

# Key components to consider when developing an anticoagulation clinic - a pharmacy teaching and training approach: Literature review

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## Abstract

**Objective:** This review aims to highlight the key components and procedures pertaining to the development and implementation of anticoagulation clinic through education and training.

**Method:** Two reviewers independently searched the MEDLINE, EMBASE and Google Scholar databases using relevant terms. Data extracted included information regarding anticoagulation clinic setting and implementation, anticoagulation therapy management, pharmacy education, training, competences teaching, healthcare professional teaching and training, study design, content source, time and personnel involved educational strategy, and measures of knowledge and pharmacist's competencies.

**Results:** A total of 84 articles were ultimately used for data extraction. Fifty-two articles adequately described features of the anticoagulation therapy management. While some papers emphasized the impact of the pharmacist-managed anticoagulation clinic, others highlighted the competencies of the clinical pharmacist, healthcare professionals teaching and training programs and offered information about the importance of anticoagulation educational certification.

**Conclusion:** Anticoagulation therapy, although potentially life-saving, has inherent risks. Establishing special clinical pharmacist competencies is important to achieve effective anticoagulation therapy outcomes. The clinical competencies are maintained and further developed through practice, continued professional development and formalised education and training. This review addresses important issues for the establishment of an anticoagulation clinic. It highlights the key components to consider before developing a high quality standard anticoagulation clinic from a pharmacy teaching and training approach.

**Keywords:** *Anticoagulation clinic, anticoagulation system setting, clinical pharmacist, key components, pharmacy education, teaching, training*

## Introduction

Anticoagulation is a high risk treatment, which commonly leads to adverse drug events due to the complexity of dosing these medications, monitoring their effects, and ensuring patient adherence with outpatient therapy. The use of standardised practices that include patient involvement can reduce the risk of adverse drug events associated with the use of heparin (unfractionated), low molecular weight heparin (LMWH), warfarin, and other anticoagulants (ACCP, 2008).

Keeping patients on oral anticoagulants within a narrow therapeutic range requires expert dose management. Due to the intensity and the sensitivity of the management required, anticoagulation clinics have been mainly developed to precisely manage patients to keep their relevant anticoagulation index within the narrow therapeutic range and to avoid adverse event (Testa *et al.*, 2012). Centralised specialty clinics with expertise in anticoagulation have demonstrated improvements in quality of care, improved

patient adherence and reduced complications compared with routine management (Harold *et al.*, 2007; Ryan *et al.*, 2008). However, estimates suggest that less than 50% of patients in the US who receive oral anticoagulants are managed by such clinics (Ansell & Hughes, 1996).

Nevertheless, establishment of an anticoagulation clinic requires careful planning, development of high quality standards and procedures, with input from local consultants, while recognizing the barriers which exist to developing such a service. This review provides an overview of factors that affect the development and implementation of anticoagulation clinic based on education and training approach, and to illustrate the development of the clinical pharmacy services.

Based on assessing the quality of the inpatient Pharmacist-Directed Anticoagulation Service (PDAS) implemented in our institution, this review was also conducted in order to discuss a perspective implementation's project of an outpatient anticoagulation clinic.

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## Method

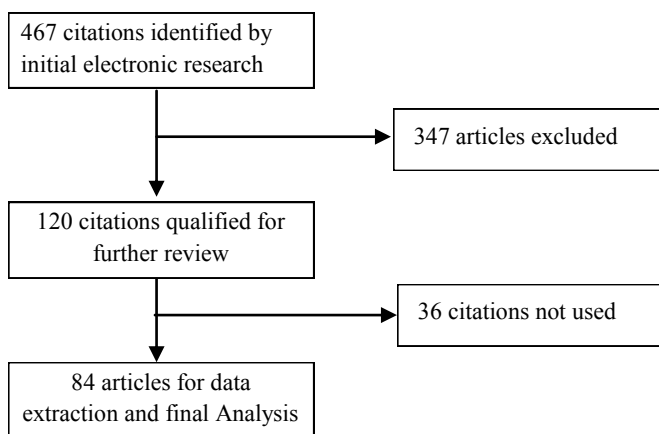
A review of the medical literature was undertaken using MEDLINE, EMBASE, Google Scholar database and international Pharmaceutical Abstracts with the following terms: warfarin, anticoagulation, dosing, clinic, management, education, implementation, patient education, pharmacist, healthcare professional, competencies, teaching and training with search dates January 1994 to June 2012. Some pertinent articles published in English were retrieved. We used the related articles links in PubMed and searched the references of identified citations for additional original articles.

