Cardiovascular Pharmacology: Open Access
ISSN: 2329-6607

Dejene et al., Cardiovasc Pharm Open Access 2017, 6:1
DOI: 10.4172/2329-6607.1000206

Research Article Open Access

Healthcare Professionals' Knowledge and Counseling Practice on Warfarin Therapy at Tertiary Care Teaching Hospital, Addis Ababa, Ethiopia

Feven Dejene, Demissew Berihun and Tamrat Assefa*

Department of Pharmacology and Clinical Pharmacy, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia

***Corresponding author:** Tamrat Assefa, Department of Pharmacology and Clinical Pharmacy, College of Health Sciences, Addis Ababa University, P.O. Box: 1176, Addis Ababa, Ethiopia; E-mail: tamrat.assefa@aau.edu.et

Received date: February 02, 2017; **Accepted date:** February 22, 2017; **Published date:** February 27, 2017

Abstract

Background: Warfarin has been the mainstay oral anticoagulant agent for the last several decades despite its narrow therapeutic index. It is critical for health professionals to have better knowledge and understanding on oral anticoagulant management and on how to give counseling for patients on this therapy. This study assessed healthcare professionals' knowledge and counseling practice on warfarin therapy at Tikur Anbessa Specialized Hospital (TASH).

Methods: Cross sectional study design which included 164 pharmacists and physicians was conducted at TASH by using questionnaire on knowledge and counseling practice about warfarin therapy. The data was analysed with SPSS and the differences between groups were compared using one-way ANOVA followed by tukey's post-hoc test.

Results: Out of 15 questions the mean total score was 9.98 (SD=1.67). Among study participants, there was no one who gave correct answers to all questions. The total score of the overall test were (9.45+1.63) by pharmacists, (10.06+1.49) by interns and (10.35+1.77) by residents. The overall residents score significantly higher ($p<0.05$) than pharmacists but was not significant ($p=0.696$) with interns. In their counseling practice, 61.6% and 29.3% of study participants responded as they provide counseling services for all and only for new patients who are on warfarin respectively. In sufficient time and poor counseling environment predominantly affect 54.3% and 32.9% of study participants' counseling service on warfarin therapy respectively.

Conclusion: The knowledge of health care professionals regarding warfarin was inadequate. The study participants had different experience on providing counseling for patients on warfarin.

Keywords: Warfarin; Thromboembolic Diseases; Anticoagulant; Tikur Anbessa Specialized Hospital; Ethiopia

Introduction

Warfarin has been the mainstay oral anticoagulant agent for the last several decades despite its narrow therapeutic index [1]. It has become a successful agent for the medical management of thromboembolic diseases such as atrial fibrillation, mechanical heart valve replacement, deep vein thrombosis, pulmonary embolism, and valvular heart disease, among others. This has led to a dramatic increase in the number of patients receiving warfarin therapy [2]. The anticoagulant effect of warfarin results from the inhibition of the vitamin K dependent post-translational carboxylation of glutamate residues on the N-terminal regions of coagulation factors II, VII, IX and X by inhibiting the conversion of vitamin 2, 3 epoxide to reduced vitamin K and also it inhibits synthesis of anticoagulant proteins C, S and Z (potential procoagulant effects) [3,4]. Pharmacokinetic drug interactions with warfarin are primarily as result of alterations in hepatic metabolism or binding to plasma proteins. Drugs that inhibit or induce the CYP2C9, CYP1A2, and CYP3A4 isoenzymes have the greatest potential to significantly alter the response to warfarin therapy [5]. Foods which have high concentration of vitamin K including green leafy vegetables, green tea and chewing tobacco all decrease anticoagulation effect of warfarin; and their intake should be constant and limited [6].

Deficiencies in the knowledge of warfarin-food and drug interactions could result in inappropriate patient counseling, disruptions in warfarin anticoagulant outcomes that may result in bleeds or clots and adverse medical consequences [7,8]. Thus, it is critical for health professionals to have better knowledge and understanding on oral anticoagulant management, warfarin monitoring parameters and its' interaction and in case an anticoagulated patient presents for an emergency medical treatment [9].

