

Assessment and evaluation efficacy of a clinical pharmacist-led inpatient warfarin knowledge education program and follow-up at a Chinese tertiary referral teaching hospital

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ABSTRACT

Background: Oral anticoagulation therapy with warfarin is used to prevent and to treat venous and arterial thrombosis and embolism. Its narrow therapeutic index should be monitored carefully in order to reach the desired outcomes.

Objective: This study aims to evaluate the clinical pharmacist-led in-patient warfarin's knowledge education program and to assess a follow-up efficacy in a Chinese tertiary referral teaching hospital.

Design and Setting: A cross-sectional and observational study was conducted at the Affiliated Hospital of Medical College of Nanjing University, a 1460-bed tertiary referral teaching hospital in Nanjing.

Materials and Methods: One-on-one interview questionnaire was conducted among 47 Chinese patients who had undergone prosthetic valve replacement. Before the patient education program's implemented, at discharge time and 3 months, 6-9 months and 12 months after surgery were considered as time points. A previously validated 17-item questionnaire was used to measure the patient's knowledge level of warfarin and to assess and evaluate a follow-up efficacy of this patient education program run by a clinical pharmacist. Knowledge scores were compared using the Student's *t*-test or one-way analysis of variance.

Main Outcome Measure: Patients' knowledge on the warfarin education program and warfarin knowledge score, drug therapy problems or bleeding complication events associated to warfarin therapy and evaluation of clinical pharmacist's service provided.

Results: Patients mean age was 47.68 ± 9.70 years (range 23-67). The higher education strata had significantly higher warfarin knowledge scores ($P < 0.05$). In terms of hospital stay post-surgery, compared with other groups, patients with an average of 11-14 days, were found significantly and statically higher knowledgeable in warfarin ($P < 0.05$).

The clinical pharmacist' service was found very satisfying $f(80.85\%)$.

Conclusion: Chinese patients on warfarin therapy should benefit from periodic educational efforts reinforcing key medication safety information. Patient education is not a once-off procedure. A complete patient education program run by a clinical pharmacist in a Cardio-thoracic ward can considerably improve and enhance to reduce the hospital stays and significantly enlighten the role of the patient education in adherence to therapy.

Key words: Anticoagulation, Chinese patients, clinical pharmacist' service, follow-up efficacy, international normalized ration, warfarin

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INTRODUCTION

Patients undergoing valve replacement with a mechanical prosthesis are candidates for warfarin therapy because they are committed to lifelong anticoagulation.^[1] Warfarin, the most commonly used oral anticoagulant, is currently the standard treatment for the prevention and treatment of these thromboembolic complications associated with prosthetic mechanical heart valve. It is an effective anticoagulant when dosed appropriately; however, its use requires systematic monitoring and close patient follow-up due to its narrow therapeutic index and several complicated pharmacokinetics and pharmacodynamics profiles.^[2] Other factors including diet, alcohol, other medications, illness and adherence can adversely affect the safety and efficacy of warfarin.^[3]

Until date, a few studies have shown an association between the outcomes of anticoagulation therapy and health literacy, patient education or knowledge of warfarin therapy; however, results are mixed.^[4-8] The need for therapeutic patient education (TPE) “cannot be disputed.”^[9] It is an integral component of good medical practice and pharmaceutical care as it enables people with chronic disease or lifetime health issue to manage their illness and yields benefits in both health and financial terms.^[10] Though acutely ill-patients may benefit from TPE, it appears to be an essential part of the treatment of long-term diseases and conditions such as: Allergies, hemophilia, cardiac insufficiency, rheumatic heart disease, epilepsy, dialysis, etc.^[11] Patients need to be equipped to make informed decisions about their health since lack of pertinent health-related information can lead to poor adherence to therapy. Health care providers tend to talk to patients about their disease rather than train them in the daily management of their condition. There is a need for a TPE, because it is therefore designed to train patients in the skills of self-managing or adapting treatment for their particular chronic disease or health condition and in the coping process and skills. The patient education is practiced by a process of diagnosis and intervention. It is planned, organized learning experiences designed to facilitate voluntary adoption of behaviors, skills, or beliefs conducive to health. The more educated a patient is, the more likely they are to actively engage in communication.^[12]

Studies have found a poor patient’s knowledge on warfarin directly correlated to poor adherence. Poor compliance is a major factor in unstable outpatient

control of anti-coagulant therapy.^[13] Improving and fostering better methods of oral anticoagulation therapy education may further reduce bleeding complications.^[7] Successful anticoagulation treatment is dependent on the patient’s knowledge of this drug.^[14] Patients’ knowledge, drug compliance and anticoagulation control all improve after patient education became part of the management plan.^[15-18] Specifically, in hospital patient education contributes to a better knowledge of the drug, compliance and reduced readmissions.^[6,19] Clinical pharmacist, as a member of the health-care team, should have responsibilities in warfarin therapy monitoring and patient education. Traditionally, clinical pharmacist involving in warfarin therapy has been limited to simple tasks ordered by physicians, especially as clinical pharmacy education in China has developed only recently.

