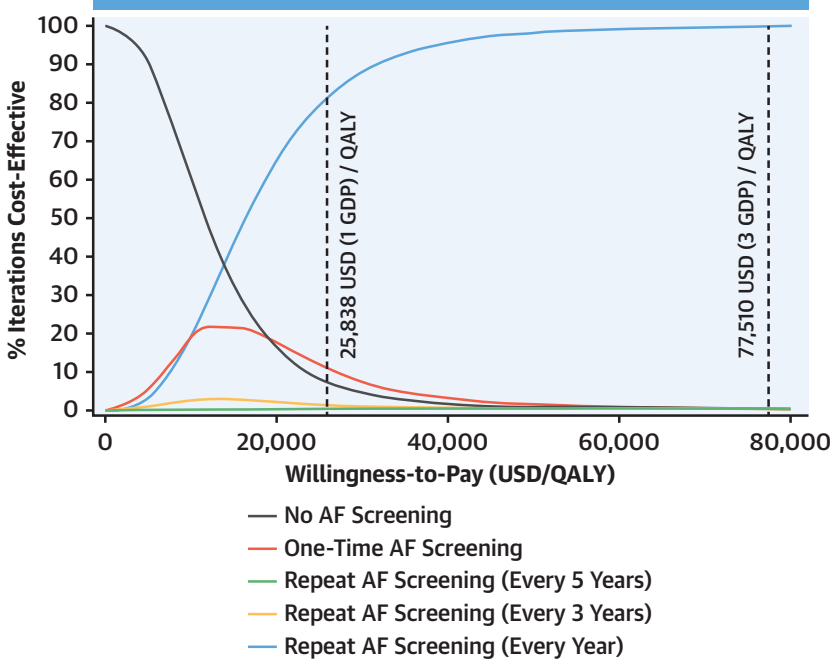
→ Incremental cost-effectiveness ratio (ICER):

$12,493 per QALY gained < willingness-to-pay threshold

One-Time Screening vs No Screening

Age of Screening, y	Incremental Costs (USD)	Incremental QALYs	ICER (USD/QALY)
65	345,920	25.64	13,493
70	452,327	35.65	12,689
75	592,451	47.42	12,493
80	738,286	59.04	12,505
85	601,152	38.57	15,585
90	580,298	23.55	24,636

Cost-Effectiveness Acceptability Curves (Initial Screening Age 75 Years)



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This study employed a Markov decision-analytic model to simulate a cohort of 10,000 individuals, evaluating the cost-effectiveness of one-time atrial fibrillation (AF) screening compared with no screening among individuals aged 75 years in Taiwan. Scenario analyses were conducted to identify the optimal age and frequency for screening. GDP = gross domestic product; QALY = quality-adjusted life year; USD = U.S. dollar.

implementing annual screening for individuals aged 65 to 80 years produced an ICER of approximately $18,000 per QALY. The notion that repeat AF screening can provide additional health benefits at a reasonable cost aligns with findings in other studies.[8,32] For instance, 1 study demonstrated the cost-effectiveness of a screening initiated at age 65 years and repeated every 5 years until age 80 years.[12] Consequently, decision-makers should consider periodic screenings to enhance population well-being, particularly if there is willingness to allocate 1 GDP for gaining an additional QALY. However, implementing such screening programs necessitates a thorough assessment of both benefits and challenges. Effective enhancement strategies should include improving public health education to increase adherence, ensuring equitable resource distribution, and continuously monitoring outcomes to refine and optimize screening protocols and recommendations.

In this study, we developed a Markov decision-analytic model to evaluate the lifetime outcomes and associated costs linked to population screening for AF. The prevalence of AF and the performance of screening tests were estimated based on data derived from a large-scale community-based AF screening program. Furthermore, we integrated local data on disease epidemiology, current medical practices, and health care resource utilization.[6,7] The probabilities of clinical events and their associated costs were obtained through a comprehensive nationwide retrospective cohort analysis. Our Markov model also incorporated various factors, including participation rates for rescreening, DOAC prescription rate, and duration of medication discontinuation after an ICH event. The extensiveness of data enabled us to account for crucial factors relevant to real-world situations.

We performed sensitivity analyses to assess uncertainties associated with the input parameters in our model, and the effectiveness of anticoagulants in preventing IS was identified as the most influential factor. Given the absence of direct evidence comparing DOACs with placebo, we used warfarin as a common reference point to estimate the risk of IS and ICH in patients with AF receiving DOAC treatment compared with untreated patients. Parameter estimation was grounded in carefully selected evidence from meta-analyses, aligning with the demographics and disease status of our study population.[2,15,19,20] However, the limited availability of references precisely fitting our research population may introduce uncertainties in the model. Furthermore, utility values were derived from studies conducted in Western populations, because no relevant utility data was available for the Asian population. Although we acknowledge that utility values from a different population may not precisely capture the impact of screening on health status in the target population, OWSAs indicated that the effects of utility parameters on the ICERs were negligible.

STUDY LIMITATIONS. First, our cohort-based simulation study was centered on a cross-sectional population screening for AF conducted in only 3 counties in Taiwan, which may limit generalizability at a national level. The lack of sociodemographic characteristics and health resource utilization data for the study subjects hindered a comprehensive assessment of participant representativeness. Employing county-level screening data in conjunction with national-level data on stroke incidence, mortality, and cost could possibly introduce biases. Second, the telephone interviews conducted after the initial screening could potentially introduce recall bias and misclassification, thereby influencing the estimation of screening benefits. Moreover, our model accounted only for ICH and did not include other major bleeding events, which might underrepresent the total risks of anticoagulant therapy. However, one-way sensitivity analyses related to ICH parameters suggest that this omission has minimal impact on the overall findings. Last, although our Markov model considers age-dependent variables, it does not account for sex-specific differences or detailed clinical factors such as history of diagnosed AF, AF severity, and stroke details, which could affect the precision of our results. Additionally, our model relied on several assumptions, such as uniform stroke risk regardless of the diagnosis method and a constant participation rate for repeat screening, which may not mirror real-world scenarios. The assumption of independence between events, typical in health economic analyses, may not fully capture the interconnected nature of health events in a real-world setting. Prospective studies involving national AF screening programs are crucial to validate the robustness of our findings.

CONCLUSIONS

Our study enhances the existing evidence by demonstrating that population screening for AF in individuals aged 65 to 80 years is a cost-effective strategy for stroke prevention. Findings suggest that repeat screening may be justified to optimize overall population well-being further. Nonetheless, it is imperative to consider factors beyond cost-

effectiveness, including feasibility, affordability, and budgetary impact, when making decisions about implementing an AF population screening program.

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APPENDIX For supplemental figures and tables, please see the online version of this paper.