Common causes of errors with anticoagulants and serious complication as severe as hemorrhage and even death are due to knowledge deficits, failure to follow guidelines and communication issues [9,10]. A lack of knowledge and skills among healthcare professionals providing anticoagulation services also contribute to reluctance in advising patients on the risks and complication of anticoagulant therapy [2]. One of the reasons for the patients' lack of knowledge concerning the disease process and the side-effects could be poor counseling and ineffective way of information-delivered by healthcare professionals [11].

Effective anticoagulation therapy requires systematic and coordinated patient care management by trained anticoagulation therapy providers [12]. Most healthcare providers are confident that they are well skilled in the practical aspects of management [13] but the literature suggests that many undesirable effects of therapy result from inappropriate management rather than patient non-compliance or other aberrations [8,13]. Other study also justified the inadequacy of antimicrobial warfarin interaction knowledge as it showed high incidence of co-prescribing, which carry excess bleeding risk [14]. Counseling patients with respect to their anticoagulant treatment is vital and significantly improves patient's knowledge and quality of anticoagulation [15]. Healthcare providers should counsel patients on need for frequent INR monitoring, common sign and symptoms of adverse drug events, precautionary measures to decrease trauma or bleeding, what to do if they miss dose(s), about potential drugs, herbals, food (vitamin K enrich diet) and alcohol interaction is also essential for better therapeutic outcome [1].

The time and resource constraints of healthcare providers have the potential impact upon the availability and the quality of education provided. Sufficient time between the patients and the health care providers in the clinic is essential to reveal and solve therapy related problems. However, busy clinics may not allow time for proper counseling [16]. In addition, communication challenges may also be one of the foremost barriers to delivering optimal anticoagulation management in settings.

Materials and Methods

The study was carried out at Tikur Anbessa Specialized Hospital (TASH) (A Tertiary Care Teaching Hospital) located at Addis Ababa, Ethiopia. TASH is selected for this study as it is the main center in the country in which warfarin is prescribed and dispensed to different patients which have or at risk of developing thromboembolism by wide range of health care providers. A cross-sectional survey was conducted, from April 20th to May 4th 2015, at TASH. Both quantitative and qualitative methods were employed in the data collection process using self-administered questionnaires completed by physicians and pharmacists who were working in the Internal and Emergency Medicine Departments and all Pharmacy Services of the hospital.

All physicians who were working different emergency and internal medicine departments and all pharmacists who were engaged in the different pharmacy units of TASH at time of data collection were considered to be eligible for this study. All other healthcare professionals and all other physicians who were working in other departments of TASH were excluded as they have minimum role in managing patients who need warfarin therapy. The required sample size was calculated by using a single population proportion formula and adjustment was made to the sample since the size of source population was less than 10,000 (N=285 during study period) and accordingly, 164 were enrolled in our study.

A structured self-administered questionnaire was used which was prepared based on evidence from different literatures to assess the knowledge of pharmacists and physicians and counseling practice about warfarin therapy. Each questionnaire contains 24 questions which were divided into three sections. The first section consisted of (study participants' socio-demographic questions), second section (composed of 15 questions which ask knowledge on different area of warfarin therapy). Among the total questions 6 of them were developed from different guidelines and literatures [4,17]. The remaining were adapted from standard patients' oral anticoagulant knowledge questionnaires [16,18,19] and modified as it can be suitable for health care professionals. The third section (assessment of counselling practice of healthcare professionals for patients on warfarin therapy and they were developed from published studies [20,21]. Data was collected by three volunteer pharmacists after pre-tested in 5% of study population to check for its clarity, simplicity, understand ability and coherency. Data were entered and analysed using SPSS version 16. Descriptive statistics including frequency, mean and standard deviation, percentage, mean score were used to summarize participants' socio-demographic data and to evaluate the study participants' knowledge regarding warfarin therapy. Multi factorial Analysis of Variance (ANOVA) was used to compare responses of the different groups on their level of knowledge. Ethical clearance was obtained from the ethics review committee of School of Pharmacy, College of Health Sciences, Addis Ababa University and formal letter was written to the heads of Internal and emergency medicine department and Director of pharmacy services. Participants of the study were asked for providing consent before participating in the study.

