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Healthcare professionals' perspectives on prescribing DOACs to frail older patients; the DOAC-FRAIL questionnaire

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Abstract

Background DOACs are increasingly prescribed for atrial fibrillation and venous thromboembolism due to their ease of use and lack of monitoring requirements. Prescribing DOACs to frail older patients remains challenging due to higher bleeding and thrombo-embolic risks, comorbidities, polypharmacy, and underrepresentation in clinical trials. This study explored prescribing behavior of healthcare professionals (HCPs) in this complex clinical context.

Methods An online questionnaire was distributed to HCPs involved in the care of frail older patients. The survey consisted of 27 items divided into three sections: demographics, factors influencing anticoagulant choice, and DOAC management. Descriptive statistics were used to evaluate outcomes.

Results 355 HCPs completed the questionnaire. HCPs considered frailty(56.9%), fall risk(47.1%) and cognitive impairment (40.0%) when choosing an anticoagulant. Apixaban was the preferred DOAC(56.6%). 74.9% of HCPs did not measure DOAC plasma levels in clinically stable patients, whereas 62.8% measured DOAC plasma level during acute hospitalizations. A large group of HCPs(46.4%) actively switched from VKA to DOAC, but expressed reservations due to fear for an increased bleeding risk. Almost half(48.1%) of HCPs indicated the need for clearer, tailored guidelines for DOAC use in frail older patients.

Conclusions This study highlights the complexity of prescribing DOACs to frail older patients. While HCPs take multiple factors into account, a standardized approach to prescribing DOACs in this population remains lacking. In addition, almost half of HCPs expressed a need for guidelines regarding DOAC use in frail older patients. Hence, more research is needed to fill this knowledge gap and guide HCPs in clinical practice.

Keywords Thrombosis, Frail, Older patients, DOAC, Prescribing behavior

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Introduction

Direct oral anticoagulants (DOACs) are increasingly prescribed by healthcare professionals (HCPs) [1, 2]. DOACs are indicated for stroke prevention in atrial fibrillation (AF) and venous thromboembolism (VTE). Compared to vitamin K antagonists (VKAs), DOACs offer advantages such as ease of use, no need for laboratory monitoring and fewer interactions with food and drugs [3, 4]. In the general patient population, DOACs have a reasonable efficacy and safety profile related to bleeding risk. Consequently, DOACs are also increasingly prescribed to frail older population (age ≥ 70 years, Clinical Frailty Scale > 5). However, specifically in this population prescribers must consider drug-drug interactions, comorbidities, fall risk, medication adherence and increased thromboembolic and bleeding risks. There is increasing evidence that DOACs should be prescribed with caution in frail older patients. First, the randomized controlled FRAIL-AF trial indicated a 69% increased risk of major bleeding and clinically relevant non-major bleeding when switching from a VKA to a DOAC in a frail older patient with AF [5]. Second, our previous study has shown that DOAC plasma level measured during an acute hospital admission were outside the expected range in more than half of frail older patients [6]. Furthermore, unusual high intra-individual variability in DOAC plasma level have been identified in the same population [7–9]. Current guidelines recommend evaluation of renal function and weight during DOAC use, but do not recommend routine testing of plasma level (Table 1). However, given the concerns outlined above, gaining insights into current prescribing practices is essential for the development of uniform guidelines for the appropriate and safe use of DOACs in the frail older population.

Knowledge on how prescribers currently approach the prescription of DOACs to frail older patients is lacking. However, given the concerns outlined above, gaining insights into current real-world prescribing practices is essential for the development of uniform guidelines for the use of DOACs in the frail older population. To explore this, we conducted a cross-sectional international study using an online questionnaire among HCPs .

Methods

Design and population

In this cross-sectional study, an online questionnaire was distributed among HCPs in the Netherlands and Belgium. This survey was developed by a team of five researchers with established expertise in the field of direct oral anticoagulants (DOACs) and the clinical management of frail older adults, in order to ensure both content validity and clinical relevance. The questionnaire was available in Dutch and French. An English version of the questionnaire is available as Supplementary Material. The

Table 1 Practical recommendations for management of DOACs in frail older patients

Patient selection	Consider DOACs as first-line therapy unless contraindicated [10–12]	At baseline
	Avoid switching stable patients from VKA to DOAC if INR control is adequate, especially in those ≥ 75 years with polypharmacy [5, 10-12]	At treatment decision
	Assess frailty (CFS), cognition, fall risk, comorbidities, and polypharmacy before initiation [10, 11, 13]	At baseline
Monitoring and follow-up	Perform a comprehensive review at least annually (annual weighing consultation) [10, 11, 14]	Every 6–12 months; more frequent if ≥ 75 years or renal impairment
	Renal function [10–12, 15]	Every 6–12 months
	Hemoglobin and full blood count [10, 11, 14]	Every 6 months
	Liver function [10, 11]	Every 6–12 months
	Body weight [10–12]	At each visit
	Adherence and medication reconciliation [10, 11, 16, 17]	At each visit
	Clinical events (thrombosis, bleeding) [10, 11]	At each visit
	More frequent monitoring in patients ≥ 75 years, with multimorbidity, renal impairment, or cognitive decline 10–12	Every 3–6 months
DOAC plasma level	Routine testing is not recommended [10–12, 15, 18, 19]	Not applicable
	Consider measurement only in: acute bleeding/thrombosis, renal failure, weight extremes, drug interactions, urgent surgery, reversal agent use [10–12, 15, 18–22]	Case-specific
Dose adjustment	Base dose strictly on renal function, age, and weight [10–12]	At initiation and each reassessment
	Do not reduce dose solely due to frailty [10, 11]	At initiation
	Reassess anticoagulation need and appropriateness at each visit [10–12, 19]	At each visit
Clinical practice implications	Individualization is required in frail, older patients [5, 10–12]	Continuous
	Structured follow-up should be incorporated [10, 11]	Continuous
	Collaboration is crucial among healthcare providers [10–12]	Continuous