We sought articles that (a) were original research studies or descriptions of anticoagulation clinic implementation and setting programs that included information on the educational content and strategy related to anticoagulation with warfarin and (b) contained instruments that measured patient knowledge, pharmacy education, training, and certification or (c) assessed and evaluated the concepts of teaching and training for clinical competencies for pharmacist and healthcare professionals. Exclusion criteria included studies unrelated to anticoagulation clinic implementation, pharmacy teaching and training, any study which were lacking original data.

An initial search identified 467 citations. Two reviewers (GAB, CN) reviewed titles and available abstracts to determine relevance to the stated objectives of identifying (1) the optimal strategies for a clinic and setting implementation content (therapy management availability, accessibility, anticoagulation clinic equipment requirements), and (2) the optimal strategies for measuring the clinical Outcome (team composition, patient education, pharmacist knowledge and competencies, Pharmacy education, certification and licensure).

Three-hundred and forty-seven citations were initially excluded because the articles were judged to be irrelevant or there was no abstract available (Figure 1). After exclusions, a total of 120 were qualified for further review and analysis. Upon further review, an additional 36 articles were excluded for inadequate anticoagulation clinic implementation program or for pharmacy competencies teaching and training programme; ultimately 84 articles were selected for final data extraction and analysis (Figure 1). Data were extracted on clinical setting, study design; group size, content source, time, personnel and equipment involved.

**Figure 1: Search Strategy flow**



## Results

### 1. Anticoagulation Clinic

#### 1.1 Definition

The Anticoagulation Clinic is a service established to monitor and manage the medication(s) that prevent blood clots. Physically, it is a specified location within a hospital or a medical office that is staffed by clinical pharmacists. The clinical pharmacists, working in conjunction with a physician and other health care providers, check blood tests and adjust the warfarin dose (Coumadin® or Jantoven®) as well as other medicines that may be needed (such as heparin shots or Vitamin K, the antidote to Coumadin). Clinics manage parenteral anticoagulants in certain settings (e.g. acute therapy, bridging therapy, or in the rare instance of a patient unable to take warfarin), but warfarin management is the core activity of such clinics (Ansell, *et al.*, 2005).

#### 1.2 The need of an anticoagulation therapy

Anticoagulants are commonly used for both the treatment and prevention of cardiac disease, cerebral vascular accident, and thromboembolism in both the inpatient and outpatient setting. Their use or misuse carries a significant potential for patient harm. Sub-therapeutic levels can increase the risk of thromboembolic complications while supra-therapeutic levels can increase the risk of bleeding complications. Anticoagulants have been implicated in adverse drug events due to many factors such as complexity of dosing and monitoring, patient compliance, and numerous drugs-to-drug and drug-to-food interactions. The demand for anticoagulation services is increasing, particularly in the elderly population. This is largely attributed to an increasing number of medical conditions requiring long-term anticoagulation (Fitzmaurice *et al.*, 1996).