Warfarin is the most commonly prescribed oral anticoagulant therapy in the United States and effective for prevention and treatment of venous thromboembolism and thromboembolism in the setting of prosthetic heart valves, atrial fibrillation and myocardial infarction,^[20] but it remains a difficult drug to manage, especially in the post-discharge period. Both patient-related factors and logistical factors have been cited as reasons for poor international normalized ration (INR) control.^[21-25] Furthermore, shorter periods of hospitalization, coupled with increasing warfarin usage, are placing additional stresses on the community-based services caring for anticoagulated patients’ post-discharge.^[26-28] Waiting times between acute in-hospital treatment and admission to rehabilitation clinics, as well as abstention from stationary rehabilitation programs, form objective adherence barriers.^[29] To overcome and to manage experiences with anticoagulation complications, many of the studies have reported the role of out-patient anticoagulation clinics, such as improving outcomes through patient engagement, improved health literacy and improved medication adherence.

Assessment of patient warfarin knowledge might be used in quality improvement initiatives in anticoagulation monitoring and patient safety including identification of areas of knowledge deficiency. Warfarin has been reported to be implicated in approximately 30% of reported anticoagulant-related errors.^[30] In order to improve the anticoagulation management and safety in our institution, it has been implemented an inpatient

pharmacist-directed anticoagulation service. The aims of this paper were to assess a pharmacist-led in-patient warfarin knowledge program and to evaluate its follow-up efficacy, the variety of instruments used for the testing of patients' knowledge regarding warfarin and anticoagulation therapy.

MATERIALS AND METHODS

Study setting

A cross-sectional and observational study was conducted at the Affiliated Hospital of Medical College of Nanjing University, a 1460-bed tertiary referral teaching hospital in Nanjing. The institutional review board approved the protocol for this study. We studied laboratory data, medication lists, information and had a 1-year telephonic interview follow-up of all the patients who were discharged between September 1st 2008 and December 30th of the same year.

Study sample

The study population used in our study was taken from the Cardio-thoracic Surgery Department patient's registry database. Warfarin-treated Asian patients were identified among patients who had undergone heart surgery. The subjects were men and women 18-70 years of age. All the patients received the clinical pharmacist-led inpatient warfarin knowledge education program (pamphlet, talk session and video projection). The inclusion criteria for patients were treatment with warfarin due to prosthetic heart valve replacement (aortic valve replacement, mitral valve replacement or/and tricuspid valve replacement); starting prior surgery the clinical pharmacist-led in-patient warfarin knowledge education program.

The exclusion criteria of our study included patients who had biological valve replacement, subjects who had other related heart surgery (such as: Ventricular septic defect, atrial septic defect, coronary artery bypass grafting, patent ductus arteriosus, Fallot's tetralogy and percutaneous endoscopy cervical discectomy), but were not administered warfarin. During the hospital stay, patients desiring self-discharge for any reason, patients transferred to other departments' wards for any additional therapy, death occurring within the hospital stay period were also excluded from this study. During the follow-up period, the subjects who could not complete the entire the follow-up period due to change of phone number and/or home address were excluded from final statistical analysis. Patients were also excluded if they refused participation or could not voice understanding after reading the informed

consent. Ultimately, a total of 47 patients was left and used for final analysis and evaluation [Figure 1]. All patients gave informed consent for the study, which was approved by the hospital's Research Ethics Board.

The follow-up set points periods were considered as follows: Follow-up stage I (included all 3 months post-surgery patients), follow-up stage II (including all the patients who had 6-9 months post-surgery time) and follow-up stage III (12 months after surgery). Figure 1 below summarizes the study sample selection.

Design and description of the interview questionnaire

A first version of the questionnaire was developed as a series of questions with multiple choice answers. This was then piloted with 15 patients and underwent review by members of two clinical pharmacists, one physician and one academic pharmacist. During the piloting process, changes were allowed to be made between patients. Comments on the questionnaire and suggestions for improvement from the patients were also highly considered. After piloting, this questionnaire was presented to an expert panel (three clinical pharmacists, two academic pharmacists, two surgeons and two clinical nurse consultants, none of them whom had been involved in item development) and further revised.