Abbreviations: *CFS* Clinical frailty scale, *DOAC* Direct oral anticoagulant, *INR* International normalized ratio, *VKA* Vitamin-k antagonist,

duration of completing the survey was approximately 10 min. Our focus was on DOAC use within the frail older population (age ≥ 70 years, Clinical Frailty Scale > 5), with in-depth questions concerning the very old population (≥ 80 years). The CFS was displayed when answering the questions about frailty in the questionnaire. The questionnaire was distributed to general practitioners, geriatricians, cardiologists, elderly care physicians [23] and physician assistants (last two are only applicable in the Netherlands), between April 2024 and January 2025. Prior to completing the survey, the aim of the survey was explained in an introductory text. Respondents were explicitly asked to complete the survey only if they regularly treated patients with DOAC or prescribed DOACs. Distribution was primarily through a QR code or web link presented in newsletters of the medical associations involved, e.g. the Dutch Society of Internal Medicine (NIV), the Dutch Geriatrics Society (NVKG), the Dutch society of cardiology (NVVC), Healthcare in development (ZIO), the Belgian Society of Cardiology (BSC), the Dutch Association of Elderly Care Physicians (Verenso), the Dutch society of Physician Assistants (NAPA), the Belgian Society of Gerontology and Geriatrics (BSGG), and General Physician society Domus Medica (LHV) with secondary distribution allowed through peer-to-peer sharing.

Ethics aproval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki. The medical ethics committee (METC) of the MUMC + assessed the study and concluded that due to the nature of the study it does not fall under the scope of the Medical Research Involving Human Subjects Act (METC number 2024-0052). This study did not involve patient data or interventions Healthcare professionals (HCPs) were invited to participate on a voluntary basis. The survey was primarily distributed via a QR code or web link included in newsletters from the participating medical associations. Upon accessing the survey, HCPs were presented with a brief introduction outlining the purpose of the study, the voluntary nature of participation, the content of the survey, and the intended use of aggregated results for analysis and publication. Formal written informed consent was not required in accordance with applicable regulations, as completion of the survey was taken as implicit consent.

Data collection

A web-based, secure software platform (Qualtrics XM) was used to build and distribute the questionnaire, followed by data collection and data-management.

The statements and questions primarily focused on exploring prescribing behavior, managing and monitoring of DOAC therapy. The aim was to gain insight into the perceived knowledge in terms of available evidence and guideline recommendations for prescribing and managing DOAC use in frail older patients. The questionnaire was developed by the research team, based on existing literature, prior research experience, clinical experience and the findings from the previous conducted DOAC-FRAIL studies [6, 7].

The questionnaire comprised 27 items across three sections. The first section included 5 questions on HCP demographics. The second section consisted of 16 statements and the third section contained 6 multiple-choice questions, both focusing on the prescription of anticoagulants, in particular DOACs, in frail older patients (S1). The themes evaluated were: (1) factors influencing the choice of anticoagulant (DOAC, VKA or low molecular weight heparin (LMWH)) (2), DOAC management approaches (3), need for and use of DOAC plasma level measurements, and (4) awareness of DOAC management guidelines and available evidence. HCPs were asked to rate the 16 statements on a 5-point Likert scale, with response options ranging from "always" to "never" and "strongly agree" to "strongly disagree" [24]. At various points, respondents were given the opportunity to share reflections, comments or questions. All questionnaires were completed. Missing responses for individual items were documented. All questions were non-compulsory.

Statistics

Questionnaires were collected in Qualtrics XM and exported to IBM Statistical Package for Social Sciences (SPSS) version 28 for analysis. Descriptive statistics were applied to all quantitative results. The open-text comments were analyzed, categorized and textually summarized by one researcher.

Results

Respondents demographics

A total of 355 HCPs completed the questionnaire (Table 2 and S1). Half of HCPs were employed in Belgium (52.4%). Most HCPs were based in a hospital (54.0%), followed by 24.2% working in general practice settings and 19.2% working in a nursing home (19.2%). The majority of HCPs was between 30 and 44 years of age (49.3%) (S2).

