Journal of the American Heart Association

ORIGINAL RESEARCH

Differences in Preferences Between Clinicians and Patients for the Use and Dosing of Direct Oral Anticoagulants for Atrial Fibrillation

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BACKGROUND: Direct oral anticoagulants (DOACs) are effective in reducing the stroke risk for patients with nonvalvular atrial fibrillation if prescribed at the labeled dose, yet underdosing is frequent. Little is known about clinician knowledge and patient or clinician preferences for DOAC dosing.

METHODS AND RESULTS: From April 2019 to March 2020, 240 clinicians and 343 patients with atrial fibrillation completed an assessment of anticoagulation knowledge/preferences. Clinician knowledge of DOAC dosing was tested with 4 hypothetical patient scenarios. Patients and clinicians were asked to grade the importance of 25 factors in anticoagulation decision making. Among clinicians, the median age was 55 years, and 23% were primary care clinicians. In scenarios of a patient indicated for full-dose DOAC, 41.2% of clinicians underdosed apixaban and 17.6% underdosed rivaroxaban. In scenarios of a patient indicated for reduced-dose DOAC, 64.6% and 71.7% of clinicians chose to use reduced-dose apixaban and rivaroxaban, respectively. Only 35.0% of clinicians correctly answered all 4 scenarios with the label-indicated dose; this knowledge gap was similar between clinicians who did and did not underdose. Among patients with atrial fibrillation, the median age was 65 years, and 89% were currently anticoagulated. Patients and clinicians ranked stroke prevention and avoiding severe bleeding as very important to anticoagulation decision making. Patients were more likely than clinicians to rank the ability to reduce anticoagulation dose if needed as very important (70.5% versus 43.6%; $P<0.001$).

CONCLUSIONS: There are considerable knowledge gaps regarding DOAC dosing in clinicians treating patients with atrial fibrillation, as well as significant differences in treatment dosing preferences between clinicians and patients.

Key Words: anticoagulation ■ atrial fibrillation ■ direct oral anticoagulants ■ shared decision making ■ underdosing

Direct oral anticoagulants (DOACs), including apixaban, rivaroxaban, dabigatran, and edoxaban, are effective in reducing the risk of stroke in patients with nonvalvular atrial fibrillation (AF) when prescribed at the dose studied in randomized clinical trials.[1] In these trial protocols, reduced DOAC doses were prescribed to patients who had renal impairment for rivaroxaban, dabigatran, or edoxaban, or met 2 of 3 criteria (age, body weight, creatinine level) for apixaban.[2–5] The ARISTOTLE (Apixaban for Reduction in Stroke and Other Thromboembolic Events in Atrial Fibrillation) trial, for example, studied apixaban at 5 mg twice daily, while patients who met 2 of 3 dose reduction criteria received 2.5 mg twice daily.[2] For patients who met labeled dose reduction criteria, the outcomes associated with apixaban 2.5 mg twice daily versus warfarin to reduce the risk of stroke or systemic embolism, major bleeding, and death were consistent with

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Supplementary Material for this article is available at https://www.ahajournals.org/doi/suppl/10.1161/JAHA.120.020697

For Sources of Funding and Disclosures, see page 11.

JAHA is available at: www.ahajournals.org/journal/jaha

CLINICAL PERSPECTIVE

What Is New?

- Knowledge gaps may exist regarding direct oral anticoagulant dosing among clinicians treating patients with atrial fibrillation.
- While both clinicians and patients ranked stroke prevention and avoiding severe bleeding very important when making decisions about direct oral anticoagulants, patients were significantly more likely to rank the ability to lower the dose of the direct oral anticoagulant if needed as very important compared with clinicians.

What Are the Clinical Implications?

- Further education may be needed to improve rates of dosing direct oral anticoagulants according to labeled parameters.
- This study also underscores the importance of shared decision making between the patient and clinician around the decision to initiate patients on oral anticoagulation for atrial fibrillation.

Nonstandard Abbreviations and Acronyms

DOAC	direct oral anticoagulant

the outcomes associated with the labeled dose (apixaban 5 mg twice daily).[6]

However, a prior study of cardiology practices in the United States revealed >4-fold higher rates of reduced-dose apixaban use when compared with use in randomized trials (20.8% versus 4.7%).[7] Additionally, in an analysis of ≈ 15 000 patients with AF initiated on a DOAC, 13% of patients received a reduced dose without meeting renal dose reduction criteria.[8] DOAC underdosing (or unlabeled reduced dose) has been shown to be associated with an increased risk of cardiovascular hospitalization.[9] Underdosing has also been linked to a higher risk of stroke[8] and an increased risk of all-cause mortality, stroke, or myocardial infarction.[10]

Little is known about clinician knowledge or clinician and patient preferences for DOAC dosing. In this study, we examined clinician knowledge of anticoagulation dosing recommendations based on labeled-dose criteria, and compared clinician and patient preferences associated with anticoagulation selection and dosing.

METHODS

This study received approval from the Duke University Institutional Review Board. Data and materials that support these findings will not be made publicly available. Before any survey was administered, patients or clinicians were given the outline of the study and an electronic informed consent document to read. If they consented to participate in the study, they gave that consent by signing and dating the informed consent document. Additionally, after review of the survey data, there were no safety events to report.

Study Population

Clinicians

All clinicians who contributed at least 15 patients with AF treated with DOACs to Symphony Health's Integrated Dataverse database were eligible to receive and take the survey. Symphony Health (a PRA Health Sciences Company) data contains prescriber information for 280 million patients and 1.8 million prescribers in the United States. All clinician specialties (ie, cardiology, primary care, and other), and types (ie, physician, physician extender, and nurse practitioner) were included. Each clinician provided informed consent before completing the survey. The clinician survey is included in Data S1. Among the 373 participants who gave consent, 103 returned incomplete surveys, 11 were duplicate responders, 13 had the survey link forwarded to them by a colleague (unable to assess whether the clinician treated at least 15 patients with AF), 5 declined to complete the survey, and 1 was from an internal employee who was not allowed to participate. There were 240 surveys included in the final analysis population.

Patients

Patients who self-reported having AF were contacted using 2 different sources. We used ResearchMatch, an online tool developed by researchers at Vanderbilt University, to locate patients who self-reported as having AF.[11] Patients can join the ResearchMatch system and enter in their health conditions and identify types of studies in which they would be willing to participate. The site then matches researchers looking for either healthy volunteers or volunteers with a certain condition. In addition to ResearchMatch, we also located patients who self-reported as having AF through social media using the sites StopAfib.org and the Atrial Fibrillation Support Forum on Facebook.[12,13] Two of the authors (M.H. and D.M.) tweeted the survey out to a group of patients who self-reported as having AF. Patients who indicated interest via ResearchMatch or through social media were sent a link to a website, where informed consent was required before the survey was completed. In total, we received 391 patient surveys, of which 48 were excluded: 9 did not report having a diagnosis

of atrial fibrillation, 13 had blank or incomplete surveys, 23 were duplicate responders, and 3 declined to complete after initiating the survey. There were 343 patient surveys used for the analysis. The patient survey is included in Data S2.

Surveys

Clinicians

Beyond clinician demographic characteristics, the survey asked clinicians to indicate what resources they use to look up DOAC dosing, prescribing strategies for patients who express a concern for DOAC bleeding side effects, and empiric likelihood of considering a reduced-dose DOAC in patients who do not meet labeled dose reduction criteria. The clinician was then given 4 hypothetical patient scenarios to evaluate knowledge of apixaban and rivaroxaban dosing (scenarios and answer options shown in Table S1). We defined an underdosed dose of a DOAC as a dose lower than the labeled dose parameters according to the Food and Drug Administration–approved labeled parameters for dose reduction.[14,15] A labeled dose is a dose that meets the labeled dose parameters according to the Food and Drug Administration–approved labeled parameters for dosing. For instance, the recommended labeled dose of apixaban is 5 mg BID, unless the patient meets at least 2 of the following characteristics: age ≥80 years, body weight ≤60 kg, or serum creatinine ≥1.5 mg/dL; then the recommended labeled dose is 2.5 mg BID.[13] For rivaroxaban, the recommended labeled dose of rivaroxaban is 20 mg daily if the creatinine clearance is >50 mL/min. If the creatinine clearance is 15 to 50 mL/min, the recommended labeled dose of rivaroxaban is 15 mg daily.[14]

Finally, the clinician was asked to rank 25 treatment characteristics (full list shown in Table 1) based on perceived importance (not at all important, maybe important, somewhat important, or very important) of these characteristics to anticoagulation treatment decision making.

Patients

Beyond asking patient demographic information, current anticoagulant status, and clinical characteristics needed to derive a CHA_2DS_2-VASc score,[16] the survey also asked patient volunteers to rank the

Table 1. Ranking of the Proportion of Clinicians and Patients Who Considered a Treatment Characteristic as "Very Important" to Anticoagulant Decision Making

Rank	Clinician	Rank	Patient
1	Reduces risk of stroke	1	Reduces risk of stroke
2	Insurance covers this medication	2	Proven to work better than other medications
3	Proven to work better than other medications	3	Lower risk of side effects
4	Severe bleeding	4	*Reversal agent*
5	Well-accepted standard treatment	5	Medication has been studied in people like me
6	Medication has been studied in people like me	6	Potential for drug interactions
7	Out-of-pocket cost	7	Insurance covers this medication
8	Lower risk of side effects	8	Severe bleeding
9	Potential for drug interactions	9	Well-accepted standard treatment
10	Requires monthly blood tests	10	Requires monthly blood tests
11	Limits food options	11	Dosing can be reduced if needed
12	Reversal agent	12	Dose can be increased if needed
13	Need for more frequent clinic visits	13	Whether on a $P2Y_{12}$ inhibitor
14	Whether on a $P2Y_{12}$ inhibitor	14	Blood test measuring efficacy
15	Dosing can be reduced if needed	15	Limits food options
16	Drug is taken daily vs twice daily	16	Out-of-pocket cost
17	Dose can be increased if needed	17	How long on the market
18	Number of other medications	18	Need for more frequent clinic visits
19	Starting at a lower dose	19	Number of other medications
20	How long on the market	20	Starting at a lower dose
21	Family/friend had bad experience	21	Minor bleeding
22	Blood test measuring efficacy	22	Family/friend had bad experience
23	May cause more easy bruising	23	Drug is taken daily vs twice daily
24	Minor bleeding	24	What is on news about medication
25	What is on news about medication	25	May cause more easy bruising

same list of 25 treatment characteristics as above on the basis of what "you feel are most important when you are trying to decide about your treatment strategy."