Based on the two questionnaires measuring patient knowledge of warfarin therapy: The oral anticoagulation knowledge test, created and validated by Zeolla *et al.*,^[31] and the anticoagulation knowledge assessment questionnaire, designed and validated by

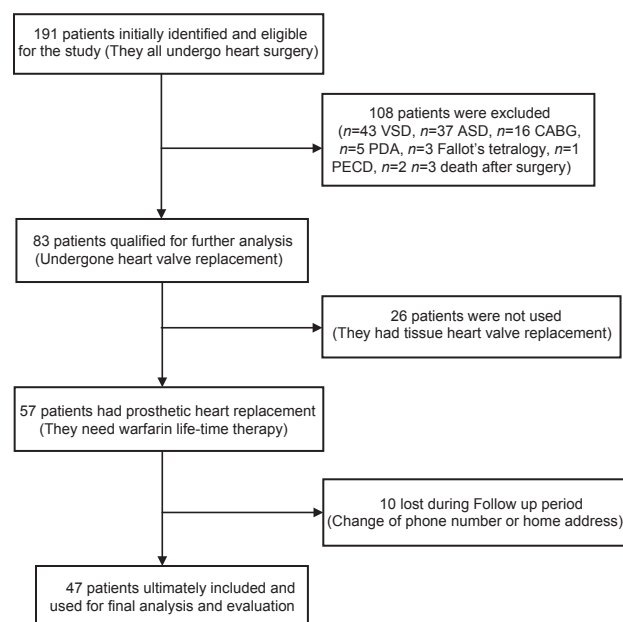


Figure 1: Study sample selection chart flow

Briggs *et al.*,^[32] an adapted and revised version of the questionnaire was adopted and validated by the expert panel mentioned previously. This revised version of questionnaire [Annex 1] consisted of 17 closed-ended multi-choice questions and was designed to address the objectives of the study by covering various issues of interest (participants' knowledge about warfarin, the importance of adherence to anticoagulation therapy and the effect of life-style factors on anticoagulation therapy). The questionnaire was divided into two sections. Although the first section of the questionnaire provided information on the socio-demographic characteristics of the respondents, the second section determined the awareness of patients about the warfarin education and anticoagulation therapy. Structured multiple-choice closed-ended questions provided 3-6 different reply options without possibility to mark several answers, excluding a possibility to add individual personal opinions. The question number 17 [double underlined, Form] sought patients' level of satisfaction for the clinical pharmacists service that they received. The following scale of option was provided in that question: "Very satisfied"; "Satisfied"; "Not satisfied."

Among the 17 questions, the reliability correlation coefficient = 0.70 made up of 12 questions [single underlined question items, Form], were scored "1" for every corrected answers, "0" for wrong answers or uncertain answer ("I do not know").

Procedure and administration of the questionnaire interview

The questionnaire was administered before and after the educational intervention so that the patients' level of knowledge before, during and after the intervention could be compared in order to establish the effect of the intervention. During the daily clinical round at the ward, the clinical pharmacist introduced himself/herself to new patients (and to their relatives) who were transferred from the intensive care unit to the ward after their surgery. The clinical pharmacist then explained the purpose of the interview session, which was to ask the patients and their relatives, questions relevant to the patients' heart surgery and warfarin therapy. The clinical pharmacist then used these basic information obtained during these initial interviews to establish the baseline warfarin knowledge. Therefore, the clinical pharmacist was able to know how much the patients and their relatives understood concerning their surgery and the relevant warfarin therapy. The patients and their relatives were encouraged to answer all the questions as honestly as they could. The topics

for education of the anticoagulated patients cover all the sections shown in Table 1.

After the first interview session, the clinical pharmacist told them the right answers and answered any relevant questions that the patients and/or their relatives could ask. The same questionnaire was used again during the following interview sessions (telephone follow-up) to determine the effect of the educational intervention on the patients' understanding of their complete medical situation especially concerning the anticoagulation therapy. The telephone follow-up time periods were set up as follows: Follow-up stage I (January 2009), follow-up stage II (July 2009) and follow-up stage III (February 2010).

Table 1: Topics in education of the anticoagulated patient

Sections	Educational topics or subjects
Surgery relevant basic information	Which kind of surgery
	Which heart valve (aortic, mitral, tricuspid)
	Type of valve used (prosthetic or biological)
Basic of anticoagulation	Description of anticoagulation system
	Comparison of normal and abnormal blood clotting
	Warfarin-mechanism
Risk-benefits	Risk of bleeding
	Risk of clotting
	Complications of thromboemboli
Adherence	Color and strength of the tablet
	Indications and dosages
	What to do if dose missed
Accessing healthcare professional	When to call your healthcare professional
	When to seek emergency care
	Anticoagulation services
Diet	Basic of vitamin K
	Specific foods
	Lab monitoring
Medication interaction	Basic of INR
	Therapeutic range of INR
	Most recent INR results
	Interpretation of INR
	Frequency of INR determination
	Antibiotics
Self-care and lifestyle	OTC medications
	Injury management and contraindicated activities
	Signs of bleeding events in case of overdose
	Signs of thromboembolic events in case of underdose
	Special situations: Travel, illness, pregnancy and surgery
	Medical bracelet and anticoagulation record book
Self-testing	Dose adjustment
	Home coagulometry
	Anticoagulation record book (for diary control)

