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# Prevalence of adherence and its impact on quality of life in oral anticoagulant users in Egypt: A cross-sectional study from two Egyptian university hospitals

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## Abstract

**Background** Oral anticoagulant therapy (OAT) is critical for managing thromboembolic disorders, but adherence challenges significantly impact its effectiveness and patients' quality of life (QoL). This study explores the predictors of adherence and their effects on QoL among OAT users in Egypt.

**Methods** This multi-center cross-sectional descriptive study with an analytical component was conducted at Mansoura University Hospital and Ain Shams University Hospital. Participants were adults over 18 years old, on OAT for at least one month, who provided informed consent. Convenience sampling was used to recruit 212 participants. Data were collected using a survey that included socio-demographic details, the Arabic Version of the Adherence to Refills and Medications Scale (ARMS), and the WHOQOL-BREF questionnaire. Statistical analyses included descriptive statistics, chi-square tests, Student's t-tests, and multivariate logistic regression.

**Results** The study included 212 participants, with an average age of 55 years, 57% female and 43% male. Among the participants, 25.5% were adherent to their anticoagulant regimen, while 74.5% were non-adherent. Adherence was significantly higher among NOAC users (44.4%) compared to warfarin users (19.0%). Key predictors of adherence included the use of NOACs (OR = 2.7), residency in rural areas (OR = 2.4), and having first-degree relatives in medical specialties (OR = 2.4). Quality of life scores were significantly higher for NOAC users in psychological, social, and environmental domains compared to warfarin users. The overall QoL score was also higher in NOAC users. Poorer adherence was associated with lower scores in these QoL domains.

**Conclusions** Our study indicates that NOACs enhance adherence and quality of life relative to VKAs. Key adherence predictors include NOAC use, rural residency, and having relatives in medical professions. Educational level, initially significant, did not persist as a predictor in multivariate analysis. Targeted strategies are needed to improve adherence and patient outcomes.

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## Background

Oral anticoagulant therapy (OAT) is a cornerstone in the prevention and management of thromboembolic events and is widely prescribed for conditions such as atrial fibrillation, venous thromboembolism, and the presence of prosthetic heart valves [1]. However, the stringent requirements for laboratory monitoring, dietary restrictions, and the potential for significant adverse events pose substantial challenges for patients, impacting their adherence to therapy and overall quality of life (QoL) [1–3].

Adherence to oral anticoagulant therapy is crucial for its effectiveness in preventing thromboembolic events [4]. Poor adherence has been associated with increased risks of stroke and other complications, particularly in patients using vitamin K antagonists (VKAs) like warfarin, which require frequent INR monitoring and have numerous dietary and drug interactions [4]. Novel oral anticoagulants (NOACs), such as dabigatran, rivaroxaban, and apixaban, offer a promising alternative due to their fixed dosing and fewer dietary restrictions, but adherence remains a critical issue influencing their effectiveness [5].

Quality of life (QoL) is a multidimensional concept that encompasses physical, psychological, social, and environmental well-being. For patients on chronic therapies such as oral anticoagulants, maintaining a high QoL is particularly important. Quality of life among patients on oral anticoagulant therapy is influenced by various factors, including the type of anticoagulant used, frequency of monitoring, and the burden of therapy-related tasks [3, 6]. Studies have shown that patients on NOACs generally report better QoL compared to those on VKAs, primarily due to the reduced need for regular monitoring and fewer lifestyle restrictions [7]. However, the psychological burden, fear of bleeding, and the complexity of managing multiple medications continue to pose significant challenges [8].

In Egypt, the context of anticoagulant therapy adherence and its impact on QoL has not been extensively studied. Given the unique healthcare landscape, socioeconomic factors, and varying levels of healthcare access, it is essential to understand these dynamics to improve patient outcomes [9]. This study aims to explore the predictors of adherence to oral anticoagulant therapy and its subsequent impact on the QoL of patients attending two major university hospitals in Egypt.

The study's objectives include identifying sociodemographic and clinical predictors of adherence, assessing the impact of adherence on various QoL domains, and providing insights into potential interventions to enhance adherence and QoL among patients on oral anticoagulant therapy in Egypt. By addressing these objectives, this study seeks to contribute to the optimization of anticoagulant therapy management, ultimately improving patient outcomes and reducing the burden of thromboembolic diseases.

## Methods

### Study design and study period

This study was a cross-sectional descriptive study with an analytical component. The study was conducted over a period from March 2023 to March 2024.

### Study setting

The study was carried out at the outpatient clinics of two university hospitals in Egypt: Mansoura University Hospital and Ain Shams University Hospital. These hospitals were selected due to their large patient populations and comprehensive healthcare services, which provided a diverse sample of patients on oral anticoagulant therapy.