Clinicians Prescribing DOAC Doses Lower Than the Labeled Criteria

Statistical Analysis

Clinician survey respondents were linked to Symphony Health's Integrated Dataverse database to describe the proportion of patients with AF for whom each clinician prescribed an adjusted dose of a DOAC without the patient meeting criteria for dose reduction. Table S2 defines the *International Classification of Diseases, Ninth Revision* (*ICD-9*) and *Tenth Revision* (*ICD-10*) codes used to define nonvalvular AF. Of the 240 clinicians who gave consent and were surveyed, 9 clinicians had missing patient weight, creatinine clearance, or creatinine data that would allow for determination of labeled dosing in their clinical practice and were excluded from this analysis. We divided clinicians into those who never underdosed a DOAC on the basis of labeled dosing parameters and those who had underdosed a DOAC in at least 1 of their patients. We then compared clinician characteristics and their responses to the DOAC dosing preference and knowledge questions among those clinicians who underdosed versus those who did not, using an ANOVA test for continuous variables and a *Z* test with 2 population proportions for categorical variables. Similar comparisons were performed for patient respondents based on current anticoagulation status. The 25 treatment factors were ranked separately for patients and clinician on the basis of the proportion of each group that ranked each factor as "very important." We also calculated the difference in percentage of patients who reported being on anticoagulation versus those who are not who indicated that each treatment characteristic was "very important" using a *Z* test with 2 population proportions. To compare categorical variables with multiple subcategories (ie, number of years in practice, number of clinicians in practice, and primary area of practice) in Table 2, we used Fisher's exact test.

RESULTS

Clinicians

Demographics

Among the 240 clinicians with completed surveys from November 2019 through March 2020, the median age was 55 years, 12.2% were women, and 66.7% were White clinicians (Table 2). The majority of clinicians surveyed reported being in practice for ≥10 years (86.3%). Among the clinicians with completed surveys, 23.8% reported being electrophysiologists, 26.3% reported being invasive cardiologists (nonelectrophysiology), 24.2% reported being noninvasive cardiologists, and 22.5% reported being primary care clinicians. The majority (91.2%) of clinicians surveyed were working in a practice with other clinicians, and 54.5% reported being affiliated with a teaching hospital. Web- and app-based dosing education resources (eg, UpToDate or Epocrates) and package insert dosing recommendations were the resources that clinicians indicated most frequently using to look up DOAC dose labeling (Figure 1).

Table 2. Characteristics of Surveyed Clinicians

Clinician Characteristics	Number (%)
Age, y	55
Female	29/238 (12.2)
Race	
White	160 (66.7)
Black	7 (2.9)
Asian	54 (22.5)
Multiracial	2 (0.83)
Prefer not to answer	17 (7.1)
Years in practice since completion of training	
<5	10 (4.2)
5–10	23 (9.6)
10–15	45 (18.8)
15–20	40 (16.7)
>20	122 (50.8)
Primary area of practice	
Electrophysiology	57 (23.8)
Invasive cardiology (non-EP)	63 (26.3)
Noninvasive cardiology	58 (24.2)
Primary care	54 (22.5)
Other	8 (3.3)
How many other clinicians are in your practice?	
Solo practice	21 (8.8)
1–5 other clinicians	62 (25.8)
6–10 other clinicians	29 (12.1)
>10 clinicians	128 (53.3)
Affiliated with a teaching hospital	131 (54.5)

EP indicates electrophysiology.

Clinical Practice and DOAC Dosing Knowledge

Most clinicians (63.0%) stated empirically they would never/rarely use an underdosed DOAC. If a patient expressed concern about potential bleeding side

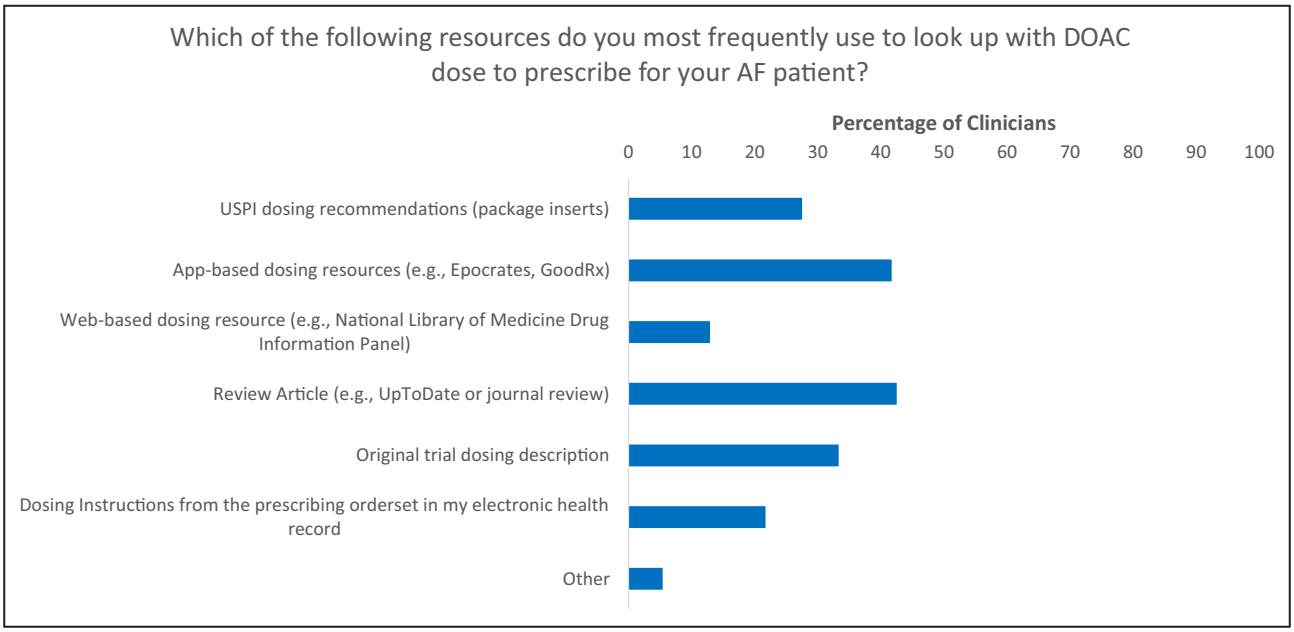

Figure 1. Resources that are used most frequently to look up which DOAC labeled dose to prescribe for patients with AF. Each surveyed clinician was asked to select up to 3 of the listed resources for which ones they most frequently use to look up DOAC dosing for patients with AF. AF indicates atrial fibrillation; DOAC, direct oral anticoagulant; and United States Prescribing Information.

effects of DOAC therapy, 14.6% of clinicians stated they would start the DOAC at a lower dose, in contrast with 18.3% who would suggest warfarin as an alternative or 17.5% who would start a proton pump inhibitor. Figures 2A through 2D describe the results of the DOAC dosing questions asked of surveyed clinicians. In hypothetical case scenarios of a patient indicated for full-dose DOAC by labeled dosing criteria, 41.2% of clinicians chose to underdose apixaban (<5 mg BID), and 17.6% chose to underdose rivaroxaban (<20 mg daily), based on labeling criteria. In other scenarios where a patient met labeled-dosing criteria for an adjusted-dose DOAC, only 64.6% (apixaban 2.5 mg BID) and 71.7% (rivaroxaban 15 mg daily) of clinicians chose the reduced-dose DOAC answer. Only 35.0% of clinicians correctly answered all 4 scenarios with the correct dose following labeling criteria.

After linking clinicians to the patients with AF they treat, 66 of 231 clinicians (28.6%) prescribed an underdosed DOAC to at least 1 patient who did not meet labeled dose reduction criteria; 41 of these 62 clinicians (62.1%) empirically stated they would never/rarely underdose a patient. Clinicians who underdosed were significantly more likely to be primary care physicians or nonelectrophysiology cardiologists and were less likely to be affiliated with a teaching hospital. DOAC dosing preference and knowledge was not significantly different between clinicians who underdosed at least 1 patient and those who never underdosed (Table 3).

Patients

Among the 343 patients with completed surveys, 86.3% were volunteers from social media, and 13.7% were volunteers from ResearchMatch. The median age of participating patient volunteers was 65 years, 74% were women, and 96.8% were White patients. The majority of patients (84.5%) surveyed reported having the diagnosis of atrial fibrillation for >1 year. The median CHA_2DS_2-VASc score was 2.[2,3] While 98.5% of surveyed patients had a CHA_2DS_2-VASc score ≥1, 89.8% reported currently taking an anticoagulant.