#### 1.3 Goals of anticoagulation clinic

The Anticoagulation Clinic (ACC) is designed to help patients manage their anticoagulation medications. The Key elements of warfarin management are summarised in the acronym **DEEARS**: (1) Determine indication and duration of therapy; (2) Establish a therapeutic range; (3) Educate the patient (and other healthcare providers); (4) Assess compliance with regimen; (5) Review medications, co-morbidities, and diet; and (6) Screen for recurrence of thrombosis or bleeding events (Macik, 2003). Readily available monitoring and an organized system for patient tracking are invaluable tools to help the provider. Often, the most difficult task is assuring prompt communication and access to acute intervention for the patient (Testa *et al.*, 2006; Macik, 2003; Witt *et al.*, 2005; Viercinski *et al.*, 2008; Ansell *et al.*, 1997).

### 2. Support and facilities required for an anticoagulation system

Support and facilities are some of the factors to consider when developing an anticoagulation system. These keys components may vary according to the desired service and to the composition of the health care team, based on the needs of the setting. Some studies emphasised that basic requirements for an standard anticoagulation therapy clinic may include the

following: Education mentoring support and clinical network facilities (e.g. Clinical Laboratory and all its necessary equipment); access to educational material - clinical reference databases; Access to relevant infection control support and guidance (e.g. for finger prick tests, Hepatitis B vaccination, hand washing); access to advice from healthcare scientists or quality assurance specialists relating to standards and maintenance of testing equipment; anticoagulant treatment record form and booklet; coagulometers; computer software for automated drug prescription (Coleman *et al.*, 2003; Sheehan *et al.*, 2000).

The work of Oertel and Mungall (2005) in the area of software applications in anticoagulation management reveals much about the accuracy of document systems in managing oral anticoagulation therapy. Accurate and easily accessible documentation systems can be used so that information pertinent to anticoagulation therapy can be retrieved in a timely fashion. It may also be possible to adapt existing computer software applications to meet anticoagulation monitoring needs or to use paper forms. In their paper on perceived software applications in anticoagulation management, Oertel *et al.*, (2005) state that “optimal anticoagulation therapy tracking system for a given healthcare environment should be dictated by factors such as the number of patients being monitored and existing information technology resources.” In agreement to their findings, in most settings, computerized anticoagulation tracking applications offer increased efficiency (Oertel *et al.*, 2005).

### 3. Anticoagulation healthcare team

#### 3.1 Team Composition

Health professionals are almost always required to work in teams to provide comprehensive, continuing and quality healthcare (Olupeliyawa *et al.*, 2009). Teamwork has become an integral component of planning processes in health care organization (David *et al.*, 2006). In their paper, David *et al.*, state that “one important element is the team’s composition that must suit the needs and unique characteristic of the organization”. Optimized anticoagulant therapy should be provided by a multidisciplinary working team of healthcare professionals practicing in a patient-oriented field (e.g. medicine, nursing, pharmacy, clinical laboratory, nutrition, information technology) possessing core competencies related to anticoagulation therapy (Adam *et al.*, 2012). Collaboration, within and between healthcare teams, facilitate effective healthcare (Simin *et al.*, 2010). Garcia *et al.* (2008) identified these core competencies as: education in a clinical field; training in patient assessment and care; and licensure in a patient-oriented healthcare field. In light of the criteria of the team member selection, the Joint Commission on Accreditation of Healthcare Organizations in its Planning Strategies for an Anticoagulation Therapy Program (2008) stated that the team member selection should be driven by a number of important factors, including organization size and type, kind of staff members, staff expertise and competencies in anticoagulation therapy, the level of resources available, and the organization’s experiences with anticoagulation therapy.

Based on the medical literature search and Google scholar database, during the past few years, the expression

“pharmacist-managed anticoagulation clinics” has been one of the most used key words or terms whenever the setting of an anticoagulation clinic is discussed. This suggests that the clinical pharmacist has an important role to play. Further to understanding the outcomes of his/her clinical input, the pharmacist should master the key clinical roles in pharmaceutical care and highlight the competencies he/she is required to have in order to carry out clinical responsibilities.