### Inclusion and exclusion criteria

The study included patients aged 18 and older who had been on oral anticoagulant therapy for at least one month and provided informed consent. Exclusion criteria encompassed individuals with severe cognitive impairments, such as dementia, and those residing in assisted living facilities or receiving home-based nursing care. Additionally, patients who self-reported significant functional disabilities or severe mental disorders that could potentially affect their adherence to the medication regimen were also excluded to ensure the accuracy and reliability of adherence data.

### Sampling method

Convenience sampling was employed to select participants from the outpatient clinics of the two university hospitals. This method involved recruiting patients who were readily available and willing to participate during their routine visits to these clinics.

### Sample size calculation

The sample size was calculated to be 139, based on the primary outcome of the prevalence of patients with good adherence. The calculation considered a reported adherence rate of 90% from a previous study [10], an alpha error of 5%, a study power of 80%, and 5% precision using OpenEpi software (https://www.openepi.com/). A total sample of 212 participants was collected.

### Study tool

The study tool comprised three sections. The first section collected socio-demographic data, including age, sex, marital status, occupation, education, residence, comorbidities, mental health problems, smoking, financial satisfaction, number of current medications, number of children, and whether the patient had a first-degree relative who was a healthcare professional. The second section measured patients' adherence to oral anticoagulants using the validated Arabic version of the Adherence to Refills and Medications Scale (ARMS), originally developed by Kripalani et al. [11] and validated in Arabic by Alammari et al. [12]. The scale for measuring adherence to medication is divided into two subscales: the "adherence with filling medications" subscale, which includes four items, and the "adherence with taking medications" subscale, which includes the remaining eight items. Each item on the scale is rated on a 4-point Likert scale, where a score of 1 means "none," 2 means "some," 3 means "most," and four means "all." The overall score on the scale, which can range from 12 to 48, indicates the level of adherence, with higher scores indicating poorer adherence. To classify patients surveyed as either adherent or non-adherent, a cut-off score of 16 or higher is used to categorize patients as non-adherent, while scores below 16 indicate adherence.

The WHOQOL-BREF is a self-administered questionnaire used to evaluate five main domains of quality of life as defined by the World Health Organization: physical health, psychological health, social relationships, environment, and overall quality of life and general [13]. It is comprised of 26 items, with the first two questions focusing on overall perceptions of quality of life and health. Respondents rate each item on a 5-point Likert scale, with 1 indicating a negative response and 5 indicating a positive response. The scores for each of the five domains are then summed and scaled in a positive direction, with higher scores indicating better quality of life. Overall, the WHOQOL-BREF is a comprehensive tool for assessing quality of life and is designed to be completed independently by the respondent.

### Data collection

The study tool, which consisted of closed-ended questions in the Arabic language, was utilized to collect the data from participants at the outpatient clinics of the aforementioned university hospitals. Prior to completing the survey, participants provided written consent. The participants then completed the survey themselves, providing self-reported data.

### Statistical analysis

Descriptive statistics were used to summarize the data, with means and standard deviations for parametric data. Normality was assessed using the Shapiro-Wilk and Kolmogorov-Smirnov tests, along with Q-Q plots and histograms. Categorical variables were compared using chi-square tests, and means of parametric data were compared using Student's t-tests. Multivariate logistic regression was employed to identify predictors of adherence to anticoagulants. A p-value less than 0.05 was considered statistically significant. Data analysis was conducted using SPSS version 24 for macOS.

## Results

### Medication adherence

Out of the 212 participants, 25.5% ($n = 54$) were adherent to their oral anticoagulant regimen, while 74.5% ($n = 158$) were non-adherent (Table 1). A significant difference in adherence was observed between users of novel oral anticoagulants (NOACs) and warfarin. Specifically, 44.4% of NOAC users were adherent compared to 19.0% of warfarin users ($p < 0.001$). Other significant determinants of adherence included educational level, residency, and having first-degree relatives studying a medical specialty. No significant differences were found between adherence and age, gender, marital status, occupation, smoking status, mental health, having children, or experiencing medication side effects.

### Quality of life

The quality of life (QoL) of participants was assessed across five domains: physical health (D1), psychological health (D2), social relationships (D3), environmental health (D4), and overall quality of life and general health (D5) (Table 2). NOAC users had significantly higher scores in psychological health (20.9 vs. 19.2), social relationships (10.1 vs. 8.7), and environmental health (28.5 vs. 23.4) compared to warfarin users. The overall QoL score was also higher in NOAC users (85.3 vs. 77.8). There were no significant differences in physical health (18.3 vs. 18.9) or overall quality of life and general health (7.5 vs. 7.4).

Adherent users showed significantly higher scores in psychological health (20.6 vs. 19.3), social relationships (9.8 vs. 8.8), and environmental health (26.9 vs. 24.1) compared to non-adherent users. The overall QoL score was also higher in adherent users (83.9 vs. 78.3). However, no significant differences were found in physical health (19.3 vs. 18.6) or overall quality of life and general health (7.5 vs. 7.4).

