Doing things differently: Changing Treatment Paradigms in Patient Flow through a Healthcare System.

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CCHSE Fellowship Project

Special Projects Option

September 2010

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Key Messages for decision makers/leaders

1. Primary care practitioners manage the largest number of patients in the health care system and act as both ‘gatekeepers’ to avoid unnecessary overuse of limited resources and filters to identify patients that require referral for specialist care .
2. ‘Specialist’ or ‘referral’ services in health care systems are usually provided by hospital based caregivers that practice in their own ‘silos’ of clinical interest.
3. Communication channels and processes of care that span the interface between primary care and the secondary/tertiary care referral systems remain poorly developed. Patients are often left hanging between the sectors, or end up being sent inappropriately to emergency departments to access non-emergency care.
4. Processes that move patients through different facets and levels of the medical system safely, efficiently and cost-effectively should be developed and can with a minimum of added cost.
5. Interventions related to improving patient transitions must be multipronged and tailored to stakeholder groups with specific emphasis on change management and sustainability strategies.
6. Involvement of stakeholders during planning and intervention phases is critical for success.
7. Development of simple ‘just in time’ responses contribute to success and ensuring that key stakeholders remain on board through implementation ups and downs.
8. There is significant value in having ‘outsiders’ such as an industrial engineer who view the issues/concerns with a different lens and provide solutions outside the realm of the usual approaches of clinical teams.

9. Utilizing an evidence informed approach has positive learning spin offs for all members of the team. Learning together strengthens teams and contributes positively to the success of initiatives.
10. Success of initiatives involving clinicians must take into consideration remuneration throughout the process as it is difficult to sustain 'volunteerism' over the life of a project spanning several months.
11. Administrators can utilize the template demonstrated using a specific clinical scenario to guide their interventions to improve the transition of patients between health care levels.

Executive Summary

Lines of communication and processes of care that span the interface between different sectors of our health care system remain poorly developed. Perhaps the most glaring 'chasm' between sectors exists between the primary care arena and that of the secondary/tertiary 'referral' segments of the system. Primary Care Practitioners or Family Physicians (FPs) manage by far the largest numbers of patients in the system and are responsible to a large extent, for identifying patients that require services that need to be provided at a secondary care level, and for facilitating the receipt thereof. Very frequently, however, when it comes to this, FPs have very little support when trying to achieve this in a timely and appropriate manner. The result of this breakdown in the flow of patients into the referral sectors is that FP's and their patients encounter numerous obstacles to achieving care. In many cases, FPs, in the belief that this is the only avenue for their patients to enter the post-primary system, simply send the patient to the Emergency Department (ED). This practice ties up emergency resources with non-emergency issues, creating congestion and longer waits for emergency patients and frustration for all involved.

That the process of primary care needs to be reformed has been acknowledged at numerous levels and by several authorities. Primary care is, by definition, an extremely wide discipline in terms of scope, and efforts to address its isolation from the rest of the health care system have been slow and frustrating. This paper presents a template for system administrators to use when implementing changes designed to span the gap between health care levels.

The method chosen to address the issue, with the direct objective of demonstrating that such fragmentation need not be accepted, was to choose a particular clinical scenario that demonstrates the primary-secondary chasm to show how a process of care can indeed perform across the border between sectors, smoothly, safely and cost effectively.

To effectively accomplish this, the clinical scenario chosen needed to be:

1) one in which fragmentation of management is obviously detrimental to achieving optimal care,
2) Common enough that the current stakeholders in management notice an improvement in process,
3) Not so common that process improvement attempts are drowned under the weight of heavy patient loads.

This project report describes, using as an example the management of suspected DVT, the process of establishing novel ways to conduct patient care through the continuum from the family physician's office through the hospital based arena and back, using a different paradigm of care and different caregivers, to deliver care that is appropriate, efficient, and associated with improved patient and caregiver satisfaction.

The group stuck to the philosophy that in any radical shift in the paradigm of care provision, attention to proven change management and sustainability techniques is as, if not more important than the intervention itself, and these are discussed in detail.