#### 3.2 Pharmacist: a special component of the anticoagulation team

Pharmacists are recognized as medication experts who improve overall patient care through partnering with physicians (Leape *et al.*, 1999). The value for pharmacist-managed anticoagulation clinics has been clearly established in the pharmacy literature (Gray *et al.*, 2007; Poon *et al.*, 2007). Pharmacist-led anticoagulation services are valuable, safe and superior to standard care (Bungard *et al.*, 2009; Dager *et al.*, 2000). In their paper, Gray *et al.* (2007) performed “a cost-benefit evaluation of a clinical pharmacist-managed anticoagulation clinic (AC)”. Their findings reported that clinical pharmacist-managed AC was effective in maintaining therapeutic prothrombin times, and reducing the incidence of hospitalization resulting from anticoagulation complications. The concept of the value for pharmacist-managed anticoagulation clinics has been also reported in another study conducted by Poon, *et al.* (2007). In that study, these authors compared warfarin therapy prescribed and monitored by physicians to a pharmacist-monitored anticoagulation service in a cohort of elderly American war veterans. With a study population of 1521 patients, Pool *et al.* (2007) found that pharmacist-monitored anticoagulation was associated with reduced thromboembolic events. Improved patient outcomes, including reduced hospital admissions for preventable embolism, bleeding, or treatment of thrombosis are well documented (Garwood *et al.*, 2008; Locke *et al.*, 2005). In their study conducted on patients’ transition from a pharmacist-managed anticoagulation clinic after stabilisation of warfarin therapy to physician-managed care, Garwood *et al.* found a significant decrease in International Normalised Ratio (INR) control, associated with a decreased patient satisfaction. Locke *et al.* reported:

*“at 6 months after discontinuation of the pharmacist-managed anticoagulation service, the frequency of adverse events increased significantly, resulting in both an increased number of hospitalizations and an increased number of hospital days accrued.”*

The American College of Clinical Pharmacy (ACCP, 2008) in its definition of clinical pharmacy had explicitly stated that the clinical pharmacist cares for patients in all health care settings emphasizes two points: (1) That clinical pharmacists provide care to their patients (*i.e.* they don’t just provide clinical services); and (2) that this practice can occur in any practice setting. The clinical pharmacist’s application of evidence and evolving sciences suggests that clinical pharmacy is a scientifically rooted discipline; the application of legal, ethical, social, cultural, and economic principles serves to remind that clinical pharmacy practice also takes into account societal factors that extend beyond science (Phillips *et al.*, 2007; Bond *et al.*, 2004; Dager *et al.*, 2007).

By stating that clinical pharmacists assume responsibility and accountability for achieving therapeutic goals, the statement: “clinical pharmacist cares for patients in all health care settings” makes it clear that they are called upon to be more than consultants (ACCP, 2008).

#### 4. Pharmacy Education

Pharmacists are the third largest healthcare professional group in the world, behind physician and nurse. Acknowledging that health care needs can vary across geography and culture, an international group of key stakeholders in pharmacy education and global health has reached unanimous agreement that pharmacy education must be quality-driven and directed towards societal health care needs (Anderson *et al.*, 2009). The education of student pharmacists is shifting to meet the envisioned and evolving role of the pharmacy profession (APhA, 2007). The education and training of pharmacists involves a demanding training designed to produce pharmacists who have abilities, skills and competencies that are necessary to achieve outcomes related to providing pharmaceutical care to patients, developing and managing medication distribution and control systems, running a pharmacy, promoting public health and providing drug information, and patient education and counseling.

Table I emphasises some important requirements related to pharmacy education and training in some countries (adapted from WHO/UNESCO/IFP, 2009).

#### 5. The Pharmacist's competencies

A World Health Organization (WHO) consultative group on the role of the Pharmacist (WHO, 1997) agreed and reported that contemporary and future pharmacists must possess specific knowledge, attitudes, skills and behaviors in support of their role. According to the WHO, the clinical pharmacist is a primary source of scientifically valid information and advice regarding the safe, appropriate, and cost-effective use of medications (WHO, 1997). Establishing specific clinical pharmacist competencies is important to achieve the outcomes listed previously. However clinical pharmacists maintain and further develop competence through practice, continuing professional development and formalised education and training.

