The Impact of a Pharmacist-led Warfarin Educational Video in a Saudi Setting

Sireen Abdul Rahim Shilbayeh

Department of Pharmaceutical Practice, College of Pharmacy, Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia

Context: Internationally, various warfarin education strategies have been described in the medical literature and delivered by a variety of health-care providers. However, none of these were tested in a Saudi setting. Aim: The aim of this study was to assess the impact of pharmacist interventions via an educational video on improving patient knowledge of and satisfaction with warfarin therapy and the international normalized ratio (INR). Setting and Design: This study adopted a prospective pre- and posttest design and enrolled 91 patients from an anticoagulant clinic at King Khaled University Hospital in Riyadh, Saudi Arabia, between September 2017 and February 2018. Materials and Methods: All patients completed the Anticoagulation Knowledge Assessment (AKA) and Anti-Clot Treatment Satisfaction (ACTS) scales. Subsequently, the patients watched a 10-min educational video containing basic information regarding warfarin and were given relevant informative booklets. The patients were reassessed after a mean follow-up period of approximately 52 days. Results: In total, 85 patients completed the study. The impact of the intervention on patient knowledge was highly significant (mean difference = 17.7%, 95% confidence interval (CI) = 21.75–13.58, P < 0.000). In addition, the patients showed significant increases in their ACTS benefits subscale scores (mean difference = 0.73, 95% CI = 1.22–0.24, P = 0.004). Despite being long-term warfarin users, the patients’ INRs had a greater tendency to be within the target range after the intervention (56.63% ± 35% vs. 64.72% ± 35% of the time; mean difference, 8.1 percentage points; effect size = 0.23). However, there was no significant effect on patients’ perceptions of the warfarin burden. Conclusion: This study provided evidence that a pharmacist-led audiovisual intervention via an educational video coupled with an informational booklet effectively improved patients’ knowledge retention and satisfaction with warfarin therapy benefits. Longer studies are needed to determine the impact of this intervention on patients’ perceptions of warfarin burdens and their INRs.

Keywords: Knowledge, patient education, satisfaction, video, warfarin
thromboembolic complications associated with various disorders or diseases.[3]

According to the American Food and Drug Administration (FDA), in the last two decades, warfarin was one of the top 10 drugs reported for serious adverse events.[4] Thus, patients undergoing warfarin therapy need close and careful monitoring[4,5] to manage warfarin's various drug–drug, drug–food, and drug–disease interactions; possible life-threatening adverse effects; and narrow therapeutic range.[6] Greater satisfaction with and adherence to warfarin therapy was found to be associated with good international normalized ratio (INR) control.[7] Patient education is often regarded as the cornerstone of care, and great emphasis is placed on its importance in improving patient outcomes.[8] However, due to clinicians' time constraints, educating patients of anticoagulation therapy is often neglected.[9] Therefore, pharmacists can play an important role in ensuring patients' adherence to anticoagulant therapy.[10]

Internationally, various warfarin education strategies have been described in the medical literature and delivered by a variety of health-care providers.[10,11] The educational materials have predominantly been delivered via simple, traditional formats, such as verbal counseling tips provided by the health-care provider to patients,[12,13] and sometimes supplemented with written materials or booklets.[13,14] However, these individual face-to-face patient education modes are labor- and time-consuming in the context of a busy clinical practice.[15] Moreover, previous studies regarding the counseling of patients about medication use have shown that patients find it difficult to retain information given to them by their doctors and forget 40%–80% of the information immediately.[16]

More recently, some studies have described other advanced and complex training strategies used to support INR self-monitoring techniques via devices.[17,18] The tools used to achieve this learning outcome widely vary and include in-clinic videotape-assisted demonstrations,[18,19] slide presentations,[15] audiovisual/multimedia resources, pictograms, drawings, and/or cue cards.[20] Evidence also suggests that multimedia education about certain medications is more effective than the usual care or no education for improving both knowledge and skill acquisition, particularly in populations with low levels of health literacy.[21]

Regarding educational video interventions, a review of the literature revealed only a few studies that were formally conducted to assess the impact of pharmacist-led audiovisual interventions on improving patients' understanding of anticoagulation therapy.[22,23] Within a hospital setting, an American study[22] revealed that viewing an educational video about warfarin had a positive impact on patients' post-video knowledge test scores and their satisfaction with using an iPad to view the educational video. Another American hospital–based study[23] evaluated the impacts of an education video on the efficiency of pharmacist-provided anticoagulation counseling and patient comprehension. The findings of this prospective, open, parallel-group study revealed that the use of informational videos coupled with teach-back questions significantly reduced the time pharmacists spent on anticoagulation counseling without compromising short-term patient comprehension.

