The Positive Impact of Pharmacist Interventions Using Educational Video Technology on Patient Knowledge of and Satisfaction with Warfarin Therapy

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ABSTRACT

To assess the positive impact of pharmacist interventions via an educational video on patients’ knowledge of and satisfaction with warfarin therapy. This study used a prospective pre-test/post-test design that enrolled 91 patients from an anticoagulant clinic at King Khaled University Hospital in Riyadh, Saudi Arabia. All patients completed the Anticoagulation Knowledge Assessment (AKA) and Anti-Clot Treatment Satisfaction (ACTS) scales. Afterwards, the patients watched a 10-minute educational video containing basic information about warfarin and were given relevant informative booklets. The patients were reassessed after a mean follow-up period of approximately 52 days. In total, 85 patients completed the study. The impact of the intervention on patient knowledge was highly significant (mean difference = 17.7%, 95% CI = 21.75-13.58, P<0.000). Additionally, the patients had significant increases in their ACTS benefits subscale scores (mean difference = 0.73, 95% CI = 1.22-0.24, P=0.004). However, there was no significant effect on the patients’ perceptions of the burden of warfarin. This study demonstrated that a pharmacist-led audiovisual intervention via an educational video coupled with an informational booklet effectively improved patients’ retained knowledge of and satisfaction with the benefits of warfarin therapy.

INTRODUCTION

Anticoagulation treatment is used by millions of patients worldwide, and warfarin remains the most commonly used oral anticoagulant (Ageno et al., 2012). Warfarin is approved for the prevention and/or treatment of thromboembolic complications associated with atrial fibrillation, valve replacement, certain thromboembolic disorders or diseases, and thromboembolic events after myocardial infarction and recurrent myocardial infarction (Keeling et al., 2011). 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 (Ball et al., 2016). Warfarin is effective when the therapeutic range is maintained within a narrow therapeutic window, but when the levels fall below or exceed the intended range, the use of warfarin is associated with increased risks of thrombosis and bleeding, respectively. Thus, patients undergoing warfarin therapy need close and careful monitoring.
Table 1: Patients’ sociodemographic and clinical characteristics (N=85)

| Variable                          | Number of patients (%) |
|-----------------------------------|------------------------|
| Age (years), mean (SD)            | 52.5 (15.1)            |
| 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)                |
| Conditions                        |                        |
| Hypertension                      | 36 (42.4)              |
| Diabetes mellitus                 | 23 (27.1)              |
| Hyperlipidaemia                   | 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)                |

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

Monitoring (Kuruvilla and Gurk-Turner, 2001; Witt et al., 2016) to manage warfarin’s various drug-drug, drug-food, and drug-disease interactions; possible life-threatening adverse effects; and narrow therapeutic range (Minno et al., 2017). Greater satisfaction with and adherence to warfarin therapy was found to be associated with good international normalized ratio (INR) control (Eltayeb et al., 2017). Patient education is often regarded as the cornerstone of care, and great emphasis is placed on its importance in improving patient outcomes (Hawes, 2018). The goal of education is to ensure that patients have a clear understanding of the risks of warfarin therapy, the precautions that must be considered, and the need for regular monitoring (Newall et al., 2005). Thus, close monitoring of the INR coupled with patient education is an important and effective way of ensuring the high-quality management of anticoagulated patients (Wofford et al., 2008). The anticoagulated patient’s level of knowledge regarding his or her therapy was found to indirectly decrease the risk of drug-drug interactions, drug-food interactions, and even complications (Wilson et al., 2003a). However, due to clinicians’ time constraints, the education of anticoagulated patients is often neglected (Wilson et al., 2003a). According to the National Patient Safety Agency guidelines issued on the safe use of anticoagulant therapy, pharmacists are in a prime position to provide both medication and disease-state counselling (National Patient Safety Agency, 2007). Therefore, pharmacists can play an important role in ensuring patients’ adherence to anticoagulant therapy as well as the control of drug-related factors, such as interactions or adverse effects (e.g., bleeding) (Wofford et al., 2008).