Perceptions of Importance of DOAC Treatment Characteristics

Both clinicians and patients were asked to assign a number for the importance of different DOAC treatment characteristics in either how they counsel their patients to choose an anticoagulation strategy (clinicians) or in how they would decide on an anticoagulation strategy (patient). Patients and clinicians were similar in what they considered the top 10 most important factors in anticoagulation decision making, although clinicians ranked cost of medication as one of the top 10 factors, whereas patients ranked availability of a reversal agent as one of the top factors (Table 1). Differences between patient and clinician rating of "very important" are shown in Figure 3. Both patients and clinicians ranked stroke prevention (95.6% versus 96.2%; P=0.83) as the most important

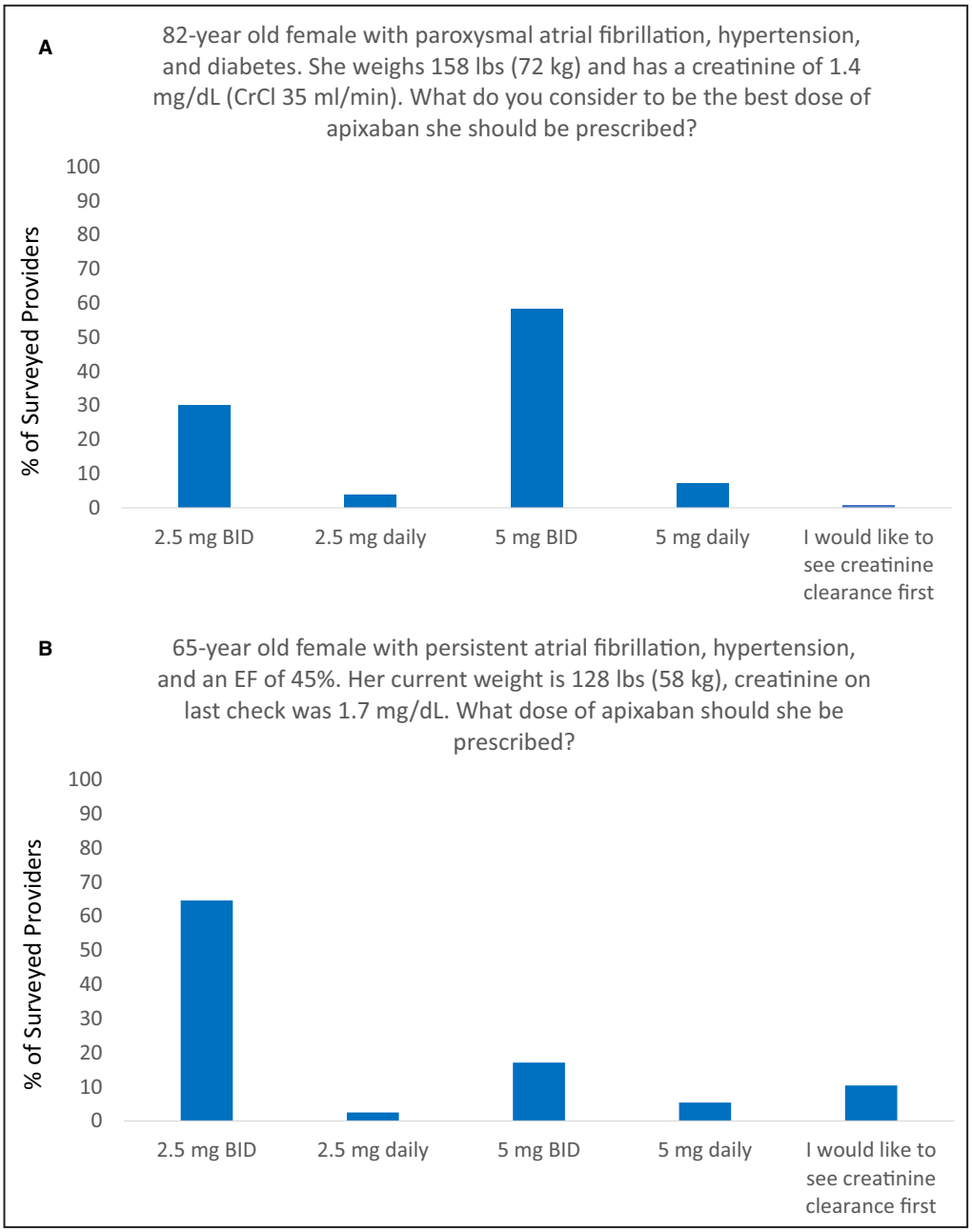

Figure 2. Explanation of each hypothetical clinical scenario administered to clinicians to examine DOAC dosing knowledge

(**A**). A clinical scenario testing labeled apixaban dosing based on knowledge of the ABC criteria. The patient portrayed here only meets one-third of the ABC criteria so should be prescribed 5 mg BID of apixaban per labeled dose criteria. (**B**). A clinical scenario testing labeled apixaban dosing based on knowledge of the ABC criteria. The patient portrayed here meets two-thirds of the ABC criteria so should be prescribed 2.5 mg BID of apixaban per labeled dose criteria. (**C**). A clinical scenario testing labeled rivaroxaban dosing based on knowledge of renal impairment thresholds whereby the dose of rivaroxaban should be adjusted. The patient portrayed here has a creatinine clearance ≤50 mL/min, so should be prescribed an adjusted dose of rivaroxaban (15 mg with evening meal) per labeled dose criteria. (**D**). A clinical scenario testing labeled rivaroxaban dosing based on knowledge of renal impairment thresholds whereby the dose of rivaroxaban should be adjusted. The patient portrayed here has a creatinine clearance >50 mL/min so should be prescribed a full dose of rivaroxaban (20 mg with evening meals) per labeled dose criteria. CrCl indicates creatinine clearance; DOAC, direct oral anticoagulant; EF, ejection fraction; and GFR, glomerular filtration rate.

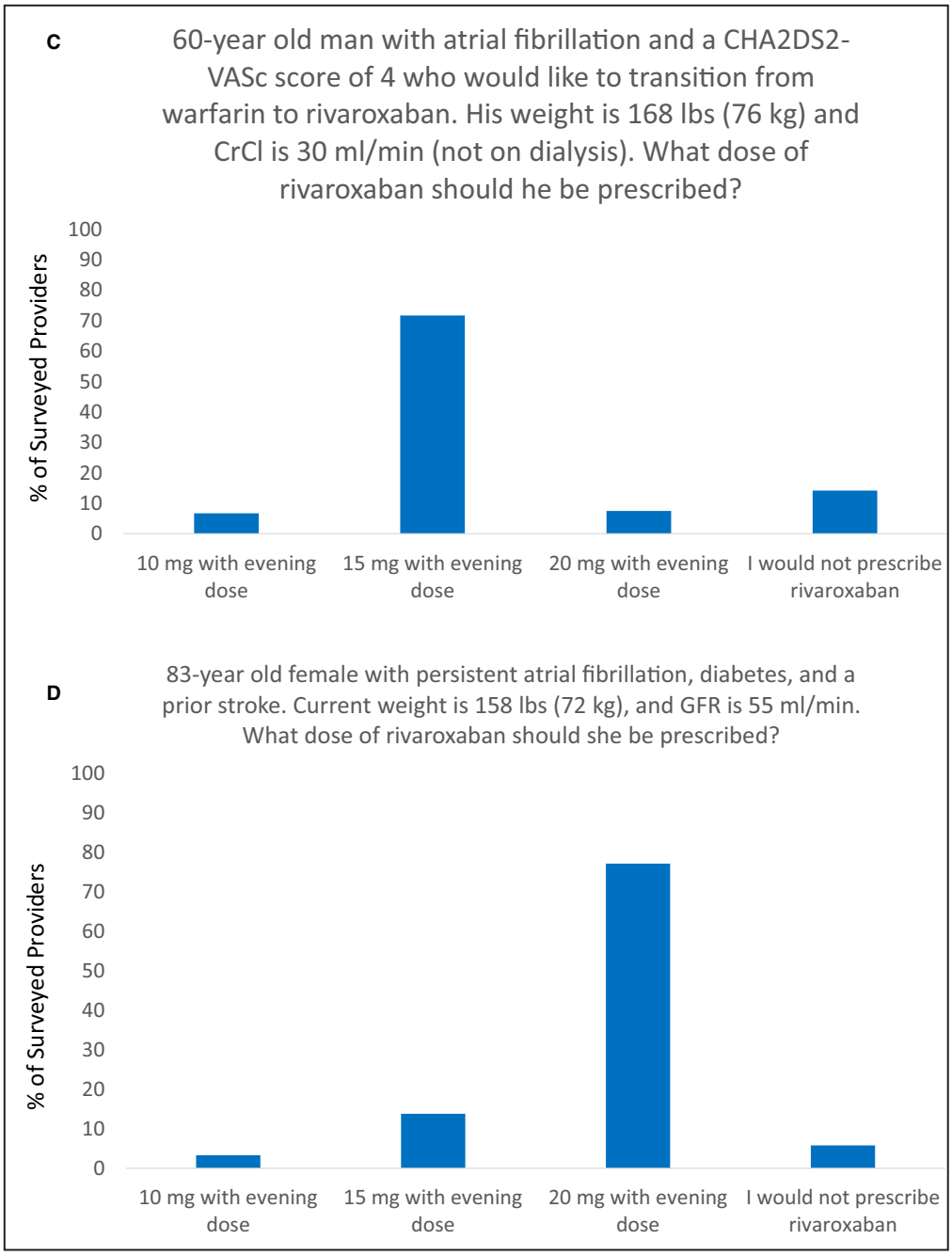

Figure 2. **Continued**

factor in anticoagulant decision making. Patients were more likely than clinicians to rank the ability to reduce the anticoagulation dose if needed as very important (70.8% versus 44.1%; $P<0.01$). While clinicians were more likely than patients to rank cost (84.8% versus 62.3%) as very important, patients were more likely than clinicians to consider the following very important: availability of a reversal agent (90.9% versus 62.1%), minor bleeding (39.1% versus 15.8%), lower risk of side effects (91.5% versus 80.7%), availability of a blood test that measures that the drug is working (65.7% versus 22.6%), what is on the news about the medication (30.3% versus 15.1%), whether a family member or friend had a bad experience (38.8% versus 22.6%), and how long the drug has been on the market (55.8% versus 25.9%; all $P<0.01$).