##### 5.1 Clinical Problem Solving, Judgment, and Decision Making

The appropriate, efficacious, safe and cost-effective use of resources should be the foundation of pharmacist's work (WHO/IFP, 2006). A combination of comprehensive therapeutic knowledge, experience, problem-solving skills, and judgment is necessary in order to be a competent clinical pharmacist. Clinical problem solving and decision making are the processes by which patient-specific data are collected, interpreted, and analyzed, medical problems are assessed, current drug therapy is evaluated, and therapeutic plans are developed. These processes are critical to optimizing

**Table 1: Requirements related to pharmacists training and education – Selected Countries**

Requirements	US	UK	France	Germany	Australia	Canada	Singapore
<b>Previous Undergraduate Degree required</b>	No, but generally 2 years of undergraduate coursework	No	No	No	No	No	No
<b>Years of Pharmacy School</b>	4	4	6-9	4	4 (bachelor's); 2 (accelerated Master's)	5 (Bachelor's) 7 (PharmD)	4
<b>Degree Title</b>	PharmD	MPharm	PharmD	BPharm	BPharm MPharm	B.Sc. Pharm PharmD	B.Sc.Pharm
<b>Clinical/Residency Training</b>	Clinical training during study; optional post-grad residencies and fellowship	Optional 1-4 weeks during study; 1 year post-grad	1-4 years during study, depending on path	1 year during the study	1 year post study	16 weeks during study; 4 months post-grad; optional 1 year residency	12 weeks during study; 1 year post-grad
<b>Specialty Training</b>	Optional	Optional	Optional (by exam, extended program)	N/A	N/A	Optional	Optional
<b>Licensing/Certification/Registration/</b>	National Exams	National Exams	National Exams	National Exams	National Exams	National Exams	National Exams
<b>Re-licensing requirements</b>	Requirements vary by state	Process under development for 2012			Annual, Requirements vary	Annual (fee)	Every two years
<b>Continuing Education required for renewal?</b>	Generally vary by state	Link to revalidation process in 2012	Policy in development	No	No	Mandatory program but limited enforcement	Mandatory for re-licensure
<b>Prescribing authority</b>	Limited	Yes	No (Except emergency contraception)		Limited	Limited to full, depending on province	No

**BPharm:** Bachelor of Pharmacy; **MPharm:** Master of Pharmacy; **PharmD:** Doctor of Pharmacy; **B.Sc.Pharm:** Bachelor of Science in Pharmacy; **N/A:** No available

medication therapy (Burke *et al.*, 2008). In their paper, Burke and co-authors stated that: “*clinical pharmacists must be able to identify patient problems, implement and manage patient pharmacotherapy, dispense and administer medications as needed, educate patients, monitor drug therapy, and consult with other patient care providers to improve patient outcomes*”. Hence clinical pharmacists cannot only focus on medications but must take into account all patient-specific medical problems as well (Burke *et al.*, 2008)

### 5.2 Communication, patient education and counseling

The ability to effectively communicate with and educate patients and health care professionals is integral to ensuring optimal patient outcomes (Burke *et al.*, 2008). As with other abilities, communication is developed and refined throughout a pharmacist’s career. The pharmacist is in an ideal position to provide a link between prescriber and patient, and to communicate information on health and medicines to the public (WHO/IFP, 2006). Communicating with patients and other health professionals about a particular issue at the appropriate level of complexity can be challenging, and pharmacists must be aware of barriers to effective communication. Because effective communication and education are so fundamental to the provision of patient care, it is imperative that these abilities be well developed (Burke *et al.*, 2008). The pharmacist has the responsibility to assist with education and training of future generations of pharmacists and the public (WHO/IFP, 2006). By doing so, it offers an opportunity to the pharmacist to gain new knowledge and to fine-tune existing skills.