Results

Socio-demographic characteristics of the study participants

In this study, 185 pharmacists and physicians were approached for self-administered questionnaires. Out of these, 171 retuned completed questionnaire during the enrolment period of which seven were incomplete and excluded from the analysis. Finally, 164 healthcare professionals were included for analysis and socio demographic profile

Table 1: Socio-demographic profile of healthcare professionals responded to questionnaire at TASH, 2015 (N=164).

Socio-demographic Profile		N (%)
Sex	Male	117 (71.3)
	Female	47 (28.7)
Age(Years)	23-30	149 (90.9)
	31-40	12 (7.3)
	>40	3 (1.8)
	Pharmacist (clinical)	28 (17.1)
	Pharmacist	29 (17.7)
	Internal medicine resident	54 (32.9)
	Emergency medicine resident	15 (9.1)
	Others*	5 (3)
Total Year(s) of experience	<1	42 (25.6)
	1-5	101 (61.6)
	5-10	17 (10.4)
	>10	4 (2.4)
Current working department	Internal Medicine Department	99 (60.4)
	Emergency Medicine Department	32 (19.5)
	OPD/Selling Pharmacy	15 (9.1)
	Drug and Supply Management	7 (4.3)
	Oncology Pharmacy Services	3 (1.8)
	Others**	8 (4.9)

OPD: Outpatient Department, others* include General Practitioners, specialists and consultants, and others** include Intensive Care Unit (ICU) pharmacy, pediatrics clinical pharmacy and ward pharmacy

of the study participants was shown in Table 1. Out of 164 participants enrolled in the study, 71.3% were male and the mean age was 27.50+3.79.

Healthcare professionals' knowledge about warfarin

Among 164 study participants, there was no one who gave correct answers to all questions. The highest correct score obtained by more than 90% of healthcare professionals were for questions asked on: Pharmacological category of warfarin, condition for which patients should go immediately to emergency room, INR value above the target range interpretation and duration of warfarin treatment. The lowest scores were for knowledge on target INR range for different warfarin indications and question on drug which potentially increase warfarin effect in which only 34 (20.7%) and 16 (9.8%) of our participants gave correct answer respectively. In this study out of 15 questions the mean total score was 9.98 (SD=1.67) (Table 2).

Table 2: Healthcare professionals knowledge about warfarin therapy among those who were working at TASH, 2015 (N=164).

Questions Description	Correct Answer N (%)	Incorrect Answer N (%)
1. Pharmacological category of warfarin	160 (97.6)	4 (2.4)
2. Best time of the day to take warfarin for patients	116 (70.1)	48 (29.9)
3. When should the patient go directly to emergency room?	153 (93.3)	11 (6.7)
4. What action should be taken if a patient missed dose?	135 (82.3)	29 (17.7)
5. Which is not major risk factor for warfarin bleeding complications?	107 (65.2)	57 (34.8)
6. INR checking frequency after stable dose of warfarin	88 (53.7)	76 (46.3)
7. Target INR mismatches with the indication of warfarin	34 (20.7)	130 (79.3)
8. INR value above the goal range Interpretation	149 (90.9)	15 (9.1)
9. Effect of eating large amount of leafy green vegetables on warfarin	124 (75.6)	40 (24.4)
10. Drug which potentially increase warfarin effect	16 (9.8)	148 (90.2)
11. Effect of chronic alcohol consumption on warfarin	63 (38.4)	101 (61.6)
12. Duration of warfarin therapy after initiation	156 (95.1)	8 (4.9)
13. Drug which potentially decrease warfarin effect	110 (67.1)	54 (32.9)
14. Reversal of excessive bleeding with INR> 5	91 (55.5)	73 (44.5)
15. Risky activity for patients while taking warfarin	135 (82.3)	29 (17.7)

Study participants' knowledge comparison on warfarin

Table 3 shows the total score (mean+SD) and the knowledge comparison among pharmacists, interns and residents. Overall residents showed significantly higher knowledge ($p<0.05$) than pharmacists but not significantly ($p=0.696$) different with interns.

Table 3: Comparison of study participants' knowledge on warfarin among three groups.