When comparing patients who reported taking an anticoagulant with those who were not, both groups had similar demographic characteristics: age (median age, 64 years) and proportion of women (73.7% versus 76.5%; $P=0.84$). Anticoagulated patients were significantly more likely to consider stroke reduction (97.7%

Table 3. Responses of Clinicians Who Underdosed DOACs (According to Labeling) in Practice to Practice Pattern and Dosing Knowledge Questions

Questions	Clinicians Who Underdosed a DOAC *N*=66	Clinicians Who Never Underdosed a DOAC *N*=165	*P* Value
Demographics			
Age, y, median (IQR)	56 (47–60)	54 (47–63)	0.77
Female, %	9.1	11.5	0.60
Years in practice since completion of training, %			
<5	0	4.2	0.12
5–10	9.1	9.7	
10–15	18.2	18.8	
15–20	27.3	16.4	
>20	54.5	50.3	
Primary area of practice, %			
Electrophysiology	21.2	26.0	<0.0001
Invasive cardiology (non-EP)	31.8	24.2	
Noninvasive cardiology	24.2	23.0	
Primary care	21.2	3.6	
Other	1.5	23.0	
How many other clinicians are in your practice?, %			
Solo practice	6.1	9.7	0.21
1–5 other clinicians	28.8	22.4	
6–10 other clinicians	16.7	10.3	
>10 clinicians	48.5	56.4	
Affiliated with a teaching hospital, %	42.4	60.6	0.01
Preference and knowledge, %			
Answered never/rarely to: "Among patients for whom you prescribed a DOAC, how often have you felt the need to prescribe a dose lower than labeled parameters?"	62.1	65.5	0.62
Clinician chose to under-dose when the hypothetical scenario was a patient indicated for full-dose apixaban	40.9	39.4	0.83
Clinician chose to underdose when the hypothetical scenario was a patient indicated for full-dose rivaroxaban	16.7	17.0	0.95
Clinician chose an incorrect dose when the hypothetical scenario was a patient indicated for adjusted dose apixaban (2.5 mg BID)	24.2	32.7	0.20
Clinician chose an incorrect dose when the hypothetical scenario was a patient indicated for adjusted-dose rivaroxaban (15 mg daily)	22.7	29.7	0.28
Answered all 4 hypothetical scenario questions correctly	37.9	35.2	0.70

DOAC indicates direct oral anticoagulant; EP, electrophysiology; and IQR, interquartile range.

versus 85.3%; *P*=0.004) as "very important" compared with patients who reported not being on anticoagulation (Table 4). Patients not on anticoagulation were significantly more likely to rank the characteristic that the medication may cause easy bruising (41.2% versus 21.8%; *P*=0.02) and severe bleeding (97.1% versus 81.4%; *P*=0.02) as "very important" compared with those patients on anticoagulation.

DISCUSSION

In this study, we observed the following:

1. While many clinicians indicated that they would never or rarely empirically underdose if the patient did not meet labeled dose reduction criteria, 41.2% and 17.6% chose to underdose apixaban and rivaroxaban, respectively, in hypothetical scenarios, and 28% of clinicians actually underdosed DOACs in patients who did not meet labeled dose reduction criteria in observed practice.
2. There were no significant differences in empiric dosing preferences or anticoagulant dosing knowledge between clinicians who underdosed DOACs and those who did not underdose.

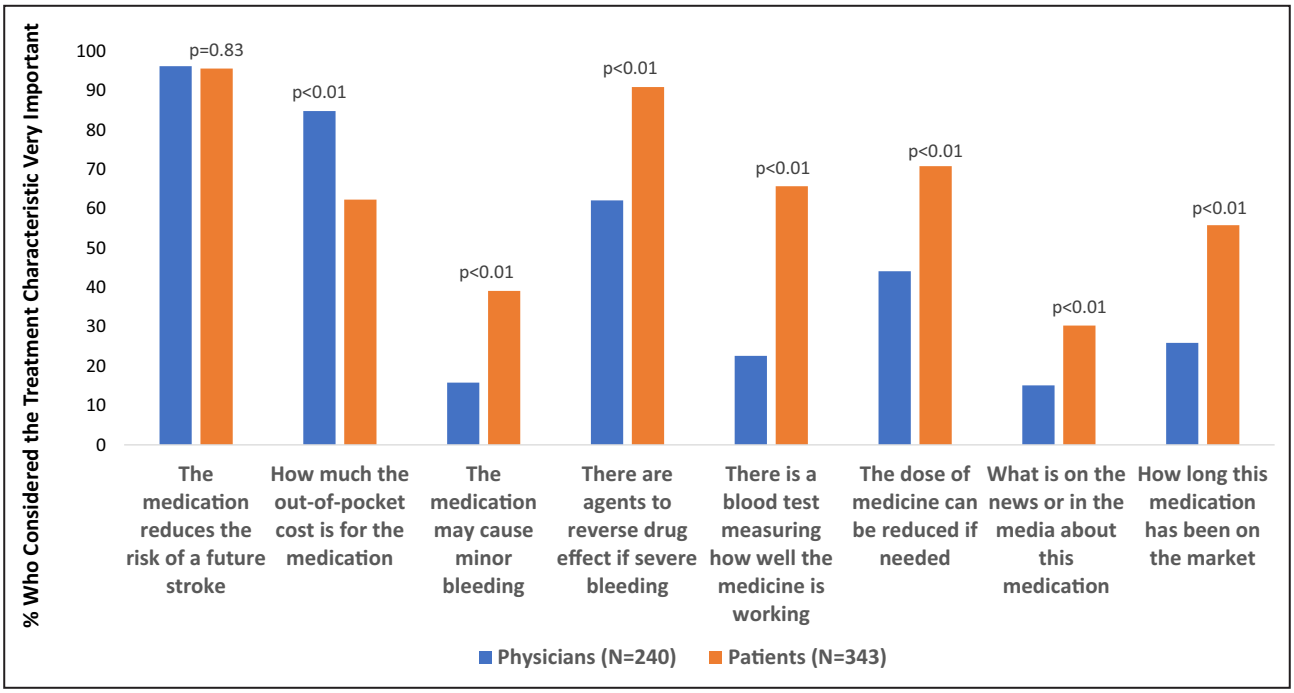

Figure 3. Comparison of percentage of patients vs clinicians who considered the surveyed treatment characteristics very important.

Clinicians and patients differed on several treatment characteristics in terms of what they considered very important. Clinicians were more likely than patients to consider out-of-pocket cost for the medication to be very important. Patients were more likely than clinicians to consider the following characteristics very important: the presence of reversal agents if severe bleeding, the dose of the medication can be reduced if needed, the duration of time the drug has been on the market, and the presence of a blood test measuring how well the medicine is working.

3. While both patients and clinicians ranked stroke prevention as most important, patients were substantially more likely than clinicians to consider the ability to reduce the dose of the DOAC as very important to anticoagulant decision making.

The use of DOACs prescribed at doses lower than the labeled dose criteria is a relatively common practice that has been associated with worse outcomes. In real-world practice, reduced-dose apixaban is used at a >4-fold higher rate than was observed in clinical trials in which dosing had more stringent protocol oversight.[7] In a large US-based clinical registry of patients with AF, 9.4% of DOAC-treated patients with AF were prescribed an underdosed DOAC.[9] Additionally, in an administrative database analysis, 13.3% of patients with AF with no renal indication for dose reduction were potentially underdosed.[8] Our study demonstrated that nearly 30% of clinicians were observed to underdose DOACs, according to labeling criteria, in their patients with AF despite many of these clinicians indicating that they would rarely or never empirically underdose.

To further understand whether knowledge gaps in dosing could explain underdosing, we developed hypothetical patient scenarios and observed that less than one-third of clinicians were able to answer all of the dosing knowledge questions accurately: 41.2% and 17.6% of clinicians chose to underdose apixaban and rivaroxaban in patients who did not meet the labeled criteria for adjusted dosing. However, this knowledge gap does not appear to explain the underdosing occurring in real-world practice, as performance on these hypothetical scenarios did not significantly differ between clinicians who did and those who did not underdose in practice. We did observe more primary care and nonelectrophysiology cardiologists in the underdosing group; thus, we hypothesize that other factors, such as concern for bleeding risk, may potentially play a role in the decision to underdose patients. This work underscores the need to give feedback to providers about their prescribing practices so that practice improvements can occur.

While our survey highlights the gaps that may exist in clinician DOAC dosing knowledge, it also highlights the gaps in treatment beliefs that exist between clinicians and patients. While both patients and clinicians ranked the reduction of stroke as the most important treatment characteristic, patients ranked the ability to reduce the dose of the DOAC as very important significantly more often compared with clinicians.