Internationally, various warfarin education strategies have been described in the medical literature and delivered by a variety of health care providers (Newall et al., 2005; Wofford et al., 2008). The educational materials have predominantly been delivered via simple, traditional formats, such as
verbal counselling tips provided by the health care provider to patients (Smith et al., 2010; Wilson et al., 2003b) and sometimes supplemented with written materials or booklets (Estrada et al., 2000; Wilson et al., 2003b). However, these individual face-to-face patient education modes are labour and time consuming in the context of a busy clinical practice (Singla et al., 1996). Moreover, previous studies regarding the counselling 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 (Ley, 1982).

More recently, some studies have described other advanced and complex training strategies to support INR self-monitoring and self-management techniques via devices (Khan et al., 2004; Koertke et al., 2005; Menéndez-Jándula et al., 2005; Mörsdorf et al., 1999). The tools employed to achieve this learning outcome vary widely and include consecutive weekly theoretical (Gadisseur et al., 2003; Khan et al., 2004; Menéndez-Jándula et al., 2005; Sawicki, 1999) teaching or practical (Smith et al., 2010) sessions for small groups of patients; in-clinic videotape-assisted demonstrations (Mörsdorf et al., 1999; Stone et al., 1989); patient logbooks (Beyth, 2000; Scalley et al., 1979) and slide presentations (Foss et al., 1999; Scalley et al., 1979; Singla et al., 1996). While other studies addressed improving patients’ knowledge of warfarin without any focus on self-management, the educational methods they described were relatively modern (Amruso, 2004; Singla et al., 1996; Voller et al., 2004) audio-visual/multimedia resources, pictograms, drawings, and/or cue cards. 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 (Ritzert, 2015).

A recent cross-sectional study (Elbur et al., 2015) 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. Another cross-sectional study (Mayet, 2015) aimed to evaluate the level of knowledge of warfarin therapy and anticoagulation control and explore the association between knowledge and anticoagulation control in a sample of the Saudi population. Although the majority of the patients were found to have good knowledge of warfarin therapy, only a third demonstrated good anticoagulation control. The findings of these two Saudi studies (Elbur et al., 2015; Mayet, 2015) suggest that further substantial efforts are needed to develop and implement intensive programmes to enhance patients’ knowledge and satisfaction.

### Table 2: Impact of the audio-visual educational intervention on patient knowledge (N = 85)

| Scale          | Baseline | Post-intervention | MD (95% CI) | P-value | Effect size* |
|----------------|----------|-------------------|-------------|---------|--------------|
|                | M (SD)  | Range             | M (SD)      | Range   |              |
| AKA (out of 29)| 14.70 (4.82) | 2.0-23.0         | 19.79 (2.83) | 12.0-26.0 | 5.08 (6.23-3.95) | 0.00 | 1.05 |
| AKA (out of 100)| 52.62 (17.22) | 7.14-82.14      | 70.29 (10.03) | 42.85-92.85 | 17.66 (21.75-13.58) | 0.00 | 1.03 |

The effect size statistic was calculated as the mean difference (change) in scores between time point 1 and time point 2 divided by the standard deviation of the time 1 score.

### Table 3: Summary of patient-reported treatment satisfaction (using the ACTS) pre- and post-educational intervention (N = 85)

| Subscale     | Baseline | Post-intervention | MD (95% CI) | P-value* | Effect size |
|--------------|----------|-------------------|-------------|----------|-------------|
|              | M (SD)  | Range             | M (SD)      | Range    |             |
| Burdens      | 42.78 (9.86) | 16.0-59.0        | 43.31 (9.68) | 13.0-58.0 | 0.53 (2.48-1.43) | 0.59 | 0.05 |
| Benefits     | 11.29 (2.34) | 5.0-15.0         | 12.02 (2.25) | 8.0-15.0  | 0.73 (1.22-0.24) | 0.004 | 0.31 |

*Wilcoxon signed rank tests for the nonparametric data or paired sample t-tests for the normally distributed outcomes.
and to improve adherence to treatment. 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, the present study was performed to:

1) design an Arabic language audio-visual 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 satisfaction with warfarin therapy and INR control as secondary outcomes.

**Study design**

A prospective pre- and post-intervention study was conducted to assess the impact of a pharmacist-administered audio-visual tool on patients' knowledge of and satisfaction with oral anticoagulation therapy during the six-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. The study aimed to include 100 patients. A stratified sampling technique was employed according to the scheduled anticoagulation clinic appointments, which were three times per week. Approximately ten patients were approached each day, for a total of 30 patients approached per week (120 patients over four weeks).