INR=International normalized ration, OTC=Over the counter

During the post-surgery in-patient hospital stays, repetition of educational interview sessions was used to enhance the patient knowledge on the warfarin anticoagulation therapy. Every twice a week (Tuesday and Thursday) in the afternoon, a 15-min video educational program on warfarin knowledge was displayed in the ward activity room. Patients and their relatives attended these video educational sessions and a time of questions and answers was always available at the end of the video session. This video education program is a successful project implemented that same year from a multidisciplinary health-care professional team run by clinical pharmacist. These video educational sessions and times for questions and answers had considerably enhanced the patient's knowledge on warfarin anticoagulation therapy.

Outcome measures

The primary outcome measure was the proportion of patients experiencing a high warfarin knowledge score at the end of the follow-up stage III period. The secondary outcome measure was the proportion of patients experiencing the considerable warfarin drug therapy problems (DTPs) or bleeding complications events at the end of the final follow-up set point. The tertiary outcome was the proportion of patients giving a considerable grade on the clinical pharmacist provided service.

Statistical analysis

Data are expressed as either the mean value \pm standard deviation or the median as indicated; categorical data are presented as frequencies and percentages. The Student's *t*-test was used to compare knowledge scores between the two groups (e.g., gender), as warfarin knowledge scores were found to be relatively normally distributed. One-way analysis of variance was used to test for differences in warfarin knowledge scores between employment and education strata. Where appropriate, *post-hoc* analysis of multiple comparison testing was performed using Tukey's test. Education and employment status categories were subsequently collapsed into two categories for statistical evaluation. A significant difference was said to exist at the $P < 0.05$ level.

RESULTS

Demographic profile

The database identified 57 patients that had received a mechanical heart valve within the designated time frame. Of these, 47 patients completed the study forming our final study group sample [Figure 1].

The study group was predominantly female $f(57.45\%)$ with a range age of 23 years to 67 years and a mean age of 47.68 ± 10 years [Table 2]. In terms of surgery, $f(38.30\%)$ of the patients had undergone mitral valve replacement, $f(34.04\%)$ had both aortic and mitral valves replaced and $f(27.66\%)$ had undergone aortic valve replacement. Most patients had an educational background which is less or equal to primary school ($n = 35$). The median patient age was 36 years to 64 years with a median hospital-stay post-surgery of 11 days to 14 days. In terms of status employment, $f(57.45\%)$ of patients were farmers, $f(21.27\%)$ of patients were employed, $f(10.64\%)$ of patients were retired and also $f(10.64\%)$ of patients were categorized as other due to the information they or their relatives provided during their enrollment into the Cardio-thoracic surgery ward. Table 3 and Figure 2 show us the DTPs or bleeding complications occurred during the study pilot period.

Variables affecting warfarin knowledge scores

Personal characteristics

The target INR was negatively related to warfarin knowledge scores [$P < 0.05$; Table 2]. The male patients had significantly higher warfarin knowledge scores compare to females, but were not found statically significant. In terms of patients' age, the patients who had less or equal to 35 years old were found to have significantly higher warfarin knowledge scores at the end of the study pilot period compared to the other age's strata [$P > 0.05$; Table 2].

Socio-educative and hospital day's post-surgery status variables

The patients with an education greater or equal to university had significantly and statically higher

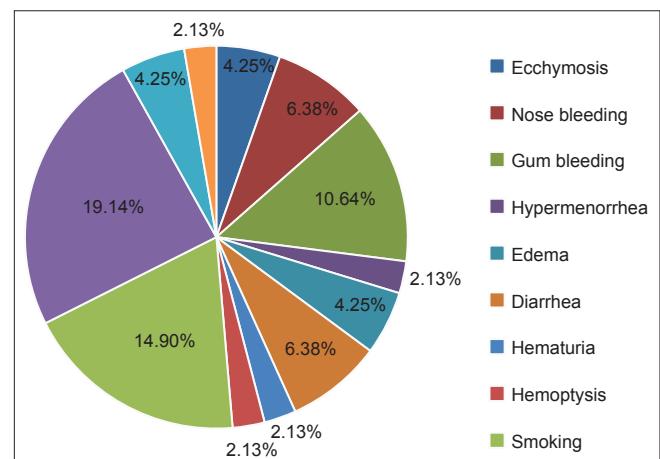


Figure 2: Drug therapy problems / bleeding complications

Table 2: Univariate analysis of the relationship between demographic and SES variables of the study participants and warfarin knowledge scores as the dependent variable