Total score	Pharmacists score (n=57)	Intern score (n=33)	Resident score (n=69)
Mean + SD	9.45+1.63	10.06+1.49	10.35+1.77
Mean score %	63%	67.1%	69%
p-value	Pharmacists *vs.* interns 0.227	Residents *vs.* interns 0.696	Residents *vs.* Pharmacists 0.009
p value<0.05 is significant, vs.: versus			

Healthcare providers' counselling practice on warfarin therapy

As described on Table 4, among the total study participants, 101 (61.6%) and nearly 30% of them responded as they provide counselling service for all patients on warfarin and only for new patients who are going to start warfarin therapy o, respectively.

Table 4: Healthcare professionals' counselling practice for patients who are taking warfarin therapy in TASH, 2015 (N=164).

Counselling Practice	N (%)
1. I provide counselling only for patient who requested me	8(4.9)
2. I provide counselling only for new patients	48(29.30
3. I provide counselling for all patients	101(61.6)
4. I didn't counsel because I assume someone did/will provide counselling	3(1.8)
5. I didn't counsel because of work load	7(4.3)
The percentage couldn't add up to hundred as one might choose more than one options	

Condition affecting healthcare professionals' counselling practice on warfarin therapy

When asked about situation that could affect their counselling practices, the participants stated that among the listed, insufficient time to counsel, poor counselling environment predominantly affect 54.3% and 32.9% of study participants respectively. Language barrier (21.3%), lack of counselling aids (7.9%), lack of enough knowledge on warfarin (7.3%) and poor counselling (4.9%) were mentioned by respondents as other reasons which influence their counselling practice for patients on warfarin in the studied hospital.

Concerning the open ended question (counselling tips for patients receiving warfarin) only 91 (55.5%) of the respondents mentioned their counselling tips to be given for patients who need warfarin therapy. Out of these, most of the respondents stated that informing patients their disease condition, importance of INR regular monitoring

and possible side effects of warfarin are among counselling tips to be provided to the patients. Some of them mentioned as they will tell their patients about interaction between warfarin and (vitamin K containing foods, drug and alcohol); and importance of adherence to their treatment.

On question asked about health care professionals perception on the adequacy of current counselling practice on warfarin and their recommendation in case of inadequacy, only less than half (47.5%) of study participants gave their opinion. Accordingly, the various ways to improve awareness/counselling regarding warfarin therapy suggested were: giving up-to-date trainings for health professionals, proper facilitation of counselling room, creating better communication mechanisms between counsellors and patients and improving awareness about the disease.

Discussion

This study was undertaken to identify healthcare professionals" knowledge and areas which have knowledge gaps about warfarin among healthcare professionals. Furthermore, it was also tried in this study to assess healthcare professionals counselling practice and conditions which could affect their counselling service for patients receiving warfarin at TASH.

Experts recommended that patients who are receiving warfarin therapy should limit their daily variations in vitamin K consumption, as increased intake can precipitate abnormal clotting and/or warfarin-resistance [22,23]. Previous studies reported that as there was knowledge gap of the healthcare team with regard to warfarin-nutrient interactions which can lead to disruption in anticoagulant outcomes [8,24,25]. The finding of our study also showed that only 75.6% of the respondents answered correctly on the effect of taking large amount of leafy green vegetables (which are enrich with vitamin K), on warfarin. 82.3% of study participants answered correctly as the patients should only take the next scheduled dose on the knowledge assessment questionnaire. Patients should take their missed warfarin dose as soon as they remembered but, they should not take if it has been more not the same day (>12 h) since missed dose [26].

One of the challenges in warfarin therapy is to obtain stable therapeutic outcome as it potentially interacts with a lot of drug which could increase or decrease warfarin effect if patients received them with warfarin. In our study, on two questions asked on drugs potentially interact with warfarin, 9.8% and 67.1% of study participants gave correct answers as cimetidine increases and carbamazepine decreases warfarin effect respectively. However, in this study it is difficult to conclude their overall knowledge on warfarin drug interaction because only two questions were provided even though warfarin interacts with different drugs [4,27,28]. Anyways, physicians and pharmacists should give special attention when prescribing and dispensing warfarin together with other drugs. Regarding alcohol and warfarin interaction, only 38.4% of our responders knew that being chronic consumer of alcohol decrease the effect of warfarin [4].