Regarding the eligibility criteria, the study included adult patients who were ≥18 years old, 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 the 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-minute video delivered key points about warfarin therapy based on the researchers’ intensive literature review of various warfarin educational tools (Briggs et al., 2005; Zeolla et al., 2006). 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.

**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; these were the oral Anticoagulation Knowledge Assessment (AKA) (Briggs et al., 2005) and the Anti-Clot Treatment Scale (ACTS) (Cano et al., 2012), respectively. These instruments were administered in face-to-face interviews conducted with each patient pre-and post-intervention. Each interview took approximately 30 minutes.

**Measure of INR 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 audio-visual tool. Two indicators were used to evaluate the quality of warfarin therapy efficacy: 1) the patient’s time in the therapeutic range (TTR) using the Rosendaal method (Rosendaal et al., 1993), which evaluates the mean percentage of time (in days) a patient’s INR is within the desired treatment range, and 2) the stability of the INR, which estimates the percentage of visits during which the INR values were within the
Table 4: Effect of the educational audio-visual intervention on the INR quality measures

| Measure               | Baseline |          | Post-intervention |          | MD (95% CI)       | P-value* | Effect size |
|-----------------------|----------|----------|-------------------|----------|-------------------|----------|-------------|
|                       | M (SD)   | Range    | M (SD)            | Range    |                   |          |             |
| TTR% (N = 70)         | 56.63(35)| 0.00-100 | 64.72(35)         | 0.00-100 | 8.097 (18.24-2.05)| 0.12     | 0.23        |
| INR stability % (N = 70) | 54.76(35.02) | 0.00-100 | 59.53(35)         | 0.00-100 | 4.77 (12.98-3.44) | 0.25     | 0.14        |

*Wilcoxon signed-rank tests for the nonparametric data or paired sample t-tests for the normally distributed outcomes.

desired range (Kaatz, 2008; Rose et al., 2009).

Data analysis

The data were statistically analysed using SPSS (version 25.0; SPSS, Inc., Chicago, IL). 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. Furthermore, the possible impacts of demographic or clinical characteristics on the mean difference in the patients’ pre- and post-intervention responses to the AKA were examined using one-way analysis of variance with Tukey’s post hoc test for categorical variables or Pearson’s correlation test for continuous variables. All variables that were significant at the 95% level in the univariate analysis were further examined with a multivariate linear regression model.

Study participants

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

From Table 1,

Abbreviations

AF: Atrial Fibrillation,
AT: Atrial Thrombus,
DVT: Deep Vein Thrombosis,
LVT: Left Ventricular Thrombus,
PE: Pulmonary Embolism,

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.

From Table 2, Clinically, increasing moderate effect sizes over time would be expected, reflecting improved treatment satisfaction. The effect sizes were interpreted as follows: 0.20 (small change), 0.50 (moderate change) and >0.80 (large change). The mean knowledge score (out of 100) at baseline was 52.6 (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

From Table 3, Higher scores indicate greater treatment satisfaction; the 12 items of the ACTS burdens domain were reverse coded (scored 5 to 1), whereas the three items of the ACTS benefits domain were coded normally (scored 1 to 5).

Patients’ INRs

The impact of the educational audio-visual intervention on INR quality measures is demonstrated in Table 4.

Table 4 shows that, The patients were further classified into the following three control-level groups by the TTR score: <60% (poor control), 60-75% (moderate control), and >75% (optimal control). For our purposes, an INR stability value ≥ 50% was considered “safe warfarin management”; this value reflects INRs in the target range (e.g., 2.0 to 3.0 for most indications) for more than half the tested times.
The impact of patient-related variables on the improvement in knowledge post-intervention

Table 5 demonstrates the results of the univariate and multivariate analyses of patient-related variables associated with the mean difference in AKA scores pre- and post-intervention. In the initial univariate analysis, factors that had a significant positive impact on AKA score improvement were the pre-intervention TTR value and the number of ACC visits prior to the intervention (last 6 months), while factors that had a significant negative association with post-AKA responses were the incidence of bleeding, time to next visit post-intervention, ACTS burdens domain pre- and post-intervention scores, and ACTS benefits domain pre-intervention score.