A recent cross-sectional study[24] was performed to examine patients' knowledge of, satisfaction with, and adherence to anticoagulation therapy in the Kingdom of Saudi Arabia (KSA). Of the included patients, only 14.9% were considered to have adequate knowledge.

A further review of the literature revealed a lack of Saudi studies describing the role of clinical pharmacists and the impact of their interventions on anticoagulation clinics (ACCs).

In this context, this study was performed to (1) design an Arabic language audiovisual educational tool with the aim of communicating key information about warfarin to warfarin-naïve patients/or patients already taking warfarin, and (2) examine the effect of the designed tool on improvements in patients' knowledge scores as a primary outcome and their satisfaction with warfarin therapy and INR control as secondary outcomes.

**Materials and Methods**

**Study design**

A prospective pre- and post-intervention study was conducted to assess the impact of a pharmacist-administered audiovisual tool on patients' knowledge of and satisfaction with oral anticoagulation therapy during the 6-month observation period.

**Study setting and participants**

The study was conducted in the ACC at King Khalid Medical City (KKMC) in Riyadh, KSA, between September 2017 and February 2018.

This study aimed to include 100 patients based on the patient's time frame and feasibility.[25]

A stratified sampling technique was used according to the scheduled anticoagulation clinic appointments, which occurred three times per week. Approximately 10 patients were approached each day, and a total of 30 patients were approached per week.
Regarding the eligibility criteria, the study included adult patients who were ≥18 years of age, were receiving warfarin, and were visiting the clinic on a regular basis. Additionally, warfarin-naïve patients (i.e., those who were recently prescribed warfarin but had not yet started warfarin therapy) were also approached and invited to take part in the study. Patients were excluded from the study for the following reasons: previous diagnosis of mental illness, communication difficulties, refusal to participate, failure to return for the next follow-up visit to reassess the study parameters (knowledge, satisfaction, and INR), and current or planned pregnancy.

**Specifications of the educational warfarin video and booklet**

The main aim of this study was to develop a valuable educational video with motion graphics and a voiceover recording to provide information about warfarin therapy. The 10-min video delivered key points about warfarin therapy based on the researchers’ intensive literature review of various warfarin educational tools. This information included the most important points for patients to be aware of during long-term warfarin therapy, such as proper use, side effects, drug interactions, dietary restrictions, the importance of monitoring the INR, activity constraints, and when to seek medical advice.

An additional informational booklet was designed to support the previous educational goals. It was provided to the patient to review at home and included blank charts on which the patient could track his/her own INR at each visit.

The content of the educational video and booklet was developed by two professors of pharmacy based at the College of Pharmacy, Princess Nourah University (PNU) and a clinical pharmacist specialist in anticoagulation therapy at KKMC. The content and format of the educational tools were revised by a focus group of internal medicine specialists at KKMC.

**Interventions**

The patients were asked to complete instruments that measured their knowledge and satisfaction on day 0 (the first ACC visit of the study) after a baseline assessment of whether the patient met the study inclusion/exclusion criteria. Thereafter, the education video was presented to the included patients on the researchers’ laptop computers while the patients were waiting to receive their medications during their routine appointment at the ACC. The booklet was also given to the patients with a verbal explanation of its content. The patients also received routine care according to the local protocol of the ACC clinical pharmacists before they left the clinic.

A follow-up visit after an extended period (of at least 45 days) was scheduled for each recruited patient at the patients’ convenience and the chief clinical pharmacist’s clinical discretion.

**Assessment methods**

Questionnaires measuring the patients’ knowledge and satisfaction were administered, including the oral Anticoagulation Knowledge Assessment (AKA) and the Anti-Clot Treatment Scale (ACTS), respectively. These instruments were administered in face-to-face interviews conducted with each patient pre- and post-intervention. Each interview lasted approximately 30 min.