Table 4. Comparison of the Percentage of Self-Reported Anticoagulated Patients vs Nonanticoagulated Patients Who Ranked a Treatment Characteristic as "Very Important"

Characteristic	Anticoagulated Patient, % *N*=308	Nonanticoagulated Patient, % *N*=34	*P* Value
Reduces risk of stroke	97.7	85.3	0.004
Severe bleeding	81.4	97.1	0.02
May cause more easy bruising	21.8	41.2	0.02
Well-accepted standard treatment	75.8	61.8	0.10
Out-of-pocket cost	62.7	57.6	0.58
Starting at a lower dose	46.9	61.8	0.11
Minor bleeding	37.7	50.0	0.19
Reversal agent	89.9	97.1	0.23
Lower risk of side effects	91.2	94.1	0.75
Proven to work better than other medications	92.4	91.2	0.73
Blood test measuring efficacy	64.4	76.5	0.19
Dosing can be reduced if needed	70.0	76.5	0.42
Dose can be increased if needed	66.8	84.8	0.05
Drug is taken daily vs twice daily	34.2	35.3	0.89
Need for more frequent clinic visits	53.7	64.7	0.28
Requires monthly blood tests	71.3	64.7	0.43
Potential for drug interactions	85.6	88.2	0.80
Limits food options	63.4	64.7	0.99
Family/friend had bad experience	37.6	50.0	0.19
What is on news about medication	30.0	33.3	0.69
How long on the market	54.7	64.7	0.28
Number of other medications	50.5	55.9	0.59
Whether on a $P2Y_{12}$ inhibitor	67.2	75.8	0.43
Insurance covers this medication	84.0	82.4	0.81
Medication has been studied in people like me	89.3	94.1	0.55

Indeed, among surveyed patients with AF, those who are not currently anticoagulated are more likely to consider easy bruising as a deciding factor for anticoagulation than patients who are currently anticoagulated. Furthermore, unlike clinicians, patients ranked availability of a reversal agent as one of their top 10 important factors for anticoagulant decision making. These differences expose an important gap that exists between what clinicians consider important and what patients consider important. In 2014, the use of shared decision making to individualize the treatment plan and anticoagulation regimen of patients with AF was issued a class I recommendation.[1] The results of our survey would indicate that shared decision making around the decision to initiate a DOAC may need to be further refined to reconcile differences between what clinicians and patients think are most important about DOAC treatment. Additionally, the results of our survey underscore the need for clinicians to approach the decision making around initiating or resuming anticoagulation therapy in patients with AF by first understanding the patient's concerns as well as understanding of the medication. Clinicians must, however, recognize that reducing the dose of a DOAC according to patient preference when not clinically indicated will potentially place the patient at a higher risk for stroke. As such, while shared decision making is critical for decision making around the use of DOACs, labeling parameters for DOACs still should be followed.

There are several limitations of the current analysis. The history obtained in the patient survey, including comorbidities, age, sex, and diagnosis of atrial fibrillation, were all self-reported and the CHA_2DS_2-VASc score may be underestimated. The patient volunteers who were surveyed included patients who voluntarily joined ResearchMatch or were active in StopAfib.org or the Atrial Fibrillation Support Forum on Facebook. The viewpoints of these patient volunteers may not be representative of a broader population of patients with AF. As we are not able to understand the complete history of patients who were deemed to be prescribed a DOAC dose lower than labeled criteria, there may be extenuating circumstances or factors that led clinicians to prescribe these doses. Additionally, if a patient requested that

his or her clinician prescribe a reduced dose of an oral anticoagulant, we would not have been able to detect this either from the claims data set or from the survey.

CONCLUSIONS

Almost 30% of clinicians treating patients with AF prescribed an underdosed DOAC despite the patient not meeting labeled dose reduction criteria. Most clinicians stated that they would never/rarely empirically underdose a patient in their practice, but a large majority of clinicians demonstrated gaps in DOAC dosing knowledge. Additionally, we observed differences in what patients and clinicians considered important to anticoagulant decision making; patients were more likely than clinicians to rank the ability to reduce the dose of the DOAC as very important. Further work is needed to determine how to optimize clinician and patient decision making for DOAC selection and dosing.

ARTICLE INFORMATION

Received January 8, 2021; accepted March 22, 2021.

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Acknowledgments

The authors thank Lauren Young and Symphony PRA for assistance with developing list of clinicians for survey purposes.

Sources of Funding

This research was funded by an investigator-initiated research award from Bristol-Myers Squibb and Pfizer, as part of the American Thrombosis Investigator Initiated Research Program (ARISTA-USA, 2017).

Disclosures

Dr Rymer reports funding for research projects from Abbott and Boston Scientific. Dr Wang reports research grants from AstraZeneca, Bristol Myers Squibb, CryoLife Inc., Portola Pharmaceuticals, and Regeneron Pharmaceuticals. The remaining authors have no disclosures to report.

Supplementary Material

Data S1–S2
Tables S1–S2

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SUPPLEMENTAL MATERIAL

Data S1.

ARISTA Provider Survey

Start of Block: Block 1 - Duke employee

Q24 Thank you for your interest in our survey study. To determine whether you qualify for this study, please answer the following question: Are you an employee of Duke University?

- ○ Yes (51)
- ○ No (52)

End of Block: Block 1 - Duke employee

Start of Block: Block 2 - Duke employee - payment

Q25 As an employee of Duke University, you may complete the survey, but you would not be eligible for compensation. Would you like to proceed with the survey?

- ○ Yes, I would like to proceed. (4)
- ○ No, I do not wish to proceed. (5)

End of Block: Block 2 - Duke employee - payment

Start of Block: Block 11 - Duke employee - decline

Q57 Thank you for considering participation in our survey!

End of Block: Block 11 - Duke employee - decline

Start of Block: Block 9 - how received

Q55 Did you receive the survey invitation directly to your in-box, or was the link forwarded to you by another recipient?

- ○ I received the link directly. (1)
- ○ The link was forwarded to me by another recipient. (2)

End of Block: Block 9 - how received

Start of Block: Block 10 - forwarded link

Q56 Based on your response, you do not qualify for our survey study. Thank you for your interest.

End of Block: Block 10 - forwarded link

Start of Block: Block 3 - consent

Q26 Based on your response, you qualify for our survey study. Please review below for more information about the study before making your decision whether or not to participate.

Q27 Purpose: To help describe provider perspectives, practices, and beliefs on the treatment of patients with atrial fibrillation (AF) with direct oral anticoagulants (DOACs). Rationale: The approval of DOACs for thromboembolic prophylaxis was long-awaited for patients with non-valvular atrial fibrillation (AF). Recent quality improvement efforts in cardiovascular care have focused on increasing anticoagulant use among indicated and eligible patients with AF. We want to explore the treatment beliefs and practices of providers when deciding on how to treat AF patients with anticoagulants. Confidentiality and Procedures: You have been identified as a provider who cares for more than 25 patients with AF. We are asking you to complete a brief survey regarding your treatment beliefs, current practices, and the patient and treatment characteristics you feel are most important when considering how to use anticoagulants in patients with AF. The Duke Clinical Research Institute (DCRI) will not share the results of your survey. Survey results will only be presented as a summary of aggregate data among all participating providers. The survey will be completed securely through the Qualtrics web-based survey tool. We will collect survey responses from up to 240 healthcare providers. Risks: There are no physical risks for participating in this survey. There is a risk of loss of confidentiality. Every effort will be made to keep your information and identity confidential. You can refuse to answer any or all of the questions. We are collecting your name and other information so we can keep track of who has responded to the survey, but this information will be removed before we perform any analyses. We may publish what we learn, but you won't be identified in any way. Compensation: As a token of appreciation for your time in completing the entire survey, you will be eligible to receive a $100 Amazon e-Gift Card. You will be able to fill out the payee form in order to request your gift card at the end of the survey. Study Contact: For more information about this survey or if you have any questions or complaints, please contact the ARISTA Study Principal Investigator, Dr. Tracy Wang, at DCRI-ARISTA-Study@dm.duke.edu . Voluntary Participation: Participation in this survey is voluntary. You

can choose not to take part. You can choose to omit any question you prefer not to answer without penalty or repercussions.

- ○ I would like to proceed with the survey (1)
- ○ I do not wish to proceed with the survey (2)

End of Block: Block 3 - consent

Start of Block: Block 4 - decline

Q28 Thank you for considering participation in our survey. So that we can track that you DO NOT want to participate, please provide the information below (for tracking purposes only).

Q37 Please list your full name:

_____

Q32 Please indicate your date of birth:

Month (1)	▼ January (1) ... (119)
Day (5)	▼ January (1) ... (119)
Year (6)	▼ January (1) ... (119)

*

Q34 Please indicate your email address:

_____

Q35 Please indicate your gender:

- ○ Male (1)
- ○ Female (2)
- ○ Prefer not to answer (4)

End of Block: Block 4 - decline

Start of Block: Block 5 - accept, demographics

Q36 Thank you for agreeing to participate in our survey. So that we can document your agreement, please complete the information below.

Q38 Please list your full name:

_____

Q39 Please indicate your date of birth:

Month (1)	▼ January (1) ... (119)
Day (5)	▼ January (1) ... (119)
Year (6)	▼ January (1) ... (119)

Q40 Please indicate your email address:

_____

Q41 Please indicate your gender:

- Male (1)
- Female (2)
- Prefer not to answer (4)

Q42 Please indicate your race:

- White (1)
- Black or African American (2)
- American Indian or Alaska Native (3)
- Asian (4)
- Native Hawaiian or Pacific Islander (5)
- Multi-racial (6)
- Prefer not to answer (9)

Q43 Please identify your ethnicity:

- Hispanic or Latino (1)
- Not Hispanic or Latino (2)
- Prefer not to answer (4)

End of Block: Block 5 - accept, demographics

Start of Block: Default Question Block

Q1 How many years have you been practicing since completing training?