Characteristics	Value N (%)	Mean score±SD					P
		Before patient education	On discharge time	Follow-up stage I	Follow-up stage II	Follow-up stage III	
Gender							
Male	20 (42.55)	4.20±1.28	9.62±0.88	10.00±0.79	10.40±0.64	11.20±0.66	0.175
Female	27 (57.45)	3.78±1.27	9.56±0.85	10.22±0.79	10.30±0.61	10.89±0.66	
Age (years)							
≤35	7 (14.90)	4.00±1.17	9.57±0.67	10.43±0.68	10.43±0.59	11.57±0.71	0.088
36-65	39 (82.98)	3.97±1.27	9.54±0.88	10.02±0.80	10.31±0.63	10.92±0.67	
>65	1 (2.12)	3±ind.	12±ind.	12±ind.	11±ind.	11±ind.	
Warfarin indications							
MVR	18 (39.30)	4.05±1.30	9.55±0.87	10.39±0.78	10.33±0.60	10.94±0.66	0.001*
AVR	13 (27.66)	4.00±1.28	9.69±0.85	10.15±0.74	10.08±0.61	11.08±0.63	
DVR	16 (34.04)	3.81±1.27	9.56±0.85	9.81±0.79	10.56±0.61	11.06±0.66	
Target INR							
1.8-2.2	12 (25.53)	3.83±1.28	9.67±0.85	10.17±0.74	10.00±0.61	11.00±0.67	0.004*
2.0-2.5	35 (74.47)	4.00±1.27	9.57±0.88	10.11±0.80	10.46±0.63	11.03±0.67	
Education level							
≤primary school	35 (74.47)	3.77±1.27	9.51±0.88	10.08±0.80	10.28±0.63	10.91±0.67	0.020*
High school	9 (19.15)	4.33±1.20	10.00±0.70	10.11±0.70	10.55±0.60	11.44±0.65	
University	3 (6.38)	5.00±1.24	9.33±0.72	10.67±0.69	10.33±0.62	11.00±0.66	
Status employment							
Employed	10 (21.27)	4.60±1.21	9.50±0.83	10.20±0.73	10.40±0.62	11.4±0.65	0.037*
Retired	5 (10.64)	4.80±1.37	10.20±0.90	10.20±0.87	10.20±0.57	10.8±0.60	
Farmer	27 (57.45)	3.67±1.27	9.52±0.88	10.11±0.80	10.30±0.63	10.89±0.67	
Other	5 (10.64)	3.40±1.21	9.60±0.72	10.00±0.70	10.60±0.57	11.20±0.67	
Hospital stays post-surgery							
≤10 days	8 (17.02)	4.12±1.24	9.5±0.66	10.25±0.71	10.37±0.54	11.00±0.66	0.015*
11-14 days	22 (46.81)	4.14±1.29	9.60±0.86	10.14±0.78	10.45±0.61	11.18±0.65	
15-21 days	11 (23.40)	3.45±1.21	9.45±0.81	9.82±0.72	10.18±0.58	10.82±0.65	
>21	6 (12.77)	4.00±1.27	10.00±0.88	10.50±0.80	10.17±0.63	10.83±0.67	

SD=Standard deviation, INR=International normalized ration, SES=Socioeconomic status, AVR=Aortic valve replacement, MVR=Mitral valve replacement, DVR=Double valve replacement. The student's t-test was used to compare knowledge scores between groups,*P<0.05 statistically significant

Table 3: Drug therapy problems or bleeding complications occurred during the study pilot period

Characteristics	Value	
	n	%
Ecchymosis	2	4.25
Nose bleeding	3	6.38
Gum bleeding	5	10.64
Hypermenorrhoea	1	2.13
Edema	2	4.25
Diarrhea	3	6.38
Hematuria	1	2.13
Hemoptysis	1	2.13
Smoking	7	14.90
Drinking	9	19.14
Dizziness	2	4.25
Fatigue	1	2.13

n=number of patients, %=Percentage of patients

warfarin knowledge scores than those who did not [P < 0.05; Table 2]. Employed patients were found to have significantly higher warfarin knowledge

scores when we compared with other patients in employment strata [P < 0.05; Table 2]. However the patients from the “other” employment strata were also found to have significantly higher warfarin knowledge scores compared to retired and farmers, surely because in this group it would have been some patients with a certain employment status. They were classified as “other” in employment status due to the little information found in the cardiac care registry database when they were enrolled in that department.

In terms of hospital stay post-surgery, the patients with a median hospital stay post-surgery of 11-14 days were found to have significant and statically higher warfarin knowledge compared to other groups [P < 0.05; Table 2].