**Anticoagulation Knowledge Assessment**

The AKA was used to assess the patients’ knowledge about warfarin. The instrument was translated into Arabic and further validated in a pilot sample. The original 29-item AKA questionnaire was developed to assess patient knowledge deficits and to identify educational content areas typically addressed in pharmacist-managed ACCs. The total score on the AKA was calculated as the percentage of correct responses among all 29 items.

**Anti-Clot Treatment Scale**

The ACTS is a 17-item patient-reported instrument that is specifically designed to assess satisfaction with anticoagulation treatment of any type. It comprises 13 items pertaining to burdens and 4 items pertaining to the benefits of ACT. Each item is scored on a five-point Likert scale. The final results regarding satisfaction are reported as two separate domains: the burdens and benefits subscale scores.

This tool was available in multiple languages but not in Arabic; therefore, it was translated to Arabic for use in this study. The translation and user agreement were obtained from the authors and the Mapi Research Trust (https://eprovide.mapi-trust.org). Two experts judged the face and content validity of the final Arabic version of this questionnaire.

**Measure of international normalized ratio control**

Control of the INR was measured in this study as a secondary outcome. Three INR readings were obtained for each patient pre- and post-administration of the educational audiovisual tool. The following two indicators were used to evaluate the quality of the warfarin therapy efficacy: (1) the patient’s time in the therapeutic range (TTR) using the Rosendaal et al. method and (2) the stability of the INR.
Statistical analysis
The data were statistically analyzed using the Statistical Package for the Social Sciences (SPSS) (version 25.0; SPSS, Chicago, Illinois). Descriptive statistics were computed for the patient characteristics and all outcome variables. The distributions of the study variables and outcomes were tested for normality with the Kolmogorov–Smirnov test. Paired sample t tests or Wilcoxon signed-rank tests were used to assess differences in the patients’ outcomes pre- and post-intervention. All P values <0.05 were interpreted as significant.

RESULTS
Study participants
The patient recruitment process is shown in the study flow chart [Figure 1]. Of 126 patients screened, 91 participants were enrolled in the study, of whom 85 (93%) completed the study within a 6-month period. The patients’ characteristics are listed in Table 1. The mean age was 52.5 ± 15.1 years, and 60% of the patients were younger than 56 years. Almost two-thirds of the participants were female (n = 61, 71.8%). All patients were prior warfarin users (≥6 months); warfarin was mainly prescribed after mechanical

Figure 1: Flowchart of the patient recruitment process
Table 1: Sociodemographic and clinical characteristics of patients (n = 85)

| Variable                              | Number of patients (%) |
|---------------------------------------|------------------------|
| Age (years), mean (SD)                | 52.5 (15.1)            |
| Age-group                             |                        |
| 19–37                                 | 17 (20.0)              |
| 38–55                                 | 34 (40.0)              |
| 56–73                                 | 28 (32.9)              |
| 74–91                                 | 6 (7.1)                |
| Sex                                    |                        |
| Male                                  | 24 (28.2)              |
| Female                                | 61 (71.8)              |
| Education level                       |                        |
| No formal education                   | 13 (15.3)              |
| Primary/secondary                     | 25 (29.4)              |
| High school                           | 23 (27.1)              |
| Diploma/university                    | 24 (28.2)              |
| Indication(s) for anticoagulation     |                        |
| Mechanical heart valve                | 27 (31.8)              |
| DVT/PE                                | 25 (29.4)              |
| AF/flutter                             | 16 (18.8)              |
| Bioprosthetic heart valve             | 9 (10.6)               |
| Stroke/TIA                            | 6 (7.1)                |
| LVT/AT                                | 2 (2.4)                |
| Smoking history                       |                        |
| Nonsmoker                             | 74 (87.1)              |
| Smoker                                | 11 (12.9)              |
| Comorbidities                         |                        |
| Yes                                   | 52 (61.2)              |
| No                                    | 33 (38.8)              |
| Conditions                            |                        |
| Hypertension                          | 36 (42.4)              |
| Diabetes mellitus                     | 23 (27.1)              |
| Hyperlipidemia                        | 11 (12.9)              |
| Heart failure                         | 10 (11.8)              |
| Other                                 | 25 (29.5)              |
| Incidence of bleeding                 |                        |
| No bleeding                           | 30 (35.3)              |
| Minor bleeding                        | 47 (55.3)              |
| Major bleeding                        | 8 (9.4)                |
| Concomitant medication                |                        |
| Yes                                   | 57 (67.1)              |
| No                                    | 28 (32.9)              |
| Medication type                       |                        |
| BB                                    | 38 (44.7)              |
| Diuretic                              | 30 (35.4)              |
| Cholesterol-lowering                  | 23 (27.1)              |
| Vitamin D                             | 18 (21.2)              |
| Antidiabetic                          | 18 (21.2)              |
| PPI                                   | 14 (16.5)              |
| ASA                                   | 13 (15.3)              |
| CCB                                   | 12 (14.1)              |
| ACE                                   | 10 (11.8)              |
| ARB                                   | 9 (10.6)               |
| Corticosteroid                        | 9 (10.6)               |
| Ferrous sulfate                       | 8 (9.4)                |
| Insulin                               | 7 (8.2)                |