### Predictors of Medication Adherence

Univariate and multivariate analyses identified several predictors of adherence (Table 3). The use of NOACs was strongly associated with adherence, with an odds ratio (OR) of 3.4 in univariate analysis (95% CI: 1.8–6.6) and 2.7 in multivariate analysis (95% CI: 1.3–5.5). Residency

**Table 1** Patient demographics and their relationship with Medication Adherence

| Variable | | Adherent | | Non-adherent | | *P*-value |
|---|---|---|---|---|---|---|
| | | *N* | % | *N* | % | |
| ***Total*** | | **54 (25.5%)** | | **158 (74.5%)** | | |
| Type of Medication | NOACs | 24 | 44.4% | 30 | 55.6% | **< 0.001** |
| | Warfarin | 30 | 19.0% | 128 | 81.0% | |
| Age **(Mean(SD))*** | | 53.75 (13.19) | | 56.20 (11.87) | | 0.23 |
| Gender | Male | 36 | 29.0% | 88 | 71.0% | 0.20 |
| | Female | 18 | 20.5% | 70 | 79.5% | |
| Marital status | Single | 2 | 33.3% | 4 | 66.7% | 0.6 |
| | Married | 47 | 25.0% | 141 | 75.0% | |
| | Widow | 5 | 33.3% | 10 | 66.7% | |
| | Divorced | 0 | 0% | 3 | 100% | |
| Education | No formal education | 19 | 29.7% | 45 | 70.3% | **0.04** |
| | Primary and secondary education# | 8 | 13.8% | 50 | 86.2% | |
| | Associate degree or higher# | 27 | 30.0% | 63 | 70.0% | |
| Occupation | Retired | 21 | 25.9% | 60 | 74.1% | 0.9 |
| | Unemployed | 21 | 26.3% | 59 | 73.8% | |
| | Employed | 12 | 23.5% | 39 | 76.5% | |
| Residency | Rural | 31 | 38.8% | 49 | 61.3% | **0.001** |
| | Urban | 23 | 17.4% | 109 | 82.6% | |
| Current smoker | Yes | 18 | 32.7% | 37 | 67.3% | 0.1 |
| | No | 36 | 22.9% | 121 | 77.1% | |
| Having first-degree relatives studying a medical specialty | Yes | 16 | 41.0% | 23 | 59.0% | **0.02** |
| | No | 38 | 22.0% | 135 | 78.0% | |
| Any mental or psychological problems | Yes | 1 | 16.7% | 5 | 83.3% | 0.9 |
| | No | 53 | 25.7% | 153 | 74.3% | |
| Having children | Yes | 53 | 26.2% | 149 | 73.8% | 0.4 |
| | No | 1 | 10.0% | 9 | 90.0% | |
| Any side effects from the medication that led to hospitalization | Yes | 12 | 25.5% | 35 | 74.5% | 0.3 |
| | No | 42 | 25.5% | 123 | 74.5% | |

**Note:** *Independent Samples t-Test, **# Primary and secondary education** refers to education from primary up to high school,

**#Associate degree or higher** refers to education from a two-year institute up to post-graduate degrees

**Table 2** Comparison of Quality-of-life domains between NOACs and warfarin users

| Variable | NOACs Mean (SD) | Warfarin Mean (SD) | *P*-value | Adherent Mean (SD) | Non-adherent Mean (SD) | *P*-value |
|---|---|---|---|---|---|---|
| **D1**: Physical Health Score | 18.3 (4.9) | 18.9 (2.7) | 0.3 | 19.3 (4.7) | 18.6 (2.9) | 0.2 |
| **D2**: Psychological Health Score | 20.9 (3.7) | 19.2 (2.3) | **< 0.001** | 20.6 (4.1) | 19.3 (2.3) | **0.01** |
| **D3**: Social Relationships Score | 10.1 (1.9) | 8.7 (1.3) | **< 0.001** | 9.8 (2.1) | 8.8 (1.4) | **< 0.0001** |
| **D4**: Environmental Health Score | 28.5 (5) | 23.4 (3.3) | **< 0.001** | 26.9 (6.3) | 24.1 (3.3) | **< 0.001** |
| **D5**: Overall Quality of Life and General Health | 7.5 (1.4) | 7.4 (1.1) | 0.7 | 7.5 (1.5) | 7.4 (1.1) | 0.7 |
| **Overall Score** | 85.3 (13.9) | 77.8 (8.9) | **< 0.001** | 83.9 (15.9) | 78.3 (8.16) | **< 0.001** |

in rural areas was another significant predictor, with an OR of 2.9 in univariate (95% CI: 1.6–5.7) and 2.4 in multivariate analysis (95% CI: 1.2–4.9). Having first-degree relatives in medical specialties also predicted adherence, with ORs of 2.471 in univariate (95% CI: 1.2–5.1) and 2.4 in multivariate analysis (95% CI: 1.1–5.3). Education level did not remain a significant predictor in the multivariate analysis.