Table 5 shows that, 1Multivariate linear regression model. 1Stepwise multivariate linear regression model. M: Mean Difference in AKA Score (100%) Pre- and Post-intervention.

However, subsequent multivariate regression analyses confirmed some positive (pre-intervention TTR value and educational level) and negative (incidence of bleeding, time to next visit post-intervention, pre-intervention ACTS burdens and benefits domains scores) predictors of the knowledge score. Interestingly, the strongest negative predictors obtained in the final stepwise regression model were the TTR baseline value and the pre-intervention ACTS benefits domain score. These findings implied that patients who had better INR control and those who perceived greater benefits of warfarin therapy were more likely to benefit from audio-visual counselling and were more attentive to information than were their counterparts. It is critical to note that other patient-related variables, such as sex, age, marital status, warfarin indication, comorbidities, concomitant medication, TTR% and INR stability levels post-intervention, were non-significant factors and did not affect the improvement in knowledge in this cohort.

The impact of patient-related variables on the mean difference in the ACTS burdens and benefits domain scores after intervention with the audio-visual educational video

We noted more positive changes in the patient-reported burdens domain satisfaction scores as a result of the positive impact of audio-visual education in patients who were younger (19-37 years), had no comorbidities (N=33, p=0.079) and were not receiving any concomitant drugs (N=28, p=0.056); however, the subgroup comparisons did not reach the level of statistical significance.

In contrast, we noted a very significant negative impact on the burdens domain satisfaction scores in the diabetic group, particularly those receiving insulin (N=23, MD= -4.5 (SD 4.8), compared to the nondiabetic group (N=62, MD=0.952 (SD 9.8), p=0.012). Diabetes was the only factor identified as significant in the analysis of the change in the ACTS burdens domain score.

Regarding the ACTS benefits domain scores, similar analyses did not identify any significant patient-related variable that impacted the mean difference in the ACTS benefits score after the intervention.

DISCUSSION

This study had the primary target of exploring the impact of a pharmacist-administered audio-visual intervention on improvements in patients’ knowledge of warfarin therapy. To the best of our knowledge, this is the first study of its kind to use an educational video about warfarin in Saudi ACCs. 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 essential component to achieving the ultimate clinical treatment goals (Eltayeb et al., 2017; Estrada et al., 2000; Ley, 1982; Singla et al., 1996; Smith et al., 2010; Wilson et al., 2003b). 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 aspect that was not considered in most previous educational video studies (Denizard-Thompson et al., 2012; Kim et al., 2015; Mazor et al., 2007; Moore et al., 2015). Additionally, most previous video intervention studies involved anticoagulated patients in hospitals, who were mostly new to warfarin (Kim et al., 2015; Moore et al., 2015; Stone et al., 1989), while this study included patients visiting an outpatient ACC, all of whom were prior warfarin users. This allowed a longer follow-up period in which to study the impact of the educational intervention on the long-term retention of warfarin knowledge rather than focusing on the immediate post-counselling effects (Kim et al., 2015; Mazor et al., 2007; Moore et al., 2015; Stone et al., 1989).

The comprehensive educational video and booklet were designed by the study team to provide essential information about warfarin; both components of the intervention were judged as simple and clear by ACC experts and specialized clinical pharmacists. Consequently, the study outcomes were overall encouraging, reflecting efficient information processing, knowledge maintenance, and belief mod-
ifications in our patients. First, regarding the main outcome of knowledge, the follow-up post-intervention AKA tests, which were administered an average of 52 days after the intervention, clearly demonstrated 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 for education about warfarin (Kim et al., 2015; Mazor et al., 2007; Moore et al., 2015; Stone et al., 1989; Vormfelde et al., 2014) or non-warfarin medications (Brock and Smith, 2007; Giuliano et al., 2017; Superior et al., 2002) 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 counselling effects within hospital settings (Giuliano et al., 2017; Kim et al., 2015; Moore et al., 2015; Stone et al., 1989; Superior et al., 2002) or in general practice clinics (Mazor et al., 2007), with no follow-up evaluation of knowledge retention.