- ○ < 5 years (1)
- ○ 5-10 years (2)
- ○ 10-15 years (3)
- ○ 15-20 years (4)
- ○ > 20 years (5)

Q2 Please list your primary area of practice (select one that best describes you)

- ○ Primary care (internal medicine, family medicine, primary care medicine, hospitalist) (1)
- ○ Anticoagulation clinic provider (2)
- ○ Noninvasive cardiology (3)
- ○ Invasive cardiology (non-EP) (4)
- ○ Cardiac electrophysiology (EP) (5)
- ○ Surgery (6)
- ○ Other (7)

Q3 How many other providers (physicians and advanced practice providers) are in your practice?

- ○ solo practice (1)
- ○ 1-5 other providers (2)
- ○ 6-10 other providers (3)
- ○ > 10 other providers (4)

Q4 Are you affiliated with an academic medical center or teaching hospital?

- ○ Yes (1)
- ○ No (2)

*

Q5 In the last year, which of the following educational resources have most strongly influenced your practice of medicine? (Select up to 3)

- ☐ Journal original articles (1)
- ☐ Electronic clinical education resource (e.g., UpToDate) (2)
- ☐ Professional society guidelines or consensus documents (3)
- ☐ Scientific conference attendance (4)
- ☐ Web-based medical news or expert perspectives (e.g., Medscape) (5)
- ☐ Web-based seminars (webinars) (6)
- ☐ Social media-based tutorials or perspectives (e.g., “tweetorials”) (7)
- ☐ Board review or maintenance of certification (MOC) courses/course materials (8)
- ☐ Educational conferences at my institution (e.g., grand rounds) (9)
- ☐ Patient-specific prompts/alerts from my electronic health record (10)
- ☐ Informal discussions with colleagues and peers (11)
- ☐ Other (12)

*

Q6 Which of the following resources do you most frequently use to look up which DOAC dose to prescribe for your AF patient? (Select up to 3)

- [ ] USPI dosing recommendations (package inserts) (1)
- [ ] App-based dosing resource (e.g., Epocrates, GoodRx) (2)
- [ ] Web-based dosing resource (e.g., National Library of Medicine Drug Information Portal) (3)
- [ ] Review article (e.g., UpToDate or journal review) (4)
- [ ] Original trial dosing description (5)
- [ ] Dosing instructions from the prescribing orderset in my electronic health record (6)
- [ ] Other (7)

Q7 For your patients who are prescribed a DOAC but don't fill it, what % don't fill because of:
Affordability (can't pay for drug) : _____ (1)
Access (can't find drug) : _____ (2)
Concern about bleeding : _____ (3)
Concern about other side effects : _____ (4)
Not sure why drug needed : _____ (5)
No specific reason provided : _____ (6)
Other reasons : _____ (7)
Total : _____

---

*

Q8 How do you manage patients who are concerned about bleeding side effects of DOAC? (select up to 3)

- [ ] Suggest warfarin as an alternative (1)
- [ ] Start DOAC at a lower dose (2)
- [ ] Schedule more frequent follow-up after initiation (3)
- [ ] Stop other meds (e.g., aspirin, NSAIDs) to avoid bleeding (4)
- [ ] Start a proton pump inhibitor (5)
- [ ] Refer for physical therapy (6)

Q9 Among patients for whom you have prescribed a DOAC, how often have you felt the need to prescribe a dose lower than labeled dose parameters (e.g., prescribed apixaban 2.5 mg BID when the patient only met 1 of the reduced dosing criteria)?

- ○ 0% (never) (1)
- ○ 1-5% (rarely) (2)
- ○ 6-10% (sometimes) (3)
- ○ 11-25% (often) (4)
- ○ > 25% (frequently) (5)

Q10 When you switched a patient from warfarin to a DOAC previously, what % was because of:
Labile or difficult to manage INR : _____ (1)
Interaction with other medications that the patient is on : _____ (2)
Patient Preference : _____ (3)
Ease of dosing : _____ (4)
Bleeding events : _____ (5)
Other : _____ (6)
Post-procedure re-initiation of anticoagulation : _____ (7)
Total : _____

Q11 How frequently do you monitor renal function in patients taking DOACs?

- ○ Only at initiation and then as needed (1)
- ○ Every 3 months (2)
- ○ Every 6 months (3)
- ○ Once a year (4)
- ○ Every other year (5)
- ○ Other (6) _____

Q12 Dosing Practice Questions

Q13 82-year old female with paroxysmal atrial fibrillation, hypertension, and diabetes. She weighs 158 lbs (72 kg) and has a creatinine of 1.4 mg/dL (CrCl 35 ml/min). What do you consider to be the best dose of apixaban she should be prescribed?

- 2.5 mg daily (1)
- 2.5 mg bid (2)
- 5 mg daily (3)
- 5 mg bid (4)
- I would not prescribe her apixaban. (5)

Q14 65-year old female with persistent atrial fibrillation, hypertension, and an EF of 45%. Her current weight is 128 lbs (58kg), creatinine on last check was 1.7 mg/dL. What dose of apixaban should she be prescribed?

- 2.5 mg daily (1)
- 2.5 mg bid (2)
- 5 mg daily (3)
- 5 mg bid (4)
- I would like to see what her creatinine clearance is before choosing a dose. (5)

Q15 60-year old man with atrial fibrillation and a CHA2DS2 VASc score of 4 who would like to transition from warfarin to rivaroxaban. His weight is 168 lbs (76 kg) and CrCl is 30 ml/min (not on dialysis). What dose of rivaroxaban should he be prescribed?

- 10 mg with the evening meal (1)
- 15 mg with the evening meal (2)
- 20 mg with the evening meal (3)
- I would not prescribe him rivaroxaban (4)

Q16 83-year old female with persistent atrial fibrillation, diabetes, and a prior stroke. Current weight is 158 lbs (72 kg), and GFR is 55 ml/min. What dose of rivaroxaban should she be prescribed?

- 10 mg with the evening meal (1)
- 15 mg with the evening meal (2)
- 20 mg with the evening meal (3)
- I would not prescribe her rivaroxaban (4)

Q17 The following scenarios are being asked of AFib patients as well to examine differences between patient and provider perspectives. **Please read the scenario and think about the questions that would be important <u>for this patient</u> to ask in deciding their treatment.**

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Q52

Scenario 1: Mrs. Johnson is a 65-year-old nurse with a history of hypertension, diabetes, and diverticular bleeding 10 years ago without recent bleeding. Her primary care doctor incidentally detected atrial fibrillation on a routine electrocardiogram and her risk of stroke is 4.8% every year. Mrs. Johnson is considering starting an anticoagulant, but is nervous about her prior

episode of bleeding 10 years ago. She mentions to you that one of her prior patients was prescribed a reduced dose of a direct oral anticoagulant. **If you were Mrs. Johnson, what would be the top 3 questions you would ask your doctor when trying to decide which treatment option to pursue? (free text)**

1. (1) _____
2. (2) _____
3. (3) _____

Q54

Scenario 2: Mr. Jones is an 81-year-old widower with a recent embolic stroke requiring him to use a walker for ambulation and to move in with his daughter due to several falls. There was concern during his hospitalization that undiagnosed atrial fibrillation could have contributed to his stroke but he deferred making the decision about anticoagulation until he could discuss more with his family. In his follow-up visit 2 months later, his doctor recommends that either warfarin or a DOAC should be started. He tells Mr. Jones that warfarin would require periodic blood test monitoring or he could choose to take a DOAC that would not need frequent blood tests but might be more expensive. Both medications can cause bleeding or bruising. Mr. Jones is not sure what anticoagulant he should choose. **If you were Mr. Jones, what would be the top 3 questions you would ask your doctor when trying to decide which treatment option to pursue? (free text)**

1. (1) _____
2. (2) _____
3. (3) _____

Q56

Scenario 3: Mrs. Arnold is a 67-year old woman with atrial fibrillation who has been taking warfarin for years. Recently she had to switch to one of DOACs because of labile INRs on

warfarin requiring weekly INR tests and warfarin dose changes. Since starting the new medicine a month ago, she has noted very easy bruising and sometimes a little bit of blood on the toilet paper from her hemorrhoids. She read online that some people must take a lower dose of the new medication, and she wonders if she should decrease her dose as well. **If you were Mrs. Arnold, what would be the top 3 questions you would ask your doctor when trying to decide which treatment option to pursue? (free text)**

1. (1) _____
2. (2) _____
3. (3) _____

Q58

Scenario 4: Mr. Miller is a 58-year old man with atrial fibrillation who has been taking 15 mg of rivaroxaban daily for the last 2 years due to a creatinine clearance (CrCl) of 40 ml/min. Last year, he lost 50 pounds with improvements in his blood pressure and diabetes. On a recent doctor's visit, his CrCl was 55 ml/min, no longer meeting dose reduction criteria. His doctor would like him to begin taking the regular dose (20mg) to better protect him against strokes.**If you were Mr. Miller, what would be the top 3 questions you would ask your doctor when trying to decide which treatment option to pursue? (free text)**

1. (1) _____
2. (2) _____
3. (3) _____

Q22 How important are each of the following to you when helping your patient choose an anticoagulation strategy? (1 = not at all important, 2-3 = maybe important, 4-6 = somewhat important, 7-9 = very important)