### Correlation of adherence with quality of life

The correlation analysis showed a significant negative correlation between adherence scores (where higher scores indicate poorer adherence) and several QoL domains (Table 4). Higher adherence scores were inversely correlated with psychological health ($r$=-0.175, $p < 0.05$), social relationships ($r$=-0.214, $p < 0.01$), environmental health ($r$=-0.342, $p < 0.01$), and the overall QoL score ($r$=-0.20, $p < 0.01$). This suggests that adherence scores are negatively correlated with QoL scores in these domains. Additionally, adherence scores were negatively

**Table 3** Predictors of Medication Adherence: Univariate and Multivariate analyses

| Variables | | Univariate | | Multivariate | |
|---|---|---|---|---|---|
| | | OR | CI (95%) | OR | CI (95%) |
| Type of Medication | Warfarin | **1 (r)** | | | |
| | NOACs | 3.4** | 1.8–6.6 | 2.7** | 1.3–5.5 |
| Education | No formal education | **1 (r)** | | | |
| | Primary and secondary education# | 0.4* | 0.2–0.9 | - | - |
| | Associate degree or higher# | 1.015 | 0.5- 2 | - | - |
| Residency | Urban | **1 (r)** | | | |
| | Rural | 2.9** | 1.6–5.7 | 2.4* | 1.2–4.9 |
| Having first-degree relatives studying a medical specialty | No | **1 (r)** | | | |
| | Yes | 2.471* | 1.2–5.1 | 2.4* | 1.1–5.3 |

**Note:** *p-value < 0.05; **p-value < 0.01, **# Primary and secondary education** refers to education from primary up to high school,
**#Associate degree or higher** refers to education from a two-year institute up to post-graduate degrees

**Table 4** Correlation matrix of adherence with quality of life and some patient characteristics

| Variable | | Adherence | D1 | D2 | D3 | D4 | Overall Score | D5 | Number of drugs used currently |
|---|---|---|---|---|---|---|---|---|---|
| **Adherence** | **r** | 1 | 0.04 | **-0.175*** | **-0.214**** | **-0.342**** | **-0.20**** | 0 | -0.11 |
| **D1** | **r** | 0.04 | 1 | **0.46**** | **0.44**** | **0.27**** | **0.65**** | **0.35**** | **-0.35**** |
| **D2** | **r** | **-0.17*** | **0.46**** | 1 | **0.66**** | **0.79**** | **0.91**** | **0.69**** | **-0.26**** |
| **D3** | **r** | **-0.21**** | **0.44**** | **0.66**** | 1 | **0.68**** | **0.79**** | **0.40**** | **-0.16*** |
| **D4** | **r** | **-0.34**** | **0.27**** | **0.79**** | **0.68**** | 1 | **0.87**** | **0.59**** | -0.09 |
| **Overall Score** | **r** | **-0.20**** | **0.65**** | **0.91**** | **0.79**** | **0.87**** | 1 | **0.71**** | **-0.28**** |
| **D5** | **r** | 0 | **0.35**** | **0.69**** | **0.41**** | **0.59**** | **0.71**** | 1 | **-0.38**** |
| **Number of drugs used currently** | **r** | -0.11 | **-0.35**** | **-0.26**** | **-0.16*** | -0.09 | **-0.28**** | **-0.38**** | 1 |

**Note:** *p-value < 0.05; **p-value < 0.01, **D1**: Physical Health, **D2**: Psychological Health, **D3**: Social Relationships, **D4**: Environmental Health, **D5**: Overall Quality of Life and General Health, **r** = Correlation Coefficient

correlated with the number of drugs currently used ($r$=-0.11), indicating that participants with poorer adherence tended to use a higher number of drugs. This relationship underscores the complexity of medication management and its impact on patient's quality of life.

## Discussion

This cross-sectional study aimed to estimate the prevalence of adherence to oral anticoagulant therapy (OAT) among patients in Egypt, identify the predictors of adherence, and assess the impact of adherence on patients' quality of life. Understanding the factors influencing adherence to OAT is crucial, as non-adherence can lead to severe complications, including thromboembolic events and increased mortality rates. This study's findings contribute to the limited body of research on OAT adherence in Egypt and provide valuable insights for healthcare providers to develop targeted interventions to improve adherence and, consequently, patient outcomes.

The prevalence of adherence to oral anticoagulant therapy varies significantly across different studies and populations. In our study, 54 out of 212 patients (25.5%) were adherent to oral anticoagulants, which is notably lower than adherence rates reported in some studies. For instance, a study indicated that adherence levels could reach higher than 50% among patients [14, 15].