Another important secondary finding in this study is the positive impact on participants’ treatment satisfaction, which is demonstrated 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 (Mazor et al., 2007) 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 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 towards 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 non-significant. Similarly, a cluster-randomized study comparing video education to patient education with a brochure alone demonstrated a non-statistically significant trend towards improvement in the TTR (mean difference of 7%) in the intervention arm (Vormfelde et al., 2014).

**Strengths and limitations of the study**

The strengths of this study lie in the fact that it is the first Saudi study to report the development of an educational video and to examine 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 (Denizard-Thompson et al., 2012; Vormfelde et al., 2014). In addition, our study is unique because of its interventional prospective pre- and post-test design. Other previous national studies in a similar clinical setting were all cross-sectional or descriptive in nature, and they did not involve any sort of clinical pharmacists’ intervention with follow-up testing of its influence on improvements in knowledge or clinical outcomes.

Moreover, unlike previous international video studies (Denizard-Thompson et al., 2012; Kim et al., 2015; Stone et al., 1989; Vormfelde et al., 2014), 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 audio-visual technologies to be used as an educational strategy to improve patients’ knowledge and satisfaction with the benefits of warfarin with less frequent pharmacist-led counselling, this study does have some limitations. First, the open-label, one-group design limits direct comparisons to other educational tools employed in routine care. According to a systematic literature review, the best strategy for developing and evaluating the mechanisms for educating patients about anticoagulation has yet to be determined (Clarke-Smith et al., 2013; Newall et al., 2005; Wofford et al., 2008).

Therefore, the specific impacts of various suggested educational and behavioural interventions on warfarin-related clinical outcomes warrant further research (Clarke-Smith et al., 2013). In our Saudi setting, future studies should consider employing a randomized, controlled parallel-groups strategy that will enable direct comparisons among various warfarin education techniques [video, traditional verbal counselling 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, the predetermined flexibility of the time interval between the intervention and the post-intervention assessment may...
Table 5: Improvement in knowledge (mean difference %) after the audio-visual educational video intervention, stratified by patient-related variables (N = 85).

| Variable                                | M (SD)       | Univariate analysis* | Multivariate analysis† | Final multivariate model‡ |
|-----------------------------------------|--------------|----------------------|------------------------|--------------------------|
|                                         | P-value      | B-coefficient        | P-value                |                          |
| Sex                                     |              |                      |                        |                          |
| Female                                  | 17.1 (20)    | 0.68                 | -4.02                  | 0.54                     |
| Male                                    | 19.0 (15.7)  |                      |                        |                          |
| Age                                     | 0.46         | -5.5                 | 0.44                   | -                        |
| ≤ 55 years                              | 20.2 (18.8)  | 0.56                 | 0.54                   | 0.83                     | 0.03                     |
| > 55 years                              | 14.3 (18.6)  |                      |                        |                          |
| Education level                         |              |                      |                        |                          |
| No formal education                     | 10.8 (16)    |                      |                        |                          |
| Primary/secondary school                | 19.4 (19.2)  |                      |                        |                          |
| High school                             | 16.1 (20.4)  |                      |                        |                          |
| Diploma/university                      | 21.5 (18.6)  |                      |                        |                          |
| Indication(s) for anticoagulation       | 0.68         | 0.022                | 0.98                   | -                        |
| Mechanical heart valve                  | 17.6 (19.6)  |                      |                        |                          |
| DVT/PE                                  | 21.7 (23.6)  |                      |                        |                          |
| AF/flutter                              | 15.8 (16.4)  |                      |                        |                          |
| Prosthetic heart valve                  | 11.9 (15.6)  |                      |                        |                          |
| Stroke/TIA                              | 28.6 (19.9)  |                      |                        |                          |
| LVT/AT                                  | 28.5 (30.3)  |                      |                        |                          |
| Smoking status                          | 0.21         | 3.7                  | 0.67                   | -                        |
| Smoker                                  | 16.7 (18.9)  |                      |                        |                          |
| Non-smoker                              | 24.4 (17.3)  | 0.52                 | -1.14                  | 0.88                     | -                        |
| Comorbidities                           |              |                      |                        |                          |
| Yes                                     | 18.7 (20.4)  |                      |                        |                          |
| No                                      | 15.9 (16)    |                      |                        |                          |
| Warfarin use status                     | 0.98         | -4.5                 | 0.78                   | -                        |
| DC warfarin/switched to another OAT     | 18.2 (14.8)  |                      |                        |                          |
| Continued on warfarin                   | 17.5 (19.4)  |                      |                        |                          |