Table 1: Continued

| Variable                                                                 | Number of patients (%) |
|--------------------------------------------------------------------------|------------------------|
| Other                                                                    | 22 (34.2)              |
| No. of prior ACC visits in the previous 6 months, mean (SD)              | 6.8 (7.3)              |
| TTR, mean (SD)                                                          | 58.3 (34.3)            |
| INR stability, mean (SD)                                                | 55.7 (31.5)            |
| Duration of follow-up (days), mean (SD)                                 | 51.6 (32.1)            |

ACC = anticoagulant clinic, ACE = angiotensin-converting enzyme, AF = atrial fibrillation, ARB = angiotensin receptor blocker, ASA = Aspirin, AT = atrial thrombus, BB = beta-blocker, CCB = calcium channel blocker, DVT = deep vein thrombosis, INR = international normalized ratio, LVT = left ventricular thrombus, PE = pulmonary embolism, PPI = proton pump inhibitor, SD = standard deviation, TIA = transient ischemic attack, TTR = time in therapeutic range

All data are presented as numbers (%) unless otherwise indicated

heart valve replacement (n = 27, 31.8%) and venous thromboembolism (n = 25, 29.4%). The subgroups did not differ significantly in their education levels.

Study outcomes

Patient knowledge scores

Patient knowledge was assessed pre- and post-intervention at a 2–6 month interval or at the subsequent appointment using a standardized 29-item questionnaire, the AKA. The details are shown in Table 2.

The mean knowledge score (maximum of 100) at baseline was 52.6 (standard deviation [SD], 17.2); however, the mean post-intervention score was 70.3 (SD, 10). There was a significant improvement in patient knowledge scores post-intervention, with a mean difference of 17.7 (P < 0.000) and an effect size of 1.03.

Patient satisfaction

Scores representing patient-reported satisfaction with their warfarin therapy pre- and post-intervention are displayed in Table 3. The patients expressed significantly higher mean satisfaction scores on the ACTS benefits domain after the video intervention (mean difference = −0.73, P = 0.004). However, no significant improvement was noted with regard to the ACTS burdens domain (mean difference = −0.53, P = 0.59).

Effectiveness of the audiovisual educational intervention with regard to improving the patients’ international normalized ratios

The impact of the educational audiovisual intervention on INR quality measures is shown in Table 4. The TTR
at the baseline was 56.6% (SD, 35), which is considered a poor level of control (<60%). The post-intervention mean TTR value was estimated at 64.7% (SD, 35), indicating improvement to within a moderate level of control (60%–75%); however, the difference between the pre- and post-intervention numerical mean TTR values did not achieve statistical significance (mean difference = 8.097 percentage points, \( P = 0.12 \)). Additionally, no significant change in INR stability was identified because the measurements at both time points were within the safe range (≥50%) (mean difference = 4.77 percentage points, \( P = 0.25 \)).