The differences in adherence rates can be attributed to several factors, including the type of anticoagulant prescribed, patient demographics, and the complexity of the medication regimen. For example, direct oral anticoagulants (DOACs) generally show better adherence compared to vitamin K antagonists (VKAs), primarily due to the fixed dosing of DOACs versus the variable dosing required for VKAs based on INR monitoring [16, 17]. Additionally, factors such as the frequency of dosing and the presence of side effects can influence adherence, with medications requiring more frequent administration, often leading to lower adherence rates [17].

One of the primary findings of our study is the significant difference in adherence rates between NOAC and warfarin users. Specifically, 44.4% of NOAC users were adherent, compared to only 19.0% of warfarin users. This disparity aligns with previous research suggesting that NOACs, with their simplified dosing regimens and fewer dietary restrictions, may enhance adherence compared to VKA [18]. Additionally, NOACs offer a better safety profile, requiring fixed dosing and resulting in fewer drug interactions, thus minimizing the need for regular monitoring [1, 7].

The adherence advantage observed with NOACs may also be attributed to their predictable pharmacokinetic profiles and reduced need for routine monitoring, which are critical factors for patients who experience difficulty

in maintaining consistent medical follow-ups [19]. This is especially beneficial for patients in remote areas, as they face additional challenges in accessing healthcare facilities, making NOACs a preferable option that minimizes their travel burden and improves overall adherence and treatment satisfaction.

Quality of life (QoL) outcomes associated with non-vitamin K antagonist oral anticoagulants (NOACs) and warfarin have been examined in several studies, with varying results. While most of the research suggests that NOAC users report higher QoL scores across various domains [20], other studies have found no significant differences between the two treatment groups [21]. Our findings indicate that NOAC users reported significantly higher scores across several domains, including psychological health, social relationships, and environmental health. The overall QoL score was notably higher among NOAC users, suggesting that NOACs may offer a better quality of life due to their more convenient and less intrusive nature of treatment.

Moreover, medication adherence played a crucial role in QoL outcomes. Adherent users exhibited higher scores in psychological health, social relationships, and environmental health compared to non-adherent users, with overall QoL scores reflecting similar patterns. However, no significant differences were observed in physical health or overall quality of life and general health between the groups, indicating that while psychological and social dimensions are enhanced, the physical health aspect remains relatively stable across different anticoagulant therapies.

These findings suggest that the choice of anticoagulant and adherence to treatment can significantly influence the psychological and social well-being of patients. The higher satisfaction and perceived quality of life among NOAC users may be attributed to fewer restrictions and less frequent monitoring compared to warfarin, which often requires regular INR checks and dietary restrictions [22, 23]. Such differences highlight the importance of considering QoL metrics alongside clinical outcomes when evaluating treatment options for patients on anticoagulation therapy. Also, these findings align with this body of literature, demonstrating that adherent users of NOACs reported higher scores in psychological health, social relationships, and environmental health compared to non-adherent users [24, 25]. This suggests that enhancing adherence could be a crucial strategy for healthcare providers aiming to improve the QoL of patients on anticoagulation therapy.

The controversial findings regarding the quality of life (QoL) between NOAC and warfarin users can be attributed to several factors that contribute to the variability in study outcomes. One key aspect is the quality of warfarin management, specifically the time in therapeutic range (TTR). Studies indicate that when warfarin is well-managed with a TTR above 70%, the differences in QoL between NOACs and warfarin diminish significantly, suggesting that the clinical benefits of NOACs may not be as pronounced in populations with optimal warfarin control [26].

Additionally, the methodologies employed in different studies, including sample size, patient demographics, and QoL assessment tools, can lead to inconsistent results. Some studies have reported no significant differences in QoL metrics, potentially due to the lack of objective symptomatic relief provided by anticoagulants, as both NOACs and warfarin do not directly alleviate symptoms associated with atrial fibrillation [22].

Furthermore, psychological factors, such as treatment satisfaction and confidence in managing one's health, may play a crucial role in perceived QoL, which may not be fully captured in quantitative assessments [27]. Therefore, while NOACs may offer advantages in terms of convenience and safety, the overall impact on QoL compared to warfarin can vary based on individual patient experiences and the quality of anticoagulation management.

In our study, we identified several key predictors of adherence to oral anticoagulant therapy, including residency, and having first-degree relatives in medical specialties. Notably, residency in rural areas emerged as a significant predictor of adherence. This finding aligns with previous research indicating that rural patients often prioritize adherence due to the challenges associated with limited access to healthcare resources [28]. Patients in these areas may be more motivated to maintain their treatment regimens to mitigate the risks of complications related to their conditions, as access to healthcare providers and facilities can be more challenging compared to urban settings.

Having family members in the medical field also positively influenced adherence. This finding suggests that a supportive family environment, particularly one that includes individuals knowledgeable about healthcare, can enhance patient engagement and understanding of treatment protocols. Family support has been recognized in the literature as a crucial factor in promoting adherence, as it can provide emotional encouragement and practical assistance in managing treatment regimens [29].