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)
The medication reduces the risk of a future stroke (1)	☐	☐	☐	☐	☐	☐	☐	☐	☐
The medication may cause more easy bruising (2)	☐	☐	☐	☐	☐	☐	☐	☐	☐
The medication is a well-accepted standard treatment for AF (3)	☐	☐	☐	☐	☐	☐	☐	☐	☐
How much the out-of-pocket cost is for the medication (4)	☐	☐	☐	☐	☐	☐	☐	☐	☐
The option of starting at a lower dose of the medication if necessary (5)	☐	☐	☐	☐	☐	☐	☐	☐	☐
The medication may cause minor bleeding (such as the occasional small nosebleed) (6)	☐	☐	☐	☐	☐	☐	☐	☐	☐
The medication may cause severe bleeding (7)	☐	☐	☐	☐	☐	☐	☐	☐	☐

There are agents to reverse drug effect if severe bleeding occurred (8)	☐	☐	☐	☐	☐	☐	☐	☐	☐
The medication has lower risk of side effect than other medications (9)	☐	☐	☐	☐	☐	☐	☐	☐	☐
This medication is proven to work better than the other medication (10)	☐	☐	☐	☐	☐	☐	☐	☐	☐
There is a blood test measuring how well the medicine is working (11)	☐	☐	☐	☐	☐	☐	☐	☐	☐
The dose of the medicine can be reduced if needed (12)	☐	☐	☐	☐	☐	☐	☐	☐	☐
The dose of the medicine can be increased if needed (13)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Whether the medication is taken once daily versus twice daily (14)	☐	☐	☐	☐	☐	☐	☐	☐	☐

The need for more frequent clinic visits while on this medication (15)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Whether the medication requires monthly blood tests for monitoring (16)	☐	☐	☐	☐	☐	☐	☐	☐	☐
The frequency of potential drug-drug interaction (17)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Whether the medication limits what foods my patient is able to eat (18)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Whether a patient's family member/friend had a bad experience with this medication (19)	☐	☐	☐	☐	☐	☐	☐	☐	☐
What is on the news or in the media about this medication (20)	☐	☐	☐	☐	☐	☐	☐	☐	☐
How long this medication has been on the market (21)	☐	☐	☐	☐	☐	☐	☐	☐	☐

The number of other medications being taken (22)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Whether my patient is on a P2Y12 inhibitor (23)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Insurance covers this medication (24)	☐	☐	☐	☐	☐	☐	☐	☐	☐
This medication has been studied in people like my patient (25)	☐	☐	☐	☐	☐	☐	☐	☐	☐

End of Block: Default Question Block

Start of Block: Block 13 - Duke employee, no payment - stop

Display This Question:

If As an employee of Duke University, you may complete the survey, but you would not be eligible for... = Yes, I would like to proceed.

Q59 Thank you for completing our survey for the ARISTA Study! You indicated that you are a Duke employee, so you are not eligible to receive compensation for completing the survey.

End of Block: Block 13 - Duke employee, no payment - stop

Start of Block: Block 6 - payment selection

Q44 Thank you for completing our survey for the ARISTA study! As a token of appreciation for your time, we would like to provide you with a $100 Amazon e-Gift Card. Please complete ALL of the following information. This information is required by Duke University for tax purposes. You do not have to provide this information, however, if you do not provide it, we will not be able to send you a gift card. This website uses encryption technology to protect your personal information, both when it is collected and stored, and when it is transmitted to Duke University. Duke University will store this information behind the Duke firewall, and it will be

accessible only to authorized staff for the purpose of processing your compensation. It will not be associated with your survey responses or included in any analyses.

- ○ I wish to provide this information and receive a gift card. (1)
- ○ I DO NOT wish to provide this information. I understand that I will not receive a gift card. (2)

Q45 Payee information:

- ○ Full name: (1) _____
- ○ Social Security Number: (2) _____
- ○ Street Address: (3) _____
- ○ City: (4) _____
- ○ State: (5) _____
- ○ Zip Code: (6) _____
- ○ Email address for gift card delivery: (8) _____
- ○ CONFIRM email address: (10) _____

End of Block: Block 6 - payment selection

Start of Block: Block 7 - payee form declined

Display This Question:

If Thank you for completing our survey for the ARISTA study! As a token of appreciation for your ti... = I DO NOT wish to provide this information. I understand that I will not receive a gift card.

Q47 Thank you. This confirms that you declined to complete the payee information, so you are not eligible to receive compensation for completing the survey.

End of Block: Block 7 - payee form declined

Start of Block: Block 8 - completed payee form

Q48 Thank you. This confirms that you completed all fields of the payee information, and are eligible to receive compensation for completing the survey upon internal validation of the information provided.

End of Block: Block 8 - completed payee form

Data S2.

ARISTA Patient Survey - Social Media

Start of Block: Diagnosis

Q40 Thank you for your interest in our survey study. To determine whether you qualify for this study, please answer the following question: Have you personally been diagnosed with atrial fibrillation (afib, AF)?

- ○ Yes, I have been diagnosed with atrial fibrillation. (4)
- ○ No, I have not been diagnosed with atrial fibrillation. (5)

End of Block: Diagnosis

Start of Block: Not Eligible

Q35 Based on your response, you do not qualify for our survey study. Thank you for your interest!

End of Block: Not Eligible

Start of Block: Eligible

Q36 Based on your response, you qualify for our survey study. Please click the arrow below to review more information about the study before making your decision whether or not to participate.

End of Block: Eligible

Start of Block: Consent

Q1 Purpose: To help describe the beliefs and perspectives of patients with atrial fibrillation (AF) who may require blood thinners to help prevent strokes.

Rationale: We want to explore how patients like you make decisions about whether to take a blood thinning medication for stroke prevention. This information will help us understand how to best lower stroke risk in other patients with atrial fibrillation

Procedures and Confidentiality: You have identified yourself as having a diagnosis of atrial

fibrillation, and have indicated your desire to participate in research related to this diagnosis. We are asking you to complete a brief survey regarding what is most important to you when considering whether to take a blood thinning medication for stroke prevention. The Duke Clinical Research Institute will not share the results of your survey. The survey will be completed securely through this Qualtrics web-based survey tool. We will collect survey responses from up to 320 people like you.

Risks: There are no physical risks for participating in this survey. You can refuse to answer any or all of the questions. We are collecting your name and birthdate so we can keep track of who has responded to the survey, but this information will be removed when we combine all the survey responses together to analyze the results. We may publish what we learn, but only using the anonymous grouped responses.

Study Contact: For more information about this survey or if you have any questions or complaints, please contact the ARISTA Study Principal Investigator, Dr. Tracy Wang, at DCRI-ARISTA-Study@duke.edu.

Voluntary Participation: Participation in this survey is voluntary. You can choose not to take part. You can choose to omit any question you prefer not to answer without penalty or repercussions.

- ○ I would like to proceed with the survey. (1)
- ○ I do not wish to proceed with the survey. (2)

End of Block: Consent

Start of Block: Block 2 - decline

Q31 Thank you for considering participation in our survey. So that we can track that you DO NOT want to participate, please provide the information below (for tracking purposes only):

Q32 Please list your full name:

_____

Q35 Please indicate your date of birth:

Month (1)	▼ January (1) ... (150)
Day (2)	▼ January (1) ... (150)
Year (3)	▼ January (1) ... (150)

Q34 Please indicate your gender:

- ○ Female (1)
- ○ Male (2)
- ○ Prefer not to answer (4)

End of Block: Block 2 - decline

Start of Block: Block 2 - accept

Q32 Thank you for agreeing to participate in our survey. So that we can document your agreement, please complete the information below (for tracking purposes only):

Q13 Please list your full name:

_____

JS

Q28 Please indicate your date of birth:

Month (1)	▼ January (1) ... (150)
Day (2)	▼ January (1) ... (150)
Year (3)	▼ January (1) ... (150)

Q15 Please indicate your gender:

- Female (1)
- Male (2)
- Prefer not to answer (4)

Q37 Please indicate your race:

- White (1)
- Black / African American (2)
- Native American / Alaskan Native (3)
- Asian (4)
- Hawaiian / Pacific Islander (9)
- Multi-racial (10)
- Prefer not to answer (11)

Q39 Please indicate your ethnic origin:

- Hispanic or Latino (1)
- Not Hispanic or Latino (2)
- Prefer not to answer (3)

End of Block: Block 2 - accept

Start of Block: Survey

Q2 How long have you known you've had atrial fibrillation?

- ○ < 1 year (1)
- ○ 1-2 years (2)
- ○ 3-5 years (3)
- ○ 6-10 years (4)
- ○ 11-20 years (5)
- ○ > 20 years (6)

Q3

Are you currently taking a blood thinning medication? Examples of blood thinning medications are warfarin (Coumadin), apixaban (Eliquis), rivaroxaban (Xarelto), dabigatran (Pradaxa), edoxaban (Savaysa), and enoxaparin (Lovenox).

- ○ Yes (1)
- ○ No (2)
- ○ I don't know (3)

Q4

Do you have any of the following health conditions? Check all that apply.

- [ ] High blood pressure (1)
- [ ] Diabetes (2)
- [ ] Previous stroke (3)
- [ ] Previous heart attack (4)
- [ ] Heart failure (heart muscle weakened or doesn't pump well) (5)
- [ ] Peripheral vascular disease (not enough blood reaching your legs) (6)
- [ ] Abnormal kidney function (7)

Q5

Below, we will describe a few hypothetical scenarios. In each scenario, we will describe a patient with atrial fibrillation and the initial information given to them by their doctor about possible treatments. Please read each scenario and think about the questions that would be important for this patient to ask before deciding on their treatment choice. As background information, when patients have atrial fibrillation, they can choose between: 1) Warfarin (Coumadin), which is a pill taken once daily. Patients on warfarin need monthly blood draws to make sure they are on the right dose of medication, and the warfarin dosage may need to be adjusted if there are changes in their diet or other medications they are taking.
or 2) A newer type of blood thinning medication, called a direct oral anticoagulant (DOAC). There are several different DOACs to choose from, all of which are pills, some are taken once daily, others are taken twice a day. Unlike warfarin, frequent blood testing is not needed for the DOAC medications, as the typical dose works for almost all patients. Because the kidney is responsible for processing these drugs, sometimes a lower dose can be prescribed for patients who have lower kidney function. All of these blood thinning medications prevent blood clots and strokes from occurring in patients with atrial fibrillation, and the most common side effect of these medications is bruising or bleeding. Patients can also choose not to be treated with any of these medicines.