**Discussion**

This study had the primary target of exploring the impact of a pharmacist-administered audiovisual intervention on improvements in patients' knowledge of warfarin therapy. Enhancing patients' satisfaction with their anticoagulant medications is another vital goal that was established in this study due to the documented impact of medication satisfaction on increasing patients’ adherence to medication regimens, which is considered an essential component to achieving the ultimate clinical treatment goals. In addition, to ensure that our evaluation was comprehensive, the impact on clinical outcome, as represented by the level of INR control, was also examined; this is an aspect that was not considered in most previous educational video studies. Additionally, most previous video intervention studies involved anticoagulation therapy patients in hospitals who were mostly new users of warfarin, whereas this study included patients visiting an outpatient ACC, all of whom were prior warfarin users. This allowed a longer follow-up period to study the impact of the educational intervention on the long-term retention of warfarin knowledge rather than focusing on the immediate post-counseling effects.
Regarding knowledge, although our patients initially received basic information about warfarin in a face-to-face interview supplemented with written material when the medication was prescribed to them and on their registration at the ACC, the baseline level of warfarin knowledge assessed among the patients in this study using the robust validated test, the AKA, showed a significant knowledge gap before the intervention. This result may not be surprising given the consistent findings of unsatisfactory anticoagulant knowledge reported in previous national survey studies based on different knowledge examination tests (such as the Oral Anticoagulation Knowledge [OAK] test).[^23-25] This finding highlighted the fact that patients may need continuing education, which supports the purpose for conducting this study; other research studies have also suggested that continuing education for long-term warfarin users, together with its sustained beneficial communication between health-care providers and their patients, are mandatory for successful anticoagulant management.[^26-29]

The selection of an audiovisual intervention as the initial tool in this primary interventional study was based on various facts. First, previous studies have shown that it is easier for patients, regardless of their literacy level or cultural barriers, to remember drug information across multiple domains when it is presented in an audiovisual format.[^24-26] This is consistent with the results of internationally validated knowledge tests that highlight 10 major areas to be included in warfarin education (indication, administration, drug interactions, activity, diet, side effects, pregnancy, informing health-care providers, procedures, and laboratory monitoring).[^27,28] Additionally, according to the protocols of the ACCs in main medical centers in Riyadh, the capital of KSA, alternative services (such as INR testing, warfarin dose adjustment, and side effects monitoring) are offered to a large population.[^29-32] Providing additional education via an audiovisual intervention to patients who are receiving warfarin could summarize the educational message, improve efficiency in the clinic, and help busy clinics provide other necessary routine services to a larger number of regular visitors to the ACC without compromising staff time and efforts, unlike time- and effort-intensive traditional teaching methods.[^33]

Consequently, the study outcomes were overall encouraging, reflecting efficient information processing, knowledge maintenance, and belief modifications in our patients. First, regarding the main outcome of knowledge, the follow-up post-intervention AKA tests, which were administered on an average of 52 days after the intervention, clearly showed significant improvements in the patients’ knowledge about warfarin (17.67%, effect size: 1.03, P < 0.001). This positive impact was comparable to the results obtained in previous international studies that used similar video tools to provide education about warfarin[^30,31,33-35] or non-warfarin medications[^36-38]. However, our impact was sustained over a longer period than has traditionally been measured in these studies, most of which observed the immediate post-video counseling effects within hospital settings[^19,22,23,37,38] or in general practice clinics[^39] with no follow-up evaluation of knowledge retention.

Two previous studies evaluated the impact of nurse-led video educational sessions on patients’ long-term warfarin knowledge retention after hospital discharge in a 6-month follow-up assessment[^15] or after viewing a series of video sessions over a 4-month period during their ACC visits and reported similar results.[^33] Another important secondary finding in this study is the positive impact on participants’ treatment satisfaction, which is shown by the significant enhancement in patients’ scores on the benefits section of the ACTS. Nevertheless, the improvement in patients’ knowledge and perceptions of warfarin benefits after viewing the video was not associated with a similar enhancement in their reported satisfaction with the burdens of warfarin therapy, indicating that treatment still imposes some level of inconvenience on their lives. Interestingly, this pattern of findings was consistent with those of a previous American video study[^40] that reported a significant gain in knowledge and greater positive shifts in patients’ beliefs that taking warfarin is beneficial, together with an increase in their confidence in the importance of adhering to laboratory monitoring. However, the videos used in that study did not eliminate patients’ negative perceptions of taking warfarin as frightening, confusing, or difficult.