Interestingly, while educational level was initially identified as a significant predictor of adherence in univariate analyses, it did not remain significant in multivariate analyses. This outcome comes in alignment with some studies that educational level was not a critical factor in adherence [30]. This outcome also differs from other studies that highlighted that higher educational attainment is often associated with better adherence to anticoagulation therapy due to increased health literacy and understanding of the treatment's importance [31]. This

discrepancy suggests that other factors, such as healthcare access and social support, might overshadow educational influences in specific populations. Also, this discrepancy may reflect the complexity of adherence behaviors, where multiple interrelated factors contribute to patient outcomes.

Our findings revealed a significant correlation between adherence to OAT and quality of life, with stricter adherence associated with a higher quality of life. OAT plays a crucial role in the prevention and management of thromboembolic events, including atrial fibrillation, venous thromboembolism, and in patients with prosthetic heart valves [32]. Additionally, OAT is essential for stroke prophylaxis. This relationship underscores the importance of maintaining adherence to prescribed OAT regimens, as it directly impacts patients' overall well-being. The effective management of these conditions through OAT not only reduces the risk of serious complications, such as stroke and systemic embolism but also contributes to improved QoL by alleviating anxiety related to potential health risks [33]. Moreover, adherence to OAT is essential for stroke prophylaxis, particularly in high-risk populations, leading to enhanced QoL outcomes [34].

We also observed a correlation between the number of medications a patient is receiving and their adherence, with adherence decreasing as the number of medications increases. This finding highlights a critical aspect of medication management: adherence to one medication does not automatically imply adherence to others. The complexity of polypharmacy can create challenges for patients, as managing multiple medications often requires greater cognitive effort, organization, and time, which can lead to confusion and non-adherence [35, 36].

### Implications

The findings of this study hold significant implications for clinical practice, particularly in optimizing OAT regimens to enhance adherence and quality of life among patients. The demonstrated benefits of NOACs over VKAs should encourage healthcare providers to consider patient preferences and lifestyle factors when selecting anticoagulant therapies, involving patients actively in the decision-making process.

To further improve adherence and QoL, it is essential to offer comprehensive patient education and support, ensuring patients are well-informed about their treatment options and the associated benefits and risks. Tailoring interventions to address the specific needs and challenges faced by patients, especially those in rural settings, can lead to better adherence outcomes and overall patient satisfaction.

### Study limitations

This study has several limitations that should be acknowledged. The cross-sectional design may not adequately capture variations in quality of life (QoL) over time, as QoL can fluctuate due to changes in health status and treatment effects. Additionally, there is potential selection bias due to the convenience sampling method; participants were recruited from outpatient clinics, which may not represent the broader population of oral anticoagulant users. Patients in poorer physical condition might have been more likely to choose direct oral anticoagulants (DOACs) over warfarin, potentially influencing the study's findings. Furthermore, the study is subject to recall bias, as the reporting of treatment complications relied on patient self-reporting, which could lead to inaccurate or incomplete information. These limitations suggest the need for a cautious interpretation of the results and consideration of longitudinal studies to better understand the dynamics of adherence and QoL over time.

## Conclusion

Our study highlights the significant advantages of NOACs in improving adherence and quality of life compared to VKAs. Key predictors of adherence included the use of NOACs, rural residency, and having first-degree relatives in medical specialties. While educational level was identified as a significant predictor in univariate analysis, it did not remain significant in the multivariate model. These findings emphasize the importance of focusing on modifiable factors like medication type and social support when addressing adherence challenges. Transitioning from VKAs to NOACs, where appropriate, can lead to substantial improvements in patient satisfaction and quality of life, particularly for those in remote areas.

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#### Author contributions

The study was conceived and designed by M.T., A.B., and M.B. Data acquisition was performed by M.E., I.H., I.E., and A.M. Data analysis and interpretation were conducted by M.T., M.B., and A.B. The tables design was completed by M.T. Manuscript drafting was carried out by M.T., M.B., and M.E. Critical revision and editing for intellectual content were undertaken by M.B., A.M., I.E., A.B., M.T., I.H., and M.E. All authors, including M.T., A.B., M.B., I.H., M.E., I.E., and A.M. approved the final version of the manuscript to be published.

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#### Data availability

The datasets used during the current study are available from the corresponding author upon reasonable request.

## Declarations

### Ethics approval and consent to participate

This study was conducted in strict accordance with the principles outlined in the Declaration of Helsinki. The study proposal was formally approved by the Institutional Review Board (IRB) at the Faculty of Medicine, Mansoura University (R.23.06.2230), and by the Institutional Review Board (IRB) at the Faculty of Medicine, Ain Shams University (FMASU R255/2023). Prior to participation, all subjects were thoroughly informed about the nature and purpose of the research, ensuring they had all the necessary information to make an informed decision regarding their involvement. Ethical principles sanctioned by the Ethics Committee were strictly adhered to. Informed consent was obtained from all subjects, affirming their voluntary participation in the study. Written consent was obtained from patients who met the inclusion criteria before they completed the questionnaire. It is important to note that participation in the study was entirely voluntary, and no compensatory remuneration was provided to participants.