Q6

Scenario 1: Your neighbor, Mrs. Johnson, is a 65-year-old nurse who was recently diagnosed with atrial fibrillation by her doctor. She had no symptoms, but atrial fibrillation was detected during a routine physical. Based on her risk factors (diabetes, high blood pressure), her doctor recommends that she take a blood thinning medication as she has a 4.8% chance of having a stroke every year. Mrs. Johnson is nervous about starting a blood thinning medication because she once had to go to the emergency room for bloody bowel movements, although this occurred more than 10 years ago and she has had no other bleeding episodes since. She mentions to you that one of the patients she cared for was prescribed a reduced dose of a direct oral anticoagulant (DOAC). If you were Mrs. Johnson, what would be the top 3 questions you would ask your doctor when trying to decide which treatment option to pursue? (free text)

1. (1) _____
2. (2) _____
3. (3) _____

Q7

Scenario 2: Your father is an 81-year-old widower who recently moved in with you and your family after suffering a stroke. He cannot live alone now because he has had several falls and now needs a walker to get around. At the time of his stroke, the doctor told him that his stroke was likely caused by several small clots traveling to his brain; the most common reason for this is atrial fibrillation. His doctor recommends that he start a blood thinning medication to help prevent future strokes; your father could choose either warfarin or a newer blood thinning medication. His doctor says that warfarin would require monthly blood tests whereas the newer medication would not need routine blood tests but could be more expensive. Both medications can cause bleeding or bruising. Your father is not sure what medication he should choose. If you were helping your father decide which treatment option to pursue, what would be the top 3 questions you would ask your doctor? (free text)

1. (1) _____

2. (2) _____

3. (3) _____

Q8

Scenario 3: Sally, a long-time friend of yours, is a 67-year old woman with atrial fibrillation who has been taking warfarin for years. Recently she had to switch to one of the newer blood thinning medications because of other medications that interfered with the warfarin, requiring her to do weekly blood tests and dose changes on warfarin. Since starting the new medicine a month ago, she has noted very easy bruising and sometimes a little bit of blood on the toilet paper from her hemorrhoids. She read online that some people must take a lower dose of the new medication, and she wonders if she should decrease her dose as well. If you were Sally, what would be the top 3 questions you would ask your doctor when trying to decide which treatment option to pursue? (free text)

1. (1) _____

2. (2) _____

3. (3) _____

Q9

Scenario 4: Your cousin, Jim, is a 58-year old man with atrial fibrillation who has been taking 15 mg of rivaroxaban daily, for the last 2 years (rivaroxaban is one of the newer blood thinning medications). He was prescribed a lower dose of this medication because he has mild kidney dysfunction. Last year, he joined a fitness group, and lost 50 pounds with improvements in his blood pressure and diabetes. On a recent doctor's visit, his kidney function had also significantly improved. As of now, he no longer needs to lower his medication dose, and his doctor would like him to begin taking the regular dose (20mg) to better protect him against strokes. If you were Jim, what would be the top 3 questions you would ask your doctor when trying to decide which treatment option to pursue? (free text)

1. (1) _____
2. (2) _____
3. (3) _____

Q10

Now we'd like you to think about your own experience as someone diagnosed with atrial fibrillation –what matters to you in your treatment decisions? Many things can affect a patient's decision about taking a blood thinning medication for atrial fibrillation. We have listed a few below along with a scale to show how important each of these might be to you when making treatment decisions. A rating of 1 means this characteristic is not at all important to you. A rating of 9 means that this characteristic is very critical to you in terms of your decision making. There are no right or wrong answers. Your answers highlight which things you feel are most important when you are trying to decide about your treatment strategy.

Q11 How important are/were the following to you when thinking about starting blood thinning medication for your atrial fibrillation?

1 = not at all important
2 or 3 = maybe important

4-6 = somewhat important
7-9 = very important

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)
The medication reduces my risk of a future stroke. (1)	○	○	○	○	○	○	○	○	○
The medication may cause me to bruise more easily. (2)	○	○	○	○	○	○	○	○	○
The medication is a well-accepted standard treatment for people like me. (3)	○	○	○	○	○	○	○	○	○
How strongly my doctor recommended the medication. (4)	○	○	○	○	○	○	○	○	○
How much I have to pay out-of-pocket for the medication. (5)	○	○	○	○	○	○	○	○	○
I can start at a lower dose of the medication if I need to. (6)	○	○	○	○	○	○	○	○	○
The medication may cause me to have minor bleeding	○	○	○	○	○	○	○	○	○

(such as the occasional small nosebleed). (7)									
The medication may cause internal bleeding if I fall. (8)	○	○	○	○	○	○	○	○	○
There are treatments available that could reverse the medication's effect if I were to have a severe bleeding episode on this medication. (9)	○	○	○	○	○	○	○	○	○
The medication has lower risk of side effect than other medications. (10)	○	○	○	○	○	○	○	○	○
This medication is proven to work better than the other medication. (11)	○	○	○	○	○	○	○	○	○
There is a blood test measuring how well the medicine is working for me. (12)	○	○	○	○	○	○	○	○	○

The dose of the medicine can be reduced if I need to. (13)	○	○	○	○	○	○	○	○	○
The dose of the medicine can be increased if I need to. (14)	○	○	○	○	○	○	○	○	○
Whether the medication is taken once daily versus twice daily. (15)	○	○	○	○	○	○	○	○	○
I would need more frequent doctor visits while I am on this medication. (16)	○	○	○	○	○	○	○	○	○
Whether the medication requires monthly blood tests for monitoring. (17)	○	○	○	○	○	○	○	○	○
Whether other medications I’m taking affects how this medication works. (18)	○	○	○	○	○	○	○	○	○
Whether the medication limits what foods I am able to eat. (19)	○	○	○	○	○	○	○	○	○
My family member/friend had a bad	○	○	○	○	○	○	○	○	○

experience with this medication. (20)									
What I hear on the news or in the media about this medication. (21)	○	○	○	○	○	○	○	○	○
How long this medication has been on the market. (22)	○	○	○	○	○	○	○	○	○
The number of medications I am already taking. (23)	○	○	○	○	○	○	○	○	○
Whether I am already taking other blood thinning medications. (24)	○	○	○	○	○	○	○	○	○
My insurance covers this medication. (25)	○	○	○	○	○	○	○	○	○
This medication has been tested in patients like me. (26)	○	○	○	○	○	○	○	○	○

End of Block: Survey

Table S1. Hypothetical Scenarios Provided in the Survey to Clinicians with correct answers and explanations.

Scenarios	Correct Answer	Explanation
82-year old female with paroxysmal atrial fibrillation, hypertension, and diabetes. She weighs 158 lbs (**72 kg**) and has a creatinine of **1.4 mg/dL** (CrCl 35 ml/min). What do you consider to be the best dose of apixaban she should be prescribed?	5 mg bid apixaban	Only has 1/3 criteria (age) for adjusted dose, so should not be dose adjusted
65-year old female with persistent atrial fibrillation, hypertension, and an EF of 45%. Her current weight is 128 lbs (**58 kg**), creatinine on last check was **1.7 mg/dL**. What dose of apixaban should she be prescribed?	2.5 mg bid apixaban	Meets 2/3 criteria for dose adjustment to 2.5 mg bid (Cr 1.7 mg/dL) and 58 kg
60-year old man with atrial fibrillation and a CHA2DS2 VASc score of 4 who would like to transition from warfarin to rivaroxaban. His weight is 168 lbs (76 kg) and **CrCl is 30 ml/min (not on dialysis)**. What dose of rivaroxaban should he be prescribed?	rivaroxaban 15 mg daily with meal	CrCl is 30 ml/min so should be dose adjusted
83-year old female with persistent atrial fibrillation, diabetes, and a prior stroke. Current weight is 158 lbs (72 kg), and **GFR is 55 ml/min**. What dose of rivaroxaban should she be prescribed?	Rivaroxaban 20 mg daily with meal	CrCl is 55 ml/min so should not be dose adjusted

*****CrCl = creatinine clearance

$^{\alpha}$GFR = glomerular filtration rate

Table S2. ICD-9 and ICD-10 Codes Used for Defining NVAF.

Inclusions/Exclusion Criteria	ICD-9 and 10 codes
Include: Atrial Fibrillation (including paroxysmal, persistent, chronic, unspecified)	427.31, I48.0, I48.1, I48.2, I48.91
Exclude: Mitral Stenosis, mitral valve stenosis and aortic stenosis, mitral stenosis and aortic valve insufficiency, rheumatic mitral stenosis, rheumatic mitral stenosis and insufficiency	394, 396.1, I05.0, I05.2
Exclude: Heart valve replaced by transplant, heart valve replaced by other means, presence of prosthetic heart valve, presence of xenogenic heart valve, presence of other heart valve replacement	V42.2, V43.3, Z95.2, Z95.3, Z95.4
Exclude: Valve Repair	V15.1