Figure 3 shows the general results of the warfarin knowledge score for the patient education program from before until the follow-up phase III.

Satisfactory grade of clinical pharmacist’s service

According to the “analysis of the relationship between demographic and socio-economic status variables of the study participants and grade of clinical pharmacist’ service provided as the dependent variable” [Table 4],

most of the patients were very satisfied for the health care service provided by the clinical pharmacist. Among the farmers, we found $f(77.78\%)$ of patients who were very satisfied, while $f(18.52\%)$ and $f(3.70\%)$ of patients were respectively fairly satisfied and not satisfied. Figure 4 displayed the complete statistical significance of the health-care service provided by the clinical pharmacist to these patients during their hospitalization and follow-up time period during the pilot study.

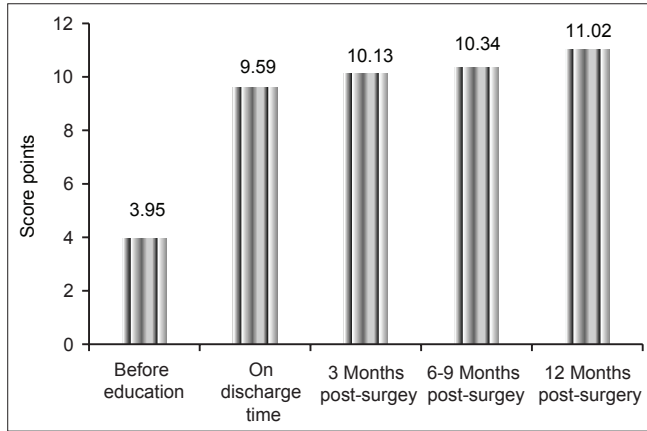


Figure 3: General warfarin knowledge score (Mean) during the stud pilot

DISCUSSION

In this pilot study, we can clearly notice that most of the patients had insufficient knowledge of warfarin therapy especially before the patient education program implement, though they had undergone heart surgery where all the aspect should have been discussed and presented to them by the physicians before the surgery. This finding confirmed some previous studies pilots done in Europe and in the

Table 4: Analysis of the relationship between demographic and SES variables of the study participants and grade of clinical pharmacist’s service provided as the dependent variable

Characteristics	Value N (%)	Number of patients (%)			P
		Very satisfied	Fairly satisfied	Not satisfied	
Gender					
Male	20 (42.55)	17 (85.00)	3 (15.00)	0 (0.00)	0.014*
Female	27 (57.45)	21 (77.78)	5 (15.52)	1 (3.70)	
Age (years)					
≤35	7 (14.90)	5 (71.43)	2 (28.57)	0 (0.00)	1.704
36-65	39 (82.98)	32 (84.21)	5 (13.16)	1 (2.63)	
>65	1 (2.12)	1 (100.00)	0 (0.00)	0 (0.00)	
Warfarin indications					
MVR	18 (39.30)	12 (66.67)	5 (27.78)	1 (5.55)	0.047*
AVR	13 (27.66)	13 (100.00)	0 (0.00)	0 (0.00)	
DVR	16 (34.04)	13 (81.25)	3 (18.75)	0 (0.00)	
Target INR					
1.8-2.2	12 (25.53)	12 (100.00)	0 (0.00)	0 (0.00)	0.823
2.0-2.5	35 (74.47)	26 (77.28)	8 (22.86)	1 (2.86)	
Education					
≤primary school	35 (74.47)	27 (77.14)	7 (20.00)	1 (2.86)	1.396
High school	9 (19.15)	8 (88.89)	1 (11.11)	0 (0.00)	
University	3 (6.38)	3 (100.00)	0 (0.00)	0 (0.00)	
Status employment					
Employed	10 (21.27)	8 (80.00)	2 (20.00)	0 (0.00)	0.954
Retired	5 (10.64)	5 (100.00)	0 (0.00)	0 (0.00)	
Farmer	27 (57.45)	21 (77.78)	5 (18.52)	1 (3.70)	
Other	5 (10.64)	4 (80.00)	1 (20.00)	0 (0.00)	
Hospital stays post-surgery					
≤10 days	8 (17.02)	6 (75.00)	2 (25.00)	0 (0.00)	0.542
11-14 days	22 (46.81)	18 (81.82)	3 (13.64)	1 (5.54)	
15-21 days	11 (23.40)	9 (81.82)	2 (18.18)	0 (0.00)	
>21	6 (12.77)	5 (83.33)	1 (16.67)	0 (0.00)	

INR=International normalized ration, AVR=Aortic valve replacement, MVR=Mitral valve replacement, DVR=Double valve replacement, SES=Socioeconomic status. The student’s t-test was used to compare knowledge scores between groups,*P<0.05 statistically significant