As America College of Chest Physicians (ACCP) guideline explained, optimal therapeutic INR range and duration of anticoagulation therapy varies with patient health status and disease condition [4]. Our study participants had good knowledge on 'the risk of the INR value reading above the target range', as 90.9% of them replied correctly these patients are at increased risk of bleeding from their warfarin therapy. However, their overall response to the question asked on target INR for different indications of warfarin was not adequate as correct answer was obtained by only 20.7% health care professionals. ACCP and British Society of Hematology guidelines recommend the correct target INR ranges that should be for all warfarin indications [4,29]. The clinicians should have better knowledge on this area as the therapeutic INR is narrow and related directly to the adequacy of the therapeutic control.

On present study 55% of pharmacists and physicians provided correct answer regarding action to be taken if patients on warfarin developed major bleeding with immediate determined INR>5 come to emergency room of the hospital. The result was similar with study done on emergency room doctors' knowledge about oral anticoagulants and its management by Borlina et al. which showed half of them answered correctly [9] omitting 1-2 dose of warfarin and providing vitamin K and fresh frozen plasma [30,31] is the correct answer. This question was delivered to all of study participants irrespective of their profession as pharmacists who are involved in dispensing and clinical pharmacy services in the hospital should know where to refer these patients and what types of information they should provide to the patients before they reach to emergency room. In addition, they may have a role in preparing warfarin reversal drugs.

On this assessment only nearly above half of (53.7%) of the study participants provided correct answer on "how often INR value should be checked for new patients on stable dose of warfarin for two to three weeks". ACCP and American Heart Association recommended that INR should be monitored at an interval of no longer than every four weeks for new patients on stable dose of warfarin [4,32]. Regarding to question asked on best time of the day to take warfarin, 70.7% of our responders gave correct answer. Even though it can be taken at any time, the best time of the day to take daily warfarin dose is in the evening [33] as most patients check their INR reading at morning i.e., to decrease the influence of drug on laboratory result if patients took it before INR determination in the morning.

In general, when the overall mean score was compared between the three groups (Table 3), relatively residents have better knowledge than interns and pharmacists and significantly different (p=0.009) with pharmacists but was not significant (p=0.696) with interns. The interns fell between the pharmacists and residents; however, their knowledge was not significantly different from either groups (p=0.696) and (p=0.227). The difference is may be due to as the residents have better clinical knowledge than other study groups and also the questions were mainly based on the overall patients' management. The knowledge between groups showed residents have better score on warfarin-drug interaction than other groups (interns and pharmacists). This finding is contrasting to the previous study that revealed pharmacists scored significantly higher on this part [34]. Those which are frequently missed questions (target INR ranges for each indication, warfarin drug interaction, warfarin reversal, INR monitoring frequency, effect alcohol consumption on warfarin) indicate potential areas for improvement in healthcare professionals" education.

Effective patient counselling/education regarding their medications is an essential component of medication safety because it improves patients' knowledge of their disease and how to manage their drug therapy [35,36]. It is difficult to be sure, what our participants said about their counselling practice is truly what they do. However, 61% of the respondents give counselling for all patients and 29.3% give only for new ones. In the review it was found that provision of warfarin education and information in hospital settings were inadequate [15]. On the other study, physicians explore their challenges on counselling

practices including; constraint of time, language and cultural barriers, guideline adherence and information overload for patients during initial consultation [37]. Our respondents also raised time constrains, language barrier and poor conducive environment as the main counselling challenges which affect their daily counselling practice regarding warfarin therapy. Quality of information given to patients by physicians, sufficient time for counselling and health providers communication skills are crucial points in improving education to patients.

This study attempted to approach healthcare personnel who are frequently prescribe and dispense warfarin for the patients in TASH. However, the study has some limitations. The first challenge was some study participants were reluctant to complete the questionnaire and it limited our sample size. The second limitation was busy and unmonitored environment, work load on healthcare professionals and rotation based service in the hospital which limited the expected study participants to be included in the survey and also contributed to inconsistent data collection process. To solve this, we tried to collect most of the data through different techniques like approaching them in the morning sessions.