Patient education is the “*process of influencing patient behavior and producing changes in knowledge, attitudes, and skills necessary to maintain or improve health*” (AAFP, 2000). Patient education has long been thought to be useful for patients receiving long-term anticoagulation. Lack of patient education can be an important predisposing factor of non-adherence to prescription medication instructions because understanding and recall of medication instructions depend on getting accurate information in the first place (Ngoh, 2009). Providing patients with complete, accurate and current information helps create an atmosphere of trust, enhances the pharmacist-patient relationship and empowers patients to participate in their own health care. Patient education and counseling should be provided longitudinally throughout the entire patient hospital stay and even after discharge via follow up visit. Patient education and counseling should take place in an environment conducive to the patient involving learning and acceptance—one that supports pharmacists’ efforts to establish caring relationship with patients (ASHP, 1997).

Because patient education and counseling is time consuming for clinicians and overwhelming for patients, education of the anticoagulated patient is often neglected (Wofford *et al.*, 2008). Published reports of patient education related to warfarin anticoagulation vary greatly in strategy, content, and patient testing, but prioritizing the educational domains, standardizing the educational content, and delivering the content more efficiently will be necessary to quality of anticoagulation with warfarin (Wofford *et al.*, 2008). In patient education and counseling, emphasising information or instructions is frequently necessary because it is not possible to accurately predict which instructional intervention will yield the desired learning by a particular patient (Idiagboff-

Prince *et al.*, 2010). In most instances, follow up reinforcement and re-teaching are needed over time, particularly for patients who are undergoing lifelong therapy.

### 5.3 Medical information evaluation and management

Clinical pharmacists must be effective managers of resources and information (Burke *et al.*, 2008). Providing quality patient care requires a knowledge base that is continuously expanding and being updated. A clinical pharmacist must be able to identify situations beyond his or her own expertise or that require new information to reach a decision. This necessitates carefully defining the question and using a variety of information sources to derive the answer (Burke *et al.*, 2008). New information is then incorporated into the existing knowledge base and is integrated with prior clinical experiences to help develop sound clinical judgment. However, more and more information and its related technology will provide challenges as clinical pharmacists assume greater responsibility (WHO/IFP, 2006).

### 5.4 Management of patient population

Many clinical pharmacists not only are involved in providing care to individual patients, but work within a health system or other organization to develop protocols and critical pathways that optimize the care of patient populations. These efforts may include analyzing drug utilization evaluations, composing protocols for disease state management, and developing organizational policies and procedures that improve patient care and resource utilization (Dobesh *et al.*, 2006; Burke *et al.*, 2008; ASHP, 2004).

### 5.5 Therapeutic knowledge

Clinical pharmacists must possess a therapeutic knowledge base of sufficient breadth and depth to effectively promote rational medication use (Burke *et al.*, 2008). In general, to be considered as clinical pharmacist, they must be sufficiently knowledgeable about the diseases and principles to effectively assess and treat the problems in the patient population they provide healthcare (Burke *et al.*, 2008). It is important to emphasize that a clinical pharmacist must be competent in the therapeutic management of the many disease states that may affect a given patient, not simply those currently identified as active problems (Burke *et al.*, 2008). Clinical pharmacists possess in-depth knowledge of medications that is integrated with a foundation of understanding of the biomedical, pharmaceutical, sociobehavioral, and clinical sciences (ACCP, 2008). To optimize a patient’s therapy, the clinical pharmacist must be able to identify and solve new problems as they arise (Burke *et al.*, 2008). Changes and advances in medicine will require periodic re-evaluation and modification of therapeutic knowledge areas.

## 6. Competencies: Teaching, training and assessment for healthcare professionals involved in the management of antithrombotic therapy.