Theme 1 factors influencing the choice for anticoagulation type

In very old (>80 years) patients, patients with cognitive impairment and in frail patients, most HCPs prefer prescribing a DOAC instead of VKA or LMWH. When selecting an anticoagulant for the oldest patients (>80 years), key considerations included the absence of a need for laboratory based dose adjustments (need for monitoring) ($n = 263$, 74,1%), adherence ($n = 168$, 47.3%), efficacy ($n = 154$, 43.4%) and side effects ($n = 147$, 41.1%),

Table 2 Demographics ($n = 355$)

Medical specialty:	*n* (%)
Geriatrician	93 (26.2%), in training 19 (5.4%)
Cardiologist	58 (16.3%), in training 10 (2.8%)
Elderly care physician	59 (16.6%), in training 16 (4.5%)
General practitioner	80 (22.5%), in training 5 (1.4%)
Physician assistant	10 (2.8%)
Other**	5 (1.4%)
Healthcare facility:	
University hospital	58 (16.3%)
Peripheral hospital	134 (37.7%)
Nursing home	68 (19.2%)
General practice	86 (24.2%)
Other***	6 (1.7%)
Age group:	
25–29 years	32 (9.0%)
30–34 years	70 (19.7%)
35–39 years	66 (18.6%)
40–44 years	39 (11.0%)
45–49 years	30 (8.5%)
50–54 years	40 (11.3%)
55–59 years	34 (9.6%)
60–64 years	24 (6.8%)
65–70 years	10 (2.8%)
Other****	10 (2.8%)
Work experience:	
0–5 years	83 (23.4%)
6–10 years	83 (23.4%)
11–15 years	59 (16.6%)
≥ 16 years	129 (36.3%)

** Gastroenterologist, cardiac surgeon and clinical pharmacologist

*** Private clinic and rehabilitation center

**** Age was not specified in additional remarks

with these factors once again favoring the use of DOACs. When selecting an anticoagulant for patients with cognitive impairment, HCPs reported that their decisions were primarily influenced by the absence of a need for laboratory based dose adjustments ($n = 295$, 73.0%), followed by medication adherence ($n = 188$, 53.0%), efficacy ($n = 128$, 36.1%) and side-effects ($n = 123$, 34.6%). Comparable factors influenced anticoagulant selection in frail patients, with similar emphasis on the absence of a need for laboratory based dose adjustments ($n = 274$, 77.2%), adherence ($n = 174$, 49.0%), efficacy ($n = 153$, 43.1%), and side-effects ($n = 140$, 39.4%). Figure 1 illustrates the responses to the multiple-choice questions related to the choice of DOAC, VKA, or LMWH as anticoagulant options.

Along with the previously mentioned patient factors, healthcare professionals were asked whether, based on their experience, a specific anticoagulant (DOAC, VKA, or LMWH) affected the occurrence of bleeding complications in frail older patients (missing data 7.9%): HCPs predominantly observed fewer bleeding complications with DOACs (81.4%) than with VKA (10.7%) or LMWH (0.0%).

Figure 2 presents four statements outlining patient factors influencing the decision between DOACs and VKAs. Many HCPs considered frailty (often 39.2%, always 17.7%), cognitive function (often 26.8%, always 13.2%), and the risk of falls (often 31.3%, always 15.8%) when choosing an oral anticoagulant class. However, age was less likely to be a factor that HCPs considered when choosing between DOACs and VKAs, with 29.3% rarely considering it and 27.9% never considering it. A significant percentage of respondents actively switched from VKA to DOAC in frail older patients (often 37.7%, always 8.7% versus never 7.6%, rarely 22.8%).

Comments of HCPs

A small number of respondents ($n = 16$) commented that a switch from a VKA to a DOAC was typically made when the INR was unstable or when issues arose with obtaining INR measurements. Additionally, a few respondents ($n = 13$) reported switching from a VKA to a DOAC less often following the FRAIL-AF study [5].

Theme 2 DOAC management approaches

Many HCPs preferred apixaban (56.6%) as the DOAC of choice (rivaroxaban 9.6%, edoxaban 16.9%, dabigatran 1.4% and no preference 14.9%). Most of the respondents did not choose a dose reduction because of frailty (never 30.4%, rarely 37.2%), regardless of renal function and/or weight (Fig. 3). More than half of HCPs reported conducting annual evaluations of medication adherence, complications, and renal function when prescribing DOACs (annual weighing consultation), with 30.4% doing so frequently and 37.2% always. In contrast, a few HCPs indicated they never (2.8%), or rarely conducted (13.5%) this annual evaluation, and 15.8% remained neutral on the matter. Additionally, many HCPs (often 30.40%, always 37.20%) checked that the DOAC dose was still in line with recommendations for renal function at each patient contact and and made adjustments when necessary.

The vast majority of HCPs considered DOACs as beneficial for the frail older population, due to fixed-dose prescription and no need for laboratory based dose adjustments (agree 46.8%, strongly agree 36.3%).