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

### Clinical trial number

Not applicable.

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### References

1. Yao X, Abraham NS, Caleb Alexander G, Crown W, Montori VM, Sangaralingham LR, Gersh BJ, Shah ND, Noseworthy PA. Effect of adherence to oral anticoagulants on risk of stroke and major bleeding among patients with Atrial Fibrillation. J Am Heart Assoc. 2016;5:1–12.
2. Aparecida R, Dantas S, Scalçone I, Corbi A, Pelegrino FM, Rodrigues A, Carvalho S. Health related quality of life of patients undergoing oral anticoagulation therapy. 2011.
3. Aparecida R, Dantas S, Rodrigues A, Carvalho S, Ciol MA, Tiu F, Rossi LA. Oral anticoagulation: the impact of the therapy in health-related quality of life at six-month follow-up 1. 2013.
4. Lekic L, Lekic A, Begić A. Adherence to oral anticoagulation therapy. J Health Sci. 2014;4:114–9.
5. Mekaj YH, Mekaj AY, Duci SB, Miftari EI. New oral anticoagulants: their advantages and disadvantages compared with vitamin K antagonists in the prevention and treatment of patients with thromboembolic events. Ther Clin Risk Manag. 2015;11:967.
6. Sridharan K, Al Banny R, Qader AM, Husain A, Qader KM. Health-related quality of life in patients receiving oral anti-coagulants: a cross-sectional study. Expert Rev Cardiovasc Ther. 2020;18:309–14.
7. De Stefano F, Benassi A, Cappelletti AM, et al. Current use of oral anticoagulation therapy in Elderly patients with Atrial Fibrillation: results from an Italian multicenter prospective study—the ISNEP Study. J Pers Med. 2022;12:1419.
8. Kvarnström K, Westerholm A, Airaksinen M, Liira H. Factors contributing to Medication Adherence in patients with a Chronic Condition: a scoping review of qualitative research. Pharm. 2021. https://doi.org/10.3390/PHARMACEUTICS13071100
9. Mohammed N, Elkerdawy H, Ahmed NG, Khorais AM. Knowledge and Adherence to Oral Anticoagulant Therapy in Patients with Atrial Fibrillation.
10. Bonsu KO, Young SW, Lee T, Nguyen HV, Chitsike RS. Self-reported adherence to direct oral anticoagulants versus warfarin therapy in a specialized thrombosis service—a cross-sectional study of patients in a Canadian Health Region. Eur J Clin Pharmacol. 2023;79:117–25.
11. Kripalani S, Risser J, Gatti ME, Jacobson TA. Development and evaluation of the adherence to refills and medications Scale (ARMS) among low-literacy patients with chronic disease. Value Health. 2009;12:118–23.
12. Alammari G, Alhazzani H, Alrajhi N, Sales I, Jamal A, Almigbal TH, Batais MA, Asiri YA, Alruthia Y. Validation of an Arabic Version of the Adherence to Refills and Medications Scale (ARMS). Healthcare. 2021;9:1430.
13. Ohaeri JU, Awadalla AW. The reliability and validity of the short version of the WHO Quality of Life Instrument in an arab general population. Ann Saudi Med. 2009;29:98–104.
14. Patel SI, Cherington C, Scherber R, Barr K, McLemore R, Morisky DE, Cha S, Mookadam F, Shamoun F. Assessment of patient adherence to direct oral anticoagulant vs warfarin therapy. J Am Osteopath Assoc. 2017;117:7–15.
15. Castellucci LA, Shaw J, Van Der Salm K, Erkens P, Le Gal G, Petrcich W, Carrier M. Self-reported adherence to anticoagulation and its determinants using the Morisky medication adherence scale. Thromb Res. 2015;136:727–31.
16. Garkina SV, Vavilova TV, Lebedev DS, Mikhaylov EN. Compliance and adherence to oral anticoagulation therapy in elderly patients with atrial fibrillation in the era of direct oral anticoagulants. J Geriatr Cardiol. 2016;13:807.
17. Ingason AB, Hreinsson JP, Lund SH, Ágústsson AS, Rumba E, Pálsson DA, Reynisson IE, Guðmundsdóttir BR, Önundarson PT, Björnsson ES. Comparison of medication adherence to different oral anticoagulants: population-based cohort study. BMJ Open. 2023;13:e065700.
18. Chen PT, Wang TJ, Hsieh MH, Liu JC, Liu CY, Wang KY, Laio WC. Anticoagulation adherence and its associated factors in patients with atrial fibrillation: a cross-sectional study. BMJ Open. 2019. https://doi.org/10.1136/BMJOPEN-2019-029974.
19. Gong IY, Kim RB. Importance of pharmacokinetic profile and variability as determinants of dose and response to dabigatran, rivaroxaban, and apixaban. Can J Cardiol. 2013;29:S24–33.
20. Balcı KG, Balcı MM, Canpolat U, Şen F, Akboğa MK, Süleymanoğlu M, Kuyumcu S, Maden O, Selçuk H, Selçuk MT. Comparison of health-related quality of life among patients using novel oral anticoagulants or warfarin for non-valvular atrial fibrillation. Anatol J Cardiol. 2016;16:474.
21. Fang MC, Go AS, Prasad PA, Zhou HX, Parks AL, Fan D, Portugal C, Sung SH, Reynolds K. Health-related quality of life associated with warfarin and direct oral anticoagulants in venous thromboembolism. Thromb Res. 2022;216:97–102.
22. Leh-Ching Ng D, Gan GG, Chai CS, Chee KH, Tan KL, Tan SB, Bee PC. Comparing quality of life and treatment satisfaction between patients on warfarin and direct oral anticoagulants: a cross-sectional study. Patient Prefer Adherence. 2019;13:1363.
23. Hicks T, Stewart F, Eisinga A. NOACs versus warfarin for stroke prevention in patients with AF: a systematic review and meta-analysis. Open Heart. 2016;3:e000279.
24. Zortea V, Curvello KD, Pilger D, Douros A, Leal LF, Sempé T da S, Pizzol T da SD. Adherence and quality of life in non-valvular atrial fibrillation with direct oral anticoagulants versus vitamin K antagonists: a systematic review. Int J Cardiovasc Sci. 2023. https://doi.org/10.36660/IJCS.20220115.
25. Lapa ME, Swabe GM, Magnani JW. Association of Depression and adherence to oral anticoagulation in patients with Atrial Fibrillation. J Am Heart Assoc. 2023;12:31281.
26. Chan YH, Lee KT, Kao YW, Huang CY, Chen YL, Hang SCL, Chu PH. The comparison of non-vitamin K antagonist oral anticoagulants versus well-managed warfarin with a lower INR target of 1.5 to 2.5 in asians patients with non-valvular atrial fibrillation. PLoS ONE. 2019. https://doi.org/10.1371/JOURNAL.PONE.0213517.
27. Manuel L, Fong LS, Ang ZH, Grant P. Comparison of novel oral anticoagulants versus warfarin for post-operative atrial fibrillation after coronary artery bypass grafting. Annals Med Surg. 2020;58:130.
28. Xu J, Zhao M, Vrosgou A, et al. Barriers to medication adherence in a rural-urban dual economy: a multi-stakeholder qualitative study. BMC Health Serv Res. 2021. https://doi.org/10.1186/S12913-021-06789-3.
29. Cîmpan PL, Chira RI, Mocan M, Anton FP, Farcaş AD. Oral anticoagulant therapy—when Art meets Science. J Clin Med. 2019. https://doi.org/10.3390/JCM8101747.
30. Rossi AP, Facchinetti R, Ferrari E, Nori N, Sant S, Masciocchi E, Zoico E, Fantin F, Mazzali G, Zamboni M. Predictors of self-reported adherence to direct oral