### 6.1 Teaching and training

In their paper, Garcia and colleagues (2008) emphasised that healthcare professionals involved in the management of

antithrombotic therapy should be educated in a clinical discipline, trained in patient assessment and care, and licensed in patient-oriented healthcare field. Collaboration among healthcare professionals is key to positive patient outcomes for an optimized anticoagulant therapy (Adam *et al.*, 2012). Each member of the healthcare team has been trained with specific knowledge and skills, which allow them to do what they do best. Coming together as a team will bring specific strengths of each discipline to focus on the care of the patient and supplement any weaknesses of other teammates (Allen *et al.*, 2006). Several papers have described and positively evaluated the types of clinical services provided by young pharmacists and pharmacy students (Slaughter *et al.*, 1994; Briceland *et al.*, 1992; Brockmiller *et al.*, 1999). Pharmacist-led anticoagulation services are valuable, safe, and superior to standard care (Bungard *et al.*, 2009). To reach such a high standard and effective clinical pharmacist-led anticoagulation clinics, it requires well educated and trained clinical pharmacists.

Building on prior definitions (ABIM, 1999; Norman, 1985; ACGME, 2000), Epstein & Hundert (2002) proposed that professional competence builds on foundation of basic clinical skills, scientific knowledge and moral development. Education and training programs for pharmacists have evolved for over the time in response to ongoing advances in medicine and technology (APhA, 2008). The educational requirements have resulted in a continuum of learning for pharmacists defined by the need for lifelong learning to assure the public that licensed pharmacists maintain and update their professional competencies (APhA, 2008). Education on the theoretical and pharmaceutical aspects of anticoagulation is a fundamental requirement for all patients on anticoagulation therapy (Ansell *et al.*, 2005). In the international consensus guidelines prepared by the International Self-Monitoring Association for Oral Anticoagulation, Ansell and co-authors emphasized that: *“education and training infrastructures will develop differently in each country, depending on local circumstances. However, it requires the development of resources to train the trainers, as well as the patients”* (Ansell *et al.*, 2005).

There are a variety of teaching and training programmes. They may include web-based electronic educational module, and/or patient education webinar (Bungard *et al.*, 2009; Clot Connect, 2012; NPSA, 2009). Continuing education (CE) programs are used to maintain and increase knowledge and fulfill requirements for certification and licensure (Rouse, 2004). The condensed continuing professional development (CPD) which is described as *“ongoing, self-directed, structured, outcomes-focused cycle of learning and personal improvement”* (Rouse, 2004) and consists of a 2-hour home study and 3-hour active learning session, is an effective and efficient way to train healthcare professionals (Tofade *et al.*, 2010). Regular training for clinical staff is essential to ensure that safety solutions are embedded within an organisation’s culture (NPSA, 2009).

## 6.2 Clinical competencies and performance assessment tools

Assessing clinical competences and performances includes objective (such as written exams, independent patient encounters, simulated patients) and subjective methods (such as attending clinical summary evaluation) (Davis *et al.*, 2007). Assessment tools for clinical competence include the Objective Structure Clinical Examination (OSCE) called also the Practical Assessment of Clinical Examination skills

(PACES) or the Clinical Skill Assessment (CSA), the Objective Long Case Examination Record (OSLER), the Objective Structured Assessment of Technical Skills (OSATS), the 360-degree evaluations and the Readiness for Interprofessional learning Scale (RIPLS) (Boursicot *et al.*, 2010; Mickelson *et al.*, 2008; Simin *et al.*, 2010). Clinical performances are often assessed using tools such as the Workplace based assessments (WPBA) that include a mini Clinical Evaluation eXercise (min CEX), Direct Observation of Procedural Skills (DOPS), Case-based discussion (CbD)/Chart Stimulated Recall (CSR) and the Mini Peer Assessment Tool (Mini-PAT). (Boursicot *et al.*, 2010; Mickelson *et al.*, 2008; Simin *et al.*, 2010).

All these assessment tools can be used in assessing competencies in the anticoagulant setting. There is data available showing good reliability, validity, acceptability and educational impact of these various assessment tools (Mickelson *et al.*, 2008; Berk, 2009; Jannett *et al.*, 1995; Pell, *et al.*, 2010).