Theme 3 need for and use of DOAC plasma level measurements

HCPs did not determine a DOAC plasma level often (rarely 18.3%) and most HCPs do not measure a DOAC plasma level at all (never 74.9% versus often 0.0% and always 1.7%). In addition, HCPs did not often adjust dosage based on the DOAC plasma level (never 67.6%, rarely 11.8% versus 0.6%, always 1.7%) (Fig. 4). During acute

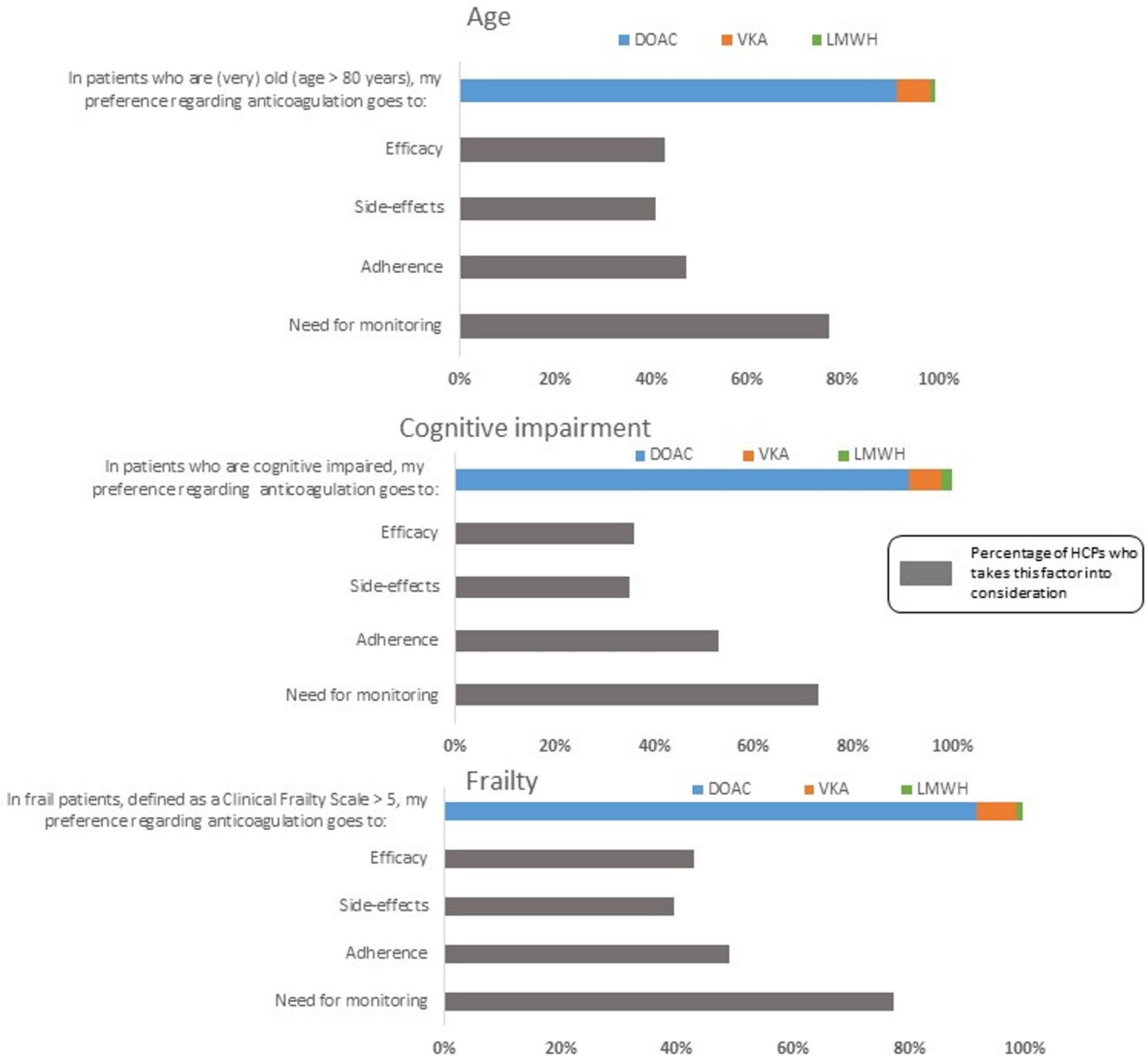

Fig. 1 Preferences of HCPs for the type of anticoagulation based on patient characteristics and characteristics of anticoagulants[1]. Abbreviations: 1 missing responses range between 0.3–7.9%

hospitalization HCPs very rarely measured a DOAC plasma level (never 52.4%, rarely 10.4% versus often 0.6, always 0.30%). Many HCPs (56.9%) were assured that when using a DOAC in frail older patients, DOAC plasma levels would be within the expected range (on-therapy) despite the absence of monitoring (often 38.9%, always 18%). When asked specifically about the reason for DOAC plasma level measurement (when measured), 25.4% ($n = 90$) indicated that this was performed because of bleeding and 24.8% ($n = 88$) because of thrombosis under DOAC use. Other reasons included acute renal impairment, evaluation of efficacy, a history of a gastric bypass or the need for surgery.