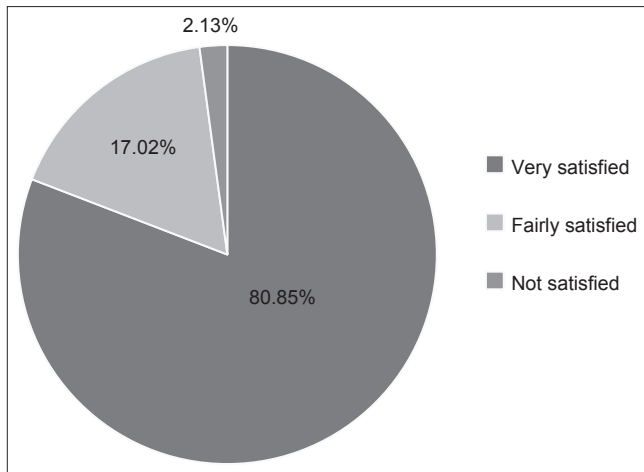


Figure 4: Satisfaction's distribution of health care service provided by clinical pharmacist

United States that also reported insufficient warfarin knowledge.^[6,33,34] The adverse effects associated with poor anticoagulation control were designated the weakest area of warfarin knowledge in these studies. However even if we can see a great significance in warfarin knowledge scores in this study, but the INR therapeutic range, the periodicity of monitoring and the proper time to take this drug were found to be the areas where the patients had less knowledge. With their small samples,^[34-36] the previous studies were not at priori design to stress out and to evaluate the factors of patient's knowledge.

In this study, we can emphasize the point that the socio-educative status is one of the potent determinants of health care in patient education programs. The patients who had less or equal to 35 years old were found to have significantly higher warfarin knowledge scores at along the study compared to the other age's strata ($P < 0.05$) [Table 2]. The more we are young in age, the better we remember things.

Patients with an education greater or equal to a university degree had significantly higher warfarin knowledge scores than those who did not ($P < 0.05$) [Table 2]. Employed patients were found to have significantly higher warfarin knowledge scores when we compared with other patients in employment strata ($P < 0.05$) [Table 2]. The level of education attained by patients may reflect their degree of literacy as reported in other studies.^[14,37-43] This reinforced the finding, which enlightens that patients with university and high school background were found with high warfarin knowledge scores compared with the others ($P < 0.05$) [Table 2]. Consequently, illiteracy is one of the barriers, which hinder patients

to receive high-quality care.^[14,37-43] The better the patient knows his medical condition, the more it allows him to be involved in the therapy and the more it enables a quicken recovery.

Despite its complex pharmacokinetics and pharmacodynamics profile; warfarin is still one of the most widely used oral anticoagulant agents. Pharmacological management of an individual's coagulation status requires a delicate balance between achieving anticoagulant status quickly, while avoiding overshooting the target. Attaining optimal anticoagulation with this agent is clinically challenging in view of its many food and drug interactions. Despite the best efforts of clinicians, warfarin remains a difficult drug to manage, especially in the post-discharge period. Due to the Chinese patients' life-style, where the consumption of alcohol and the intake of smoke have a high significant impact,^[44,45] clinicians always advised their patients to reduce or to quit smoking and drinking while they are on warfarin therapy. However this is something difficult for Chinese patients. Thus among the DTPs, bleeding complications and life-style factors, smoking and drinking are reported with high percentage [Table 3].

Along during this study, most of the patients were very satisfied $f(80.85\%)$ for the health-care service provided by the clinical pharmacist [Figure 4]. This funding confirms what have been reported in some studies where doctors and nurses in anticoagulation clinic overwhelmingly support the presence of clinical pharmacists, regularly seek their advice and feel that they improve patient safety and quality of care.^[46] It also reinforces that funding where the evaluation of pharmacist-led anticoagulation service have gone beyond the assessment of clinical outcomes to consider economic impacts, where outcomes were reported in terms of complication rates, medical care utilization, cost-effectiveness, patient health and quality-of-life and/or patient satisfaction.^[47]

CONCLUSION

The need for patient education cannot be disputed; it is an integral component of good medical practice and pharmaceutical care. Outcomes of educating patients include an increase in their levels of knowledge about the condition, as well as its therapy, adaptation of life-styles and improved adherence to therapy, as well as health-related outcomes. It must be devoid of gender, ethnic and age bias and effective for persons of widely varied levels of formal education.