## 7. Certification and Licensure for Anticoagulation Care

Healthcare professionals involved in the management of antithrombotic therapy should be educated in a clinical discipline, trained in patient assessment and care, and licensed in a patient-oriented healthcare field. Certification in the field of pharmacy and especially for anticoagulation care providers is a way to demonstrate advanced knowledge and skills above and beyond a degree programme or licensure. In the United States, the National Certification Board of Anticoagulation Providers (NCBAP) has the mission to improve the quality of patient care through recognition and promotion of specialized knowledge and skills pertaining to antithrombotic therapy (NCBAP, 2011). NCBAP endorses voluntary certification of anticoagulation providers who meet education and patient-care requirements (NCBAP, 2011). To be eligible to sit for the Certified Anticoagulation Care Provider (CACP) exam, a candidate should meet requirements which are: Professional qualification (holding a professional license for a minimum 2 years prior to the application deadline) and Professional experience (the applicant must provide documentation of a minimum of 750 hours of active anticoagulation patient management in the 18months immediately preceding the application deadline) (NCBAP, 2011). A clinic that has a healthcare team where most of the providers possess an anticoagulation therapy certification may reflect a clinic with a high quality standard of care, but at the same time affording this kind of certification depends on the setting and capacity issues. Only the National Certification Board confers the Certified Anticoagulation Care Provider (CACP) credential for Anticoagulation Providers, which is required to recertify by examination five years (NCBAP, 2011). Pharmacists who have a specialty board certification are considered clinical pharmacists specialists (Carmichael *et al.*, 1997) and clinical pharmacists as certified anticoagulation care providers may take positions that empower them to function in a capacity of anticoagulation clinics setting (Alsuwaidan *et al.*, 1998).

Nevertheless certified pharmacists have clearly demonstrated their ability to identify, resolve and prevent drug therapy problems in a specialized area of practice. Therefore, anticoagulation certification can be very rewarding on both a professional and personal level by nationally recognizing and validating anticoagulation providers who fulfill certification requirements.

## Conclusion

Anticoagulation services can provide safe and effective management of short-term and long-term warfarin therapy for the prevention and treatment of thrombosis.

Whether a patient is managed in a solo practice or a specialised anticoagulation management service, a systematic approach to the key elements may reduce the likelihood of adverse events. While the opportunity to establish Anticoagulation Clinic Services (ACS) exists in many global regions, establishing these services may seem daunting and risky to both healthcare professionals and administrators. It is important to consider essential components while developing an anticoagulation system. Anticoagulation clinics should be run by healthcare professionals who are committed and clinically competent to provide quality clinical and patient educational services that are timely and responsive to the needs of the patients.

However establishment of an anticoagulation service requires careful planning, development of high quality standards and procedures, with input from local consultants, while recognizing the barriers which exist to developing such a service. The literature reported that there are four main challenges summarised in implementation of Anticoagulation services: (1) Evaluating the organization's need to establish such a service; (2) Identifying the stakeholders (they need to see the justification for funding such a service); (3) Recruiting the right personnel to run the service; and (4) Continuously seeking new talent and service opportunities throughout the health care organization (Joedell *et al.*, 2008). Clinical competencies are important to achieve effective anticoagulation therapy outcomes. The clinical competencies are maintained and further developed through practice, continued professional development and formalised education and training. Assessing clinical competencies and performances through reliable and effective assessments tools or methods remain a key aspect to evaluate the clinical abilities and skills and to achieve high standard anticoagulation therapy outcomes.

The need for continued research to validate optimal practices for managing anticoagulation therapy is acknowledged.

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## Conflict of Interest

The authors declare there is no conflict of Interest.

## Authors' Contributions

GAB designed the research, prepared the manuscript, performed the research, analysed, interpreted the data and revised the manuscript. CN performed the research and interpreted the data. GWE contributed in the design of the research. YF contributed in the design of the research. All authors read and approved the final manuscript.

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