Another interesting finding in the current setting is the positive trend toward an improvement in the time spent in the INR target range (mean difference of 8%) in the post-intervention period; the INR tended to be more clinically controlled, although the trend was statistically nonsignificant. Similarly, a cluster-randomized study comparing video education to patient education with a brochure alone showed a nonstatistically significant trend toward improvement in the TTR (mean difference of 7%) in the intervention arm.[^33] The achievement of this increase (7%-8%) within a short period after one use of this simple tool was deemed to be of value in terms of the clinical consequences and coagulation risk reduction. However, further studies that are primarily designed to investigate factors that may influence...
patients’ INR quality after educational interventions are needed.

The strengths of this study lie in the fact that it is a multi-outcome comprehensive study reporting the development of an educational video and examining its long-term impact on outpatients’ knowledge, treatment satisfaction, and clinical parameters in an ACC. At the international level, only two studies have addressed the development and testing of a video approach directed at the improvement and long-term retention of warfarin knowledge in similar settings. In addition, this study is unique because of its interventional prospective pre-and posttest design. Other previous national studies in a similar clinical setting were all cross-sectional or descriptive in nature, and they did not involve any type of clinical pharmacist intervention with follow-up testing of its influence on improvements in knowledge or clinical outcomes.

Moreover, unlike previous international video studies, we assessed outcomes using internationally validated, robust tools (i.e., AKA and ACTS) that were translated into Arabic using standardized methods. The full psychometric properties of the Arabic versions of the AKA and ACTS will be discussed in another report.

Although we revealed the potential for audiovisual technologies to be used as an educational strategy to improve patients’ knowledge and satisfaction with the benefits of warfarin with less frequent pharmacist-led counseling, this study does have some limitations. First, the open-label, one-group design limits direct comparisons to other educational tools used in routine care. According to a systematic literature review, the best strategy for developing and evaluating mechanisms for educating patients about anticoagulation has yet to be determined. Therefore, the specific impacts of various suggested educational and behavioral interventions on warfarin-related clinical outcomes warrant further research. In our Saudi setting, future studies should consider using a randomized, controlled parallel-group strategy that will enable direct comparisons among various warfarin education techniques (video, traditional verbal counseling methods, or other electronic multimedia resources) in terms of their impacts on maximizing patients’ knowledge of anticoagulants. It would also be interesting to rate patients’ acceptance of these tools and their relevance to our cultural media sources.

Second, although the sample size and time frame of this study were adequate for revealing significant knowledge improvement (primary outcome), a longer observation period of at least 1 year, a larger sample size, and a multicenter design might provide more insight into patients’ reported levels of burden satisfaction, INR control, and INR stability. These issues would broaden the generalizability of the results to real-world practice.

Finally, some patients were lost to follow-up because they switched to other anticoagulant medications or stopped using warfarin. Therefore, an examination of the impact of the audiovisual tool on patients’ knowledge of and satisfaction with newer oral anticoagulants, particularly in patients for whom warfarin is contraindicated, could be our next goal, as those agents may share similar educational aspects (e.g., the importance of taking the medicine at the same time each day, self-awareness of bleeding tendency, and reporting significant signs and symptoms immediately to physicians or the ACC).

CONCLUSION

The results of the assessments of warfarin knowledge in this study agreed with the results of previous national surveys showing that long-term warfarin users visiting ACCs in the KSA may need further educational interventions. The assessments of the pharmacist-led intervention in this study showed that a 10-min educational video coupled with an informational booklet can effectively improve both patients’ knowledge and their self-reported satisfaction with the benefits of warfarin therapy. Additionally, longer multicenter studies are needed to determine whether such an intervention or other tools could improve patients’ levels of satisfaction with warfarin burdens or prompt other behavioral changes, such as compliance, and augment the impact on INR parameters.

Statement of ethics

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee (Institutional Review Boards (IRBs) of PNU (17–0074) and KKMC (17/0321) and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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**Conflicts of interest**
There are no conflicts of interest.

**REFERENCES**

1. Ageno W, Gallus AS, Wittkowsky A, Crowther M, Hylek EM, Palareti G. Oral anticoagulant therapy: antiplatelet therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians evidence-based clinical practice guidelines. Chest 2012;141:e44-88.