Patient education has entered into a new era where accountability in educational outcomes, interest in literacy/language barriers and the importance of cost-effectiveness will influence the process of patient education. Prioritizing the educational content and using validated instruments for measuring the outcomes of patient education will be a necessary first step in improving anticoagulation outcomes.^[48]

A significant number of patients receiving mechanical prosthetic valves were found to have insufficient knowledge therapy, especially after the therapy was being initiated. However this was corrected as the clinical pharmacists were consecrated to these patients before their discharge period and even up to a year after their surgery by a telephone follow-up. Patients with lower education background and those who were farmers had significantly lower warfarin knowledge scores ($P < 0.05$) [Table 2]. In terms of hospital stay post-surgery, the patients with a median hospital stay post-surgery of 11-14 days were found to have significantly higher warfarin knowledge compared with other groups in univariate analysis ($P < 0.05$) [Table 2].

These findings suggest and support that patient education is not a once-off, but a continuous procedure; patients need to keep receiving information when they visit health-care providers for follow-up purposes. This will help to reinforce the advice they received previously for their current therapy as lack of pertinent health-related information can lead to poor adherence to therapy.

There are limitations to this study. A partial of the data were collected by a retrospective telephone interview conducted between 3 and 12 months post-discharge. Therefore, data regarding the types of educational tools and the duration of education may be limited by the ability of the participants to accurately remember the type of concomitant medications that they received. In addition, as this was a retrospective study and for some of the patients who were monitoring their INR at their community hospitals, we were sometimes unable to collect all the information relevant to the participants' INR levels during each of their INR monitoring visits. Therefore, we were sometimes unable to correlate INR values with knowledge scores. Some other studies have shown that there is a positive correlation between patients' knowledge and anticoagulation control, drug compliance and the number of INR values within the INR range.^[49-51]

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Annex 1: Warfarin therapy knowledge assessment tool

Patient's evaluation form on Warfarin knowledge

Name: _____ Gender: _____ Age: _____ Patient I.D.: _____

Phone: _____ Statistic No: _____ Filling Date: _____ Discharge Date: _____

1. Education level
 - A. Primary school and below
 - B. High School
 - C. Bachelor or equivalent
 - D. Master and/or above
 2. Professional status
 - A. Student
 - B. Having a permanent wor
 - C. Farmer
 - D. Retired
 - E. Other (Specify)
 3. Surgery information
 - A. Valve Replacement
 - B. Valvuloplasty
 - C. Annuloplasty
 - D. I do not know
 4. Type of valve
 - A. Mechanical Valve
 - B. Biological Valve
 - C. Valve Ring
 - D. I do not know
 5. Why do you need to take Warfarin?
 - A. Prevent Clotting
 - B. Prevent Bleeding
 - C. Improve the heart Function
 - D. I do not know
 6. Will you still to take this drug after being discharged?
 - A. Yes
 - B. No
 - C. I do not know
 7. How many times a day should you take this drug?
 - A. Once a day
 - B. Twice a day
 - C. Three times a day (Morning – Noon – Evening)
 8. For how long will you need to take this drug?
 - A. One month
 - B. 3 to 6 months
 - C. Lifetime
 - D. I do not know
 9. When is the appropriated time to take this medicine?
 - A. Before Meal
 - B. After Meal
 - C. Before or after meal, it doesn't matter
 - D. I do not know
 10. The medicine you are using now is:
 - A. Imported (3.0 mg – Blue Color)
 - B. Domestic (2.5 mg – White Color)
 11. Do you know the common Complications (Side Effects) of this drug?
 - A. Clotting and Bleeding
 - B. Dizziness
 - C. Chest pain
 - D. I do not know
 12. Which are the items needed to monitor your blood test while under warfarin therapy?
 - A. PT+INR
 - B. PT
 - C. Normal Blood Test (WBC, RBC.)
 - D. I do not know
 13. How often will you be monitored?
 - A. After being discharged, no need.
 - B. Once after being discharged
 - C. Periodically according to the stability required
 - D. I do not know
 14. According to the Surgery you undergo, in which range value should be your INR?
 - A. Below 1.8
 - B. 1.5-2.0
 - C. 1.8-2.2
 - D. 2.0-2.5
 - E. 2.5-3.0
 - F. Above 3.0
 15. Which are the common factors which can influence your anticoagulation Therapy Goal?
 - A. (Disease, New Drugs, Weather, Diet and Lifestyle)
 - B. I do not know
 16. Let's imagine that you forgot to take your medicine last night and suddenly you remember this morning. What should you do?
 - A. Immediately take the missed dose
 - B. Don't take the missed dose but double the dose tonight
 - C. Forget about the missed dose and still take the drug as it's has been scheduled
 - D. I do not know
 17. Are you satisfied with the Clinical Pharmacist service?
 - A. Very Satisfied
 - B. Satisfied
 - C. Not Satisfied
- Note:
 PT=Prothrombin time, INR= International normalized ratio, WBC=White blood cells, RBC=Red blood cells