Conclusion and Recommendations

The knowledge of healthcare professionals regarding warfarin therapy was inadequate at TASH especially on their knowledge on target INR range for warfarin indications; and question on drug which potentially increase warfarin effect. The time constraint of healthcare professionals which have the potential impact on education/counselling provision are real and often cited as a major barrier to patient education in the busy treatment setting. Additional trainings are essential to improve their knowledge on warfarin therapy which could promote appropriate patient counselling and better therapeutic outcomes. As recommendation, the pharmacy unit being with other concerned departments in the hospital shall prepare counselling tips that should be given to the patients on warfarin therapy.

Acknowledgment

We would like to express our gratitude to the study participants and data collectors. We also awe our deepest gratitude for the Heads of Internal and Emergency departments and Director, Pharmacy Service Directorate of TASH for facilitating the data collection process. We haven't received any fund for this study.

References

1. Jaffer A, Bragg L (2003) Practical tips for warfarin dosing and monitoring. Cleve Clin J Med 70: 361-371.
2. Yahaya AHM, Hassali MA, Awaisu A, Shafie AA (2009) Factors associated with warfarin therapy and anticoagulation control among patients attending warfarin clinic in Malaysia. J Clin Diagn Res 3: 1663-1670.
3. Teles JS, Fukuda EY, Feder D (2012) Warfarin: pharmacological profile and drug interactions with antidepressants. Einstein (Sao Paulo) 10: 110-115.
4. Ageno WS. Gallus A, Wittkowsky A, Crowther M, Hylek E, et al. (2012) Oral Anticoagulant Therapy: Antithrombotic Therapy and Prevention of Thrombosis (9th edn.). American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest 141: 44-88.
5. Haines ST, Witt DM, Nutescu EA (2008) Venous Thrombosis. In Dipiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM, eds. Pharmacotherapy A Pathophysiologic Approach (7th edn.). New York, Mc Graw Hill Medical pp: 364-404.
6. Wittkowsky A, Nutescu EA (2009) Thrombosis. In Anne KM, Yee YL, Alldredge BK.; Corelli R L, Joseph GB, Kradjan WA, Williams BR. Applied Therapeutics: The Clinical Use of Drugs (9th edn.). Lippincott Williams & Wilkins 15: 2-36.
7. Wells PS, Holbrook AM, Crowther NR, Hirsh J (1994) Interactions of warfarin with drugs and food. Ann Intern Med 121: 676-683.
8. Couris RR, Tataronis GR, Dallal GE, Blumberg JB, Dwyer JT (2013) Assessment of healthcare professional's knowledge about warfarin-vitamin K drug-nutrient interactions. J Am Coll Nutr 19: 439-445.
9. Borlina LP, Cavalcanti EL, Ghislandic C, Ribas Timi JR (2010) Emergency-room doctors' knowledge about oral anticoagulants and its management. J Vasc Bras 9: 24-28.
10. Schilling J, Kaatz S, Hudson M, Krol G, Szandzik EG, et al. (2011) Clinical and safety impact of an inpatient pharmacist directed anticoagulation service. J Hosp Med 6: 322-328.
11. Nadar S, Begum N, Kaur B, Sandhu S, Lip GY (2003) Patients' understanding of anticoagulant therapy in a multiethnic population. J R Soc Med 96: 175-179.
12. Cabral KP, Ansell J, Hylek EM (2011) Future directions of stroke prevention in atrial fibrillation: the potential impact of novel anticoagulants and stroke risk stratification. J Thromb Haemost 9: 441-449.
13. Kakkar N, Kaur R (2004) Knowledge base of clinicians regarding oral anticoagulant therapy in a teaching institution a questionnaire survey. J Assoc Physicians India 52: 868-872.
14. Lane MA, Devine ST, McDonald JR (2012) High-risk antimicrobial prescriptions among ambulatory patients on warfarin. J Clin Pharm Ther 37: 157-160.
15. Kagansky N, Knobler H, Rimon E, Ozer Z, Levy S (2004) Safety of anticoagulation therapy in well-informed older patients. Arch Intern Med 164: 2044-2050.
16. Khudair IF, Hanssens YI (2010) Evaluation of patients' knowledge on warfarin in outpatients anticoagulation clinics in a teaching hospital in Qatar. Saudi J 31: 672-677.
17. (2012) Orlando Regional Medical Center. Warfarin Reversal Guideline.
18. Baker WJ, Kristi L, Pierce LK, Ryals AS (2011) INR Goal Attainment and Oral Anticoagulation Knowledge of Patients Enrolled in an Anticoagulation Clinic in a Veterans Affairs Medical Center. J Manag Care Pharm 17: 133-142.
19. Assefa T, Gedif T, Bekele A(2014) Evaluation of Patients' Knowledge on Warfarin Therapy Among Outpatients Receiving Warfarin at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia. Ethiop Pharm J 30: 133-138.
20. Stafford L, Van Tienen EC, Bereznicki LR, Peterson GM (2012) The benefits of pharmacist-delivered warfarin education in the home. Int J Pharm Pract 20: 384-389.
21. Collins S, Barber A, Sahm JL (2014) Pharmacist's Counseling Improves Patient Knowledge Regarding Warfarin, Irrespective of Health Literacy Level. Pharmacy 2: 114-123.
22. http://www.ashp.org/doclibrary/bookstore/p2548/sample
23. Wysowski DK, Nourjah P, Swartz L (2007) Bleeding complications with warfarin use: a prevalent adverse effect resulting in regulatory action. Arch Intern Med 167: 1414-1419.
24. Lasswell AB, DeForge BR, Sobal J, Muncie HL, Michocki R (1995) Family medicine residents' knowledge and attitudes about drug nutrient interactions. J Am Coll Nutr 14: 137-143.
25. Couris R, Tatarouis G, McCloskey W, Oertel L, Dallal G, et.al. (2006) Diatery Vitamin K Variability Affects International Normalized Ratio [INR] Coagulation Indices. Int J Vitam Nutr Res 76: 65-74.
26. Bajorek BV (2011) A review of the safety of anticoagulants in older people using the medicines management pathway: weighing the benefits against the risks. Ther Adv Drug Saf 2: 45-58.