Theme 4 DOAC management guidelines and available evidence

20% of HCPs stated that there was insufficient evidence for safe prescription of DOACs in the frail older population (agree 17.7%, strongly agree 2.3%). Furthermore, 77.7% of HCPs indicated that there should be clearer recommendations regarding DOAC management in this specific population (strongly agree 19.7%, agree 58.0%; Fig. 5).

Discussion

This study provides new insights into oral anticoagulant prescribing behavior of HCPs to frail older patients. First, HCPs (in general) preferred DOACs over VKAs. Second,

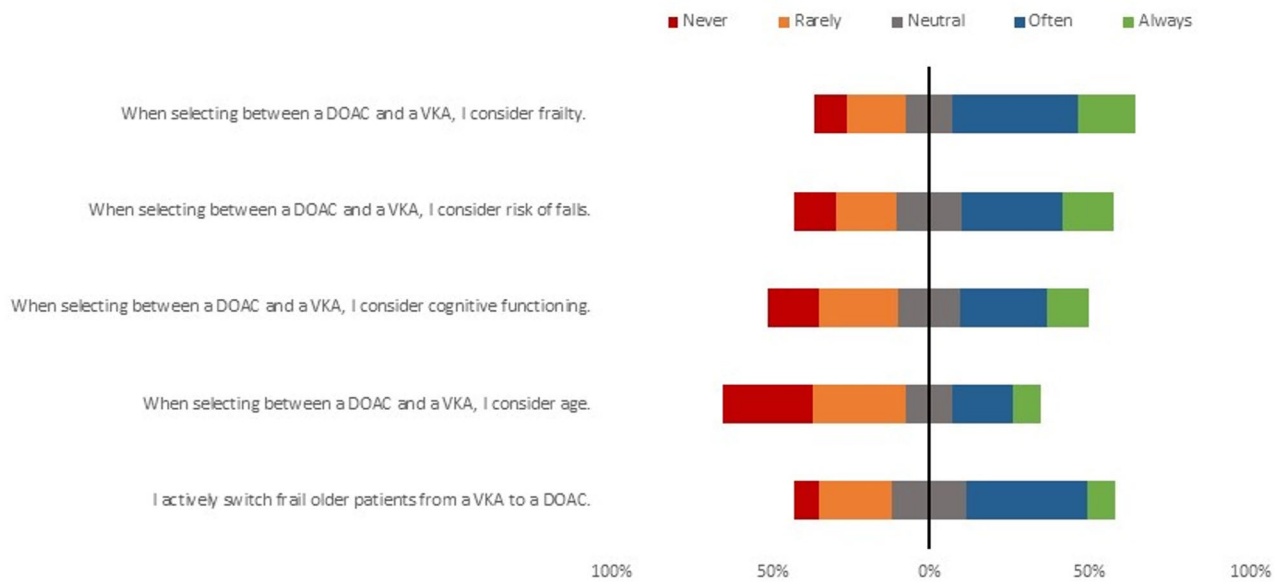

Fig. 2 HCPs responses regarding patient factors influencing the choice between DOAC and VKA[1]. Abbreviations: [1] missing responses range between 0.3–0.6%

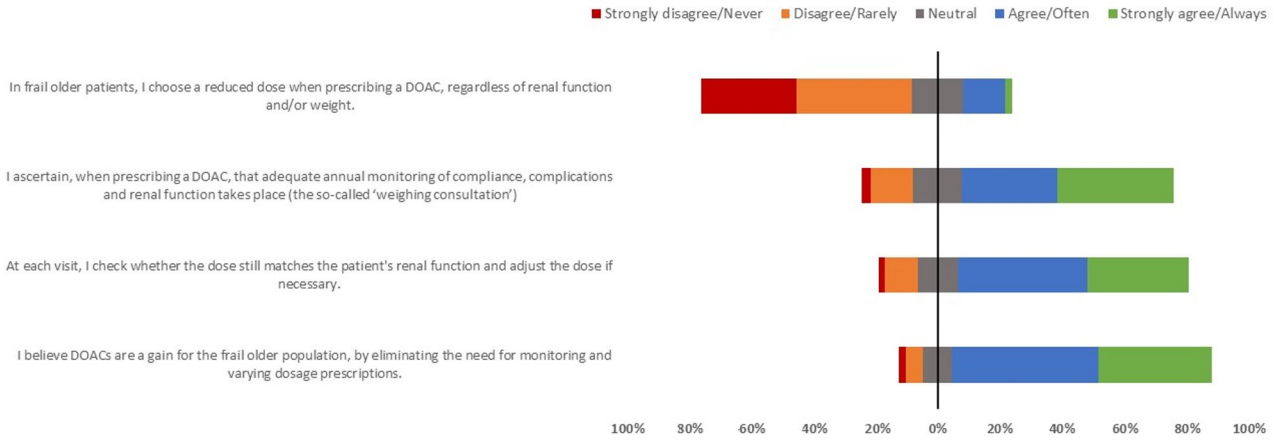

Fig. 3 HCPs responses regarding DOAC management

the study found that cognitive impairment, fall risk and frailty were all key factors considered when determining for the appropriate type of anticoagulation treatment, while age was not. In addition, the primary reasons HCPs preferred DOACs over VKA were no need for monitoring and medication adherence. Notably, almost half of the HCPs actively converted patients from VKA to DOAC, although additional comments suggested that several HCPs have abandoned this practice since the publication of the FRAIL-AF study [5]. Fourth, an important observation was that only two-thirds of HCPs performed an annual treatment assessment in frail older patients using DOACs. In addition, most HCPs did not perform specific DOAC plasma levels in this specific population, and only 56.9% of HCPs expressed confidence that DOAC plasma levels would be within the expected range. Lastly, a significant portion of HCPs expressed the need for explicit recommendations regarding DOAC therapy in frail older patients.