2. Keeling D, Baglin T, Tait C, Watson H, Perry D, Baglin C, et al.; British Committee for Standards in Haematology. Guidelines on oral anticoagulation with warfarin, fourth edition. Br J Haematol 2011;154:311-24.

3. Ball R, Robb M, Anderson SA, Dal Pan G. The FDA’s sentinel initiative—a comprehensive approach to medical product surveillance. Clin Pharmacol Ther 2016;99:265-8.

4. Witt DM, Clark NP, Kaatz S, Schnurr T, Ansell JE. Guidance for the practical management of warfarin therapy in the treatment of venous thromboembolism. J Thromb Thrombolysis 2016;41:187-205.

5. Kuruvilla M, Gurk-Turner C. A review of warfarin dosing and monitoring. Proc (Bayl Univ Med Cent) 2001;14:305-6.

6. Di Minno A, Frigerio B, Spadarella G, Ravanu A, Sansaro D, Amato M, et al. Old and new oral anticoagulants: food, herbal medicines and drug interactions. Blood Rev 2017;31:193-203.

7. Eltayeb TYM, Mohamed MS, Elbur AI, Elsayed ASA. Satisfaction with and adherence to warfarin treatment: a cross-sectional study among Sudanese patients. J Saudi Heart Assoc 2017;29:169-75.

8. Hawes EM. Patient education on oral anticoagulation. Pharmacy (Basel) 2018;6:E34.

9. Wilson SJ, Wells PS, Kovacs MJ, Lewis GM, Martin J, Burton E, et al. Comparing the quality of oral anticoagulant management by anticoagulation clinics and by family physicians: a randomized controlled trial. CMAJ 2003;169:293-8.

10. Wofford JL, Wells MD, Singh S. Best strategies for patient education about anticoagulation with warfarin: a systematic review. BMC Health Serv Res 2008;8:40.

11. Newall F, Monagle P, Johnston L. Patient understanding of warfarin therapy: a review of education strategies. Hematology 2005;10:437-42.

12. Smith MB, Christensen N, Wang S, Strohecker J, Day JD, Weiss JP, et al. Warfarin knowledge in patients with atrial fibrillation: implications for safety, efficacy, and education strategies. Cardiology 2010;116:61-9.

13. Wilson FL, Racine E, Tekieli V, Williams B. Literacy, readability and cultural barriers: critical factors to consider when educating older African Americans about anticoagulation therapy. J Clin Nurs 2003;12:275-82.

14. Estrada CA, Hryniewicz MM, Higgs VB, Collins C, Byrd JC. Anticoagulant patient information material is written at high readability levels. Stroke 2000;31:2966-70.

15. Singla DL, Jasser G, Wilson R. Effects of group education on patient satisfaction, knowledge gained, and cost-efficiency in an anticoagulation center. J Am Pharm Assoc (Wash) 2003;43:264-6.

16. Ley P. Satisfaction, compliance and communication. Br J Clin Psychol 1982;21:241-54.

17. Menéndez-Jándula B, Souto JC, Oliver A, Montserrat I, Quintana M, Gich I, et al. Comparing self-management of oral anticoagulant therapy with clinic management: a randomized trial. Ann Intern Med 2005;142:1-10.

18. Mörskov S, Ylén J, Taborski U, Schenk JF, Erdlenbruch K, Novotny-Reichert G, et al. Training of patients for self-management of oral anticoagulant therapy: standards, patient suitability, and clinical aspects. Semin Thromb Hemost 1999;25:109-15.

19. Stone S, Holden A, Knapic N, Ansell J. Comparison between videotape and personalized patient education for anticoagulant therapy. J Fam Pract 1989;29:55-7.

20. Völler H, Dovifat C, Glatz J, Körtke H, Taborski U, Wegscheider K. Self management of oral anticoagulation with the IN ratio system: impact of a structured teaching program on patient’s knowledge of medical background and procedures. Eur J Cardiovasc Prev Rehabil 2004;11:442-7.

21. Ritzert B. Multimedia educational interventions for consumers about prescribed and over-the-counter medications. Public Health Nurs 2013;32:186-8.