27. Lindh JD, Andersson ML, Mannheimer B (2014) Adherence to guidelines for avoiding drug interactions associated with warfarin-a Nationwide Swedish Register Study. PLoS One 9: e97388.
28. Miller AM, Boro MS, Korman NE, Davoren JB (2011) Provider and pharmacist responses to warfarin drug-drug interaction alerts: a study of healthcare downstream of CPOE alerts. J Am Med Inform Assoc 18: 45-50.
29. Kealing D, Baglin T, Tait C, Watson H, Perry D, et al. (2004) Guidelines on oral anticoagulation with warfarin. British Journal of Hematology.
30. Hanley JP (2004) Warfarin reversal. J Clin Pathol 57: 1132-1139.
31. Hirsh J, Fuster V, Ansell J, Halperin JL (2003) American Heart Association/American College of Cardiology Foundation Guide to Warfarin Therapy. Circulation 107:1692-1711.
32. http://www.eyemouthmedicalpractice.co.uk/guides/warfarin.pdf
33. Benni JM, Jayanthi MK, Tubaki BR, Renuka M (2012) Knowledge and awareness of food and drug interaction (FDI): a survey among health care professionals. Int J Pharmacol Clin Sci 1: 97-105.
34. The American Society of Health-System Pharmacists (2005) Warfarin: Medline Plus Drug Information.
35. Nasser S, Mullan J, Bajorek B (2012) Educating patients about warfarin therapy using information technology: A survey on healthcare professionals' perspectives. Pharma Pract 10: 97-104.
36. Borg Xuereb C, Shaw RL, Lane DA (2012) Patients' and health professionals' views and experiences of atrial fibrillation and oral-anticoagulant therapy: a qualitative meta-synthesis. Patient Educ Couns 88: 330-337.
37. Nasser S, Mullan J, Bajorek B (2012) Challenges of older patients' knowledge about warfarin therapy. J Prim Care Commun Health 3: 65-74.