HCPs favored DOACs for frail, cognitively impaired patients or patients at risk of falls. The preference for DOACs aligns with evidence suggesting they offer advantages over VKAs such as reduced need for laboratory drug plasma level monitoring and fewer food interactions [25]. However, literature shows growing awareness of important issues related to DOAC use such as poor medication adherence [26], the impact of polypharmacy [4, 27], comorbidities [28] and renal failure in relation to DOAC use [29]. Moreover, the underrepresentation of frail older adults in major clinical trials complicates anticoagulant selection and limits the applicability of trial results to real-world practice. Interestingly, despite

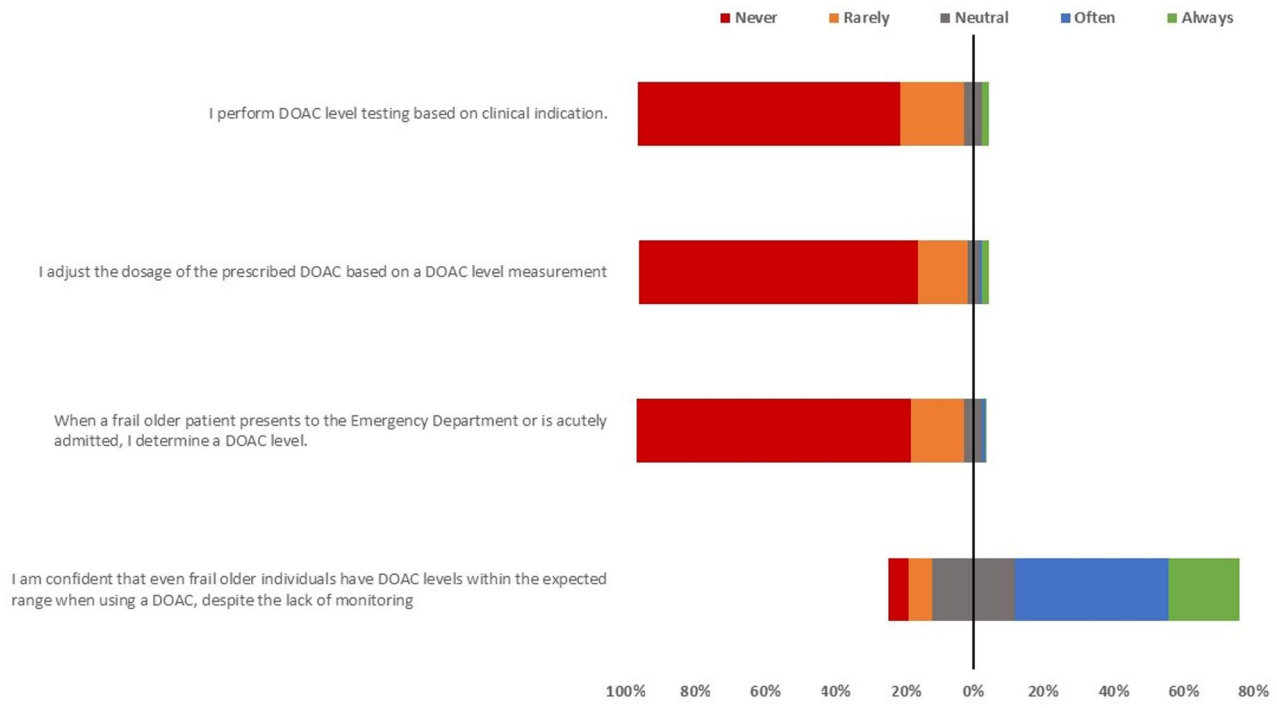

Fig. 4 HCPs responses regarding DOAC plasma level measurement

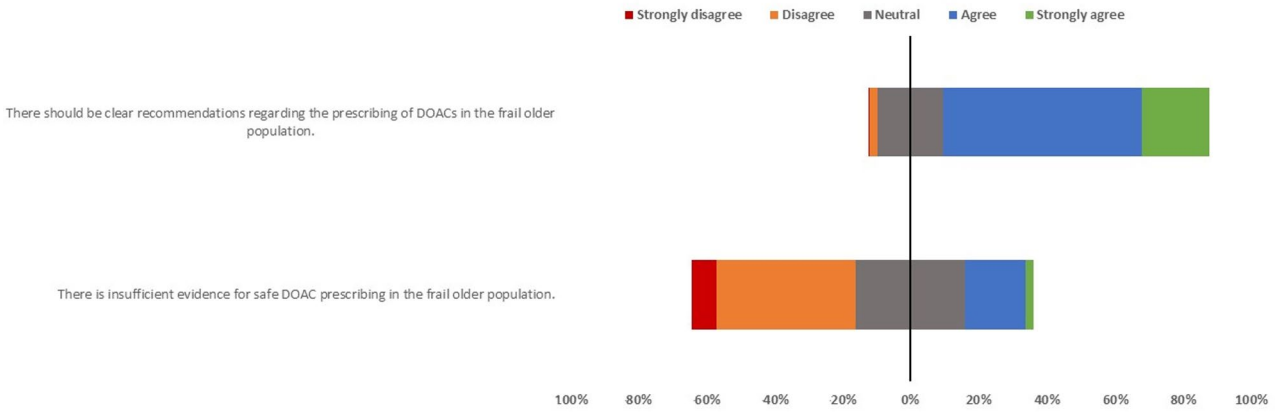

Fig. 5 HCPs responses regarding evidence and recommendations for prescribing DOACs in frail older patients

the preference for DOACs, our survey revealed reservations about switching from VKAs to DOACs. This finding echoes concerns raised by the recent randomized FRAIL-AF study, which indicated an increased risk of major and clinically relevant non-major bleeding complications in frail older patients when switching from VKAs to DOACs [5]. In line with the aforementioned, the recently updated guidelines for the management of atrial fibrillation by the European Society of Cardiology, developed in collaboration with the European Association for Cardio-Thoracic Surgery, recommend that frail patients aged 75 years or older who are on polypharmacy and stable on a VKA continue VKA therapy rather than switch to a DOAC [11]. Thus, while DOACs are considered an appropriate choice for the frail older population, HCPs should be increasingly cautious about making active switches, particularly in light of bleeding risks. Further research is warranted to determine whether the 'one-size-fits-all' approach of DOAC prescribing is truly appropriate and safe for this population.