22. Kim JJ, Mohammad RA, Coley KC, Donihi AC. Use of an iPad to provide warfarin video education to hospitalized patients. J Patient Saf 2015;11:160-5.

23. Moore SJ, Blair EA, Steeb DR, Reed BN, Hull JH, Rodgers JE. Impact of video technology on efficiency of pharmacist-provided anticoagulation counseling and patient comprehension. Ann Pharmacother 2015;49:631-8.

24. Elbur AI, Albarraq A, Maugrabi M, Alharthi S. Knowledge of, satisfaction with and adherence to oral anticoagulant drugs among patients in King Faisal Hospital, Taif, Kingdom Saudi Arabia. Int J Pharm Sci Res 2015;31:274-80.

25. Hertzog MA. Considerations in determining sample size for pilot studies. Res Nurs Health 2008;31:180-91.

26. Briggs AL, Jackson TR, Bruce S, Shapiro NL. The development and performance validation of a tool to assess patient anticoagulation knowledge. Res Social Adm Pharm 2005;1:40-59.

27. Zeolla MM, Brodeur MR, Dominelli A, Haines ST, Allie ND. Development and validation of an instrument to determine patient knowledge: the oral anticoagulation knowledge test. Ann Pharmacother 2006;40:633-8.

28. Cano SJ, Lamping DL, Bamber L, Smith S. The anti-clot treatment scale (ACTS) in clinical trials: cross-cultural validation in venous thromboembolism patients. Health Qual Life Outcomes 2012;10:120.

29. Rosendaal FR, Canguier SC, van der Meer FJ, Britt E. A method to determine the optimal intensity of oral anticoagulant therapy. Thromb Haemost 1993;69:236-9.

30. Rose AJ, Berlowitz DR, Frayne SM, Hylek EM. Measuring quality of oral anticoagulation care: extending quality measurement to a new field. Jt Comm J Qual Patient Saf 2009;35:146-55.
31. Kazis LE, Anderson JJ, Meenan RF. Effect sizes for interpreting changes in health status. Med Care 1989;27:S178-89.
32. Mazor KM, Baril J, Dugan E, Spencer F, Burgwinkle P, Gurwitz JH. Patient education about anticoagulant medication: is narrative evidence or statistical evidence more effective? Patient Educ Couns 2007;69:145-57.
33. Denizard-Thompson NR, Singh S, Stevens SR, Miller DP, Wofford JL. iPod™ technology for teaching patients about anticoagulation: a pilot study of mobile computer-assisted patient education. Prim Health Care Res Dev 2012;13:42-7.
34. Mayet AY. Association between oral anticoagulation knowledge, anticoagulation control, and demographic characteristics of patients attending an anticoagulation clinic in Saudi Arabia: a cross-sectional prospective evaluation. Trop J Pharm Res 2015;14:1285-91.
35. Vormfelde SV, Abu Abed M, Hua TD, Schneider S, Friede T, Chenot JF. Educating orally anticoagulated patients in drug safety: a cluster-randomized study in general practice. Dtsch Arztebl Int 2014;111:607-14.
36. Dib JG, Mohammed K, Momattin HI, Alshehri AM. Implementation of pharmacist-managed anticoagulation clinic in a Saudi Arabian health center. Hosp Pharm 2014;49:260-8.
37. Giuliano C, Nofar T, Edwin SB. Can a short video improve apixaban knowledge in an inpatient setting? P T 2017;42:256-60.
38. Superior CK, Broyles JE, Oliphant CS, Mack GD, Thornton D. Development and evaluation of a medication education videotape for hospitalized patients. Am J Health Syst Pharm 2002;59:859-61.
39. Brock TP, Smith SR. Using digital videos displayed on personal digital assistants (PDAs) to enhance patient education in clinical settings. Int J Med Inform 2007;76:829-35.
40. Clarkesmith DE, Pattison HM, Lane DA. Educational and behavioural interventions for anticoagulant therapy in patients with atrial fibrillation. Cochrane Database Syst Rev 2013;4:CD008600.
41. Chen EY, Diug B, Bell JS, Mc Namara KP, Dooley MJ, Kirkpatrick CM, et al. Spontaneously reported haemorrhagic adverse events associated with rivaroxaban and dabigatran in Australia. Ther Adv Drug Saf 2016;7:4-10.