anticoagulation in a population of elderly men and women with non-valvular atrial fibrillation. J Thromb Thrombolysis. 2018;46:139–44.
31. Cabellos-García AC, Martínez-Sabater A, Díaz-Herrera MÁ, Gea-Caballero V, Castro-Sánchez E. Health literacy of patients on oral anticoagulation treatment- individual and social determinants and effect on health and treatment outcomes. BMC Public Health. 2021. https://doi.org/10.1186/S12889-021-11259-W.
32. Chen A, Stecker E, Warden BA. Direct oral anticoagulant use: a practical guide to common clinical challenges. J Am Heart Assoc. 2020;9:17559.
33. Lip GYH, Proietti M, Potpara T et al. Atrial fibrillation and stroke prevention: 25 years of research at EP Europace journal. Europace. 2023. https://doi.org/10.1093/EUROPACE/EUAD226
34. Luger S, Hohmann C, Niemann D, Kraft P, Gunreben I, Neumann-Haefelin T, Kleinschnitz C, Steinmetz H, Foerch C, Pfeilschifter W. Adherence to oral anticoagulant therapy in secondary stroke prevention – impact of the novel oral anticoagulants. Patient Prefer Adherence. 2015;9:1695.
35. Lavrador M, Cabral AC, Castel-Branco M, Figueiredo IV, Fernandez-Llimos F. Polypharmacy and medication adherence. Aging: From Fundamental Biology to Societal Impact. 2023;435–453.
36. Marcum ZA, Gellad WF. Medication adherence to Multi-drug Regimens. Clin Geriatr Med. 2012;28:287.

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