HCPs' preference for apixaban as the most suitable DOAC for frail older patients is consistent with existing literature, which highlights the drug's favorable pharmacokinetic profile and lower bleeding risk compared to other DOACs such as rivaroxaban or edoxaban [30]. In addition, many HCPs adjust dosages based on age and/or

frailty, and not solely based on renal function or weight [14]. Recent findings display benefits of reduced doses in older adults with multimorbidity [31].

Annual weighing consultation was acknowledged by only 67.6% of the respondents, which is concerning. The issue of monitoring is a critical aspect of anticoagulation management. The 2018 European Heart Rhythm Association (EHRA) guidelines concluded that DOAC treatment requires vigilance due to potentially severe complications, particularly as the target patient population tends to be of older age and frail [14]. In patients aged ≥ 75 and/or with increased frailty, blood tests evaluating hemoglobin, liver function and renal function are recommended at least every 6 months [14]. The 2021 practical guide on the use of non-vitamin K antagonist oral anticoagulants (EHRA) strongly advises a regular weighing consultation for patients with renal failure, older age, comorbidities, frailty or cognitive decline. Follow-up should include evaluation of adherence, thromboembolic events, bleeding events, adverse effects, co-medication, need for blood sampling, modifiable risk factors and optimal DOAC and correct dosing [10]. To facilitate this, recent studies suggest reassessing the role of anticoagulation clinics to monitor patients on DOACs, similar to the approach used for those on VKAs [32–34]. The low number of HCPs performing these weighing consultations is possibly due to a paucity in implementing these guidelines.