Continued on next page
| Variable | M (SD) | Univariate analysis* | Multivariate analysis† | Final multivariate model‡ |
|----------|--------|----------------------|------------------------|--------------------------|
|          |        | P-value | B-coefficient | P-value |                      |
| Incidence of bleeding | 0.94 | -9.3 | 0.037 | 0.005 |                      |
| No bleeding | 16.5 (18.2) |          |          |          |                      |
| Minor bleeding | 18.3 (19.7) |          |          |          |                      |
| Major bleeding | 18.3 (17.9) |          |          |          |                      |
| Pre-intervention INR control |  |          |          |          |                      |
| TTR, mean | - | R = -0.41, P = 0.000 | 0.43 | 0.004 | 0.000 |
| INR stability, mean | - | R = -0.35, P = 0.001 | 0.07 | 0.76 | - |
| Post-intervention INR control |  |          |          |          |                      |
| TTR, mean | - | -0.16, P = 0.08 | -0.062 | 0.58 | - |
| INR stability, mean | - | -0.17, P = 0.08 | -0.049 | 0.69 | - |
| Concomitant drug use | 0.67 | -2.7 | 0.72 | - |                      |
| Yes | 18.2 (19.6) |          |          |          |                      |
| No | 16.4 (17.4) |          |          |          |                      |
| No. of ACC visits prior to intervention (previous 6 months) | - | r = -0.15, P = 0.24 | 0.92 | 0.018 | - |
| Time to next visit post-intervention | - | r = -0.23, P = 0.022 | -0.16 | 0.044 | 0.047 |
| ACTS burdens domain pre-intervention score | - | R = -0.22, P = 0.023 | -0.42 | 0.047 | 0.068 |
| ACTS burdens domain post-intervention score | - | R = -0.20, P = 0.034 | -0.39 | 0.068 | - |
| ACTS benefits domain pre-intervention score | - | R = -0.29, P = 0.004 | -2.32 | 0.008 | 0.000 |
| ACTS benefits domain post-intervention score | - | R = -0.16, P = 0.056 | -1.48 | 0.112 | - |

*ANOVA test with the Tukey post hoc test for categorical variables or Pearson's correlation test for continuous variables.
have negatively affected the outcome scores, especially among older patients, as they find it difficult to recall information. In fact, the mean difference in AKA scores was inversely related to the time-to-next visit. This implies that more consistent follow-up points would provide a more accurate estimation of the exact improvements or gaps in knowledge and satisfaction for many patients. Third, although the sample size and time frame of this study were adequate to reveal significant knowledge improvement (primary outcome), a longer observation period of at least one year, a larger sample size and a multi-centre 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.

Fourth, this study did not include a detailed analysis of the knowledge items that did not improve after the video intervention, as indicated by the results of the AKA test; however, this was not the primary goal of this report. Further analysis would help identify specific knowledge gaps that would guide us to improve the intervention design and content. 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 audio-visual 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) (Chen et al., 2016).

CONCLUSIONS

In particular, the study provided evidence that clinical pharmacists might play a major role in enhancing the positive impact of educational videos on information processing, arguing, observational learning, and perceiving the benefits and burdens of warfarin therapy.

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Author contributions

SS, AFA, MMA, MNA, OAA, and WFA performed the literature review. SS conceived and designed the protocol. MAA supported the enrollment of the patients, supervised the data collection, and provided logistic support. AFA, MMA, MNA, OAA, and WFA performed the research, provided research materials (Educational Video Technology) to patients, and collected and organized the data. SS drafted the manuscript and substantively revised it to meet the journal requirements. Both SS and MAA supervised the adaptation of the study tools to the Arabic language. SS performed the statistical analyses and discussed the interpretation of the results. AFA, MMA and OAA confirmed the interpretation of the results, ensured the resolution documented in the literature, and helped to write the scientific publication. All authors have agreed to be personally accountable for their own contributions, and all authors have reviewed and approved the final version of manuscript for submission.

Ethical approval

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 Princess Nourah University (PNU) (17-0074) and KKMC (17/0321) and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Conflict of interest

All authors declare that they have no competing interests.

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