HCPs did not or very rarely measure DOAC plasma levels. Even in acute situations or during hospitalization, DOAC plasma levels were not or rarely measured by HCPs. Interestingly, only 56.9% were convinced that DOAC plasma levels would be within the on-therapy range when used in frail older patients. Not measuring DOAC plasma levels may, for a large part, reflect lack of availability and/or knowledge about indications for DOAC plasma level testing or is a consequence of an cost-effectiveness assessment. It may also be linked to the notion that DOACs, unlike VKAs, generally do not require regular dose adjustment for optimizing therapeutic efficacy. Furthermore, there is a lack of information regarding the clinical consequences of deviant plasma levels under medically stable conditions. However, elevated plasma levels have been associated with an increased risk of bleeding, while lower plasma levels are linked to a higher risk of thrombosis [35–38]. The International Council for Standardization in Haematology recommends the option of DOAC plasma level testing in patients with advanced age, severe renal failure, high body mass index, drug interactions or prior to an intervention with high bleeding risk [39]. In contrast, the EHRA guidelines recommend measuring DOAC plasma levels in emergency situations such as bleeding, stroke or overdose, as well as in medication interactions, extremes in body weight and renal impairment [10]. ESC guidelines recommend measurements in the presence of stroke or bleeding conditions and the need for acute surgery only [11]. In addition, in cases of acute life-threatening bleeding, when reversal agents are being considered, measuring DOAC plasma levels is advised to assess the contribution of the DOAC and to support decision-making for interventions [40]. The infrequent measurement of DOAC plasma levels by HCPs during acute hospitalizations warrants further investigation, as recent studies suggest that DOAC plasma level measurements could be beneficial in improving the management of patients with acute conditions or complications [39, 41]. Importantly, this study revealed that some HCPs (20.0%) thought there was insufficient evidence to support the safe prescription of DOACs in the frail older population. In addition, a substantial number of HCPs expressed the need for clearer recommendations and guidelines specifically tailored to frail older patients. The desire for more evidence and specific recommendations reflects the broader clinical uncertainty regarding the optimal approach to DOAC use in frail, older patients, as well as the challenges HCPs face in balancing the associated benefits and harms. This underscores a critical gap in clinical knowledge and emphasizes the need for further research, particularly randomized controlled trials, focusing on the safety and efficacy of DOACs in this population, serving as a first step toward developing tailored recommendations in clinical guidelines. The current study has noteworthy strengths. First, the questionnaire was specifically focused on DOAC treatment in frail older patients, addressing a diverse group of HCPs, including those working in university and non-university hospitals, nursing homes, and general practice clinics. Second, this is the first study to provide insight into the use of DOAC plasma level measurements in daily practice by HCPs, as well as to address the need for tailored guidelines for the frail older population. A possible disadvantage of this study is that prior to completing the survey, respondents were not explicitly asked to only complete the survey if they regularly treated patients with a DOAC. However, when answering the question of whether DOACs were regularly prescribed or whether vulnerable, older patients were treated with DOACs, 78.2% of HCPs indicated that this was often the case (never 0.3%, rarely 2.0%, neutral 6.5% and always 13.0%). Given that DOAC treatment and prescribing were a structural part of the responsibilities of the vast majority of HCPs, we can assume that they were aware of the existing guidelines and recent recommendations. A limitation of the study is the inability to calculate the response rate due to several factors: (1) no data was available on the exact number of members receiving the newsletter from the relevant professional associations (2), HCPs may have received the survey through multiple associations, and (3) survey distribution

was allowed via peer-to-peer channels. However, a total of 355 HCPs completed the survey, representing a relatively large group of participants. Another limitation of the study is that the design and method of survey distribution may limit the generalizability of the findings to other healthcare systems in Europe and beyond.

Conclusion

In conclusion, this study provides valuable insights into the complex decision-making process surrounding the use of DOACs in frail older patients. In short, many HCPs do not follow a uniform approach when prescribing and managing DOACs in frail older patients. In addition, a significant proportion of HCPs are seeking tailored recommendations. Thus, there is a need for further research on DOAC management in this specific population with the goal of ensuring safer use of DOACs and providing clinically applicable recommendations in guidelines.

Abbreviations

AF	Atrial fibrillation
BSC	Belgische Vereniging voor Cardiologie
BSGG	Belgische Vereniging voor Gerontologie en Geriatrie
CFS	Clinical frailty scale
DOAC	Direct Oral AntiCoagulant
EHRA	European Heart Rhythm Association
ESC	European Society of Cardiology
HCP	Healthcare Professional
INR	International Normalized Ratio
LHV	Landelijke Huisartsen Vereniging
LMWH	Low Molecular Weight Heparin
METC	Medical Ethical Committee
MUMC +	Maastricht University Medical Centre
NAPA	Nederlandse Vereniging voor Physician Assistants
NIV	Nederlandse Internisten Vereniging
NVKG	Nederlands Vereniging voor Klinische Geriatrie
NVVC	Nederlands Vereniging voor Cardiologie
SPSS	Statistical Package for the Social Sciences
VKA	Vitamin-K antagonist
VTE	Venous Thromboembolism

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12877-026-06972-3.

Supplementary Material 1.

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Disclosures

There was no funding or sponsor's role in the design, methods, subject recruitment, data collection, analysis, or preparation of the paper. This paper was not submitted, published or presented elsewhere.

Authors' contributions

F. Magdelijns and M. de Jong conceived the study. F. Magdelijns, M. de Jong, S. Robben, D. Janssen and A. Brys contributed to the design of the study and drafting the questionnaire. All authors helped distribute the questionnaire to DOAC prescribing healthcare professionals. F. Magdelijns and M. de Jong collected all data. F. Magdelijns, A. Brys, H. ten Cate, K. Winckers and M. de Jong contributed to the interpretation of the data. M. de Jong wrote the manuscript. F. Magdelijns, A. Brys. K. Winckers and H. ten Cate revised the manuscript. All authors reviewed and approved the final version of the manuscript.

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There was no funding or sponsor's role in the design, methods, subject recruitment, data collection, analysis, or preparation of the paper.

Data availability

The dataset used and analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki. The medical ethics committee (METC) of the MUMC + assessed the study and concluded that due to the nature of the study it does not fall under the scope of the Medical Research Involving Human Subjects Act (METC number 2024-0052).

Consent for publication

Formal written informed consent was not required in accordance with applicable regulations, as completion of the survey was taken as implicit consent. Prior to the start of the questionnaire, respondents were informed about the intention to publish the data obtained from the completed questionnaires.

Competing interests

The authors declare no competing interests.

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