Using a combination of an appraisal of current clinical evidence, focus groups and structured interviews with relevant stakeholders, a process was designed and implemented whereby the investigation and management of the condition has been streamlined, with improved wait times and more efficient and coordinated processes of care.

A review on the published literature on change management both within and without health care led to the establishment of an unambiguous and firm change management strategy which was employed to direct the implementation of the process to stakeholders. The strategy framework used to guide the project was based on the methodology described by the Clinical Practice Improvement Unit of the Northern Sydney Central Coast Health in New South Wales, Australia, which includes the use of the Plan, Do Study, Act (PDSA) concept to continue to develop the initiative as opposed to expecting to have the perfect plan at the time of initial introduction. In addition to hospital clinicians and administrators, the team employed an industrial engineer with specific training and experience in process development and design.

A process design based on current evidence was made easily accessible that allows the smooth movement of appropriate patients through the health care system. The clinical example demonstrated a template that can be used to develop patient care processes for other clinical presentations (requiring multidisciplinary care) that will be managed by FPs from their community practice.

The development template includes the following aspects that can be applied by clinical leaders and administrators to improve care for similar clinical presentations:

- Literature review methodology.
- Pathway development.
- The exploration of untapped capacity in the system.

- Multi level introduction strategies, tailored specifically to each stakeholder group in the process with particular emphasis in developing and demonstrating a specific advantage of the intervention to each group.
- Aggressive use of the PDSA cycle, with timely feedback to all concerned.
- Sustainability strategies.

Outcomes

Changes in the process started as soon as the pilot phase was introduced, both in response to stakeholder suggestions and with recognition of unanticipated barriers to successful implementation ('unanticipated changes' had been anticipated, and were responded to as soon as identified). Posters graphically illustrating how to use the process were displayed in prominent places, and stakeholders that had not been identified in the pre-release phase were recruited to the implementation team.

Problems encountered were addressed as soon as possible, and wherever possible after consulting the literature to find proven strategies to address each of them. The process was well received by enough stakeholders to make it work, and gradually more stakeholders 'came on board'. The pilot project was expanded by offering the process algorithm and referral option to the remaining family physicians in the Capital Health district, and is now considered 'standard of care'. Indications from the relevant clinics, diagnostic imaging department and family physicians are that the project has been a success and has improved the process with reference to the investigation and management of DVT. The success of the project has also opened the minds of

caregivers to the potential effectiveness of quality improvement initiatives in improving patient care.

Further indicators of success include 88.9% of patients processed by the pathway reporting being 'satisfied' or 'very satisfied' by their care, 95% of emergency physicians and 89% of advanced care paramedics reporting that the system was worthwhile and improved patient care and a rating of 8.99 out of a perfect rating of 10, from surveyed FPs. Length of stay for patients referred to the emergency department for DVT management decreased by 94.57 minutes from the period before introduction of the process of care. Referrals to the appropriate clinic increased by 14.2%, with an increase in the proportion of the most suitable referrals. No reduction in the use of compression ultrasound was noted.

Ongoing influence of the project in health care delivery

Using the lessons learned from this project, and the template developed, we have already developed and are using similar tools to help further bridge the gap between primary and secondary care, after identifying other clinical presentations where patient care can be improved by the use of a coordinated, facilitated interdisciplinary model of care soft tissue infections potentially requiring intravenous therapy, migraine headaches and open wounds. . This project represents the first step taken in an ongoing development of a 'toolkit' that will guide both community-based and hospital-based caregivers as to how a number of such situations can be managed within the existing system, according to similarly developed care processes.

Success with this project has resulted directly in the assumption of a new approach to the delivery of emergency care in our institution. The use of allied healthcare providers, such as

Advanced care paramedics (ACPs) has become an accepted practice in our institution, to the extent that an extra ACP position has been created in the new Charles V Keating Emergency and Trauma Centre that is dedicated to the facilitated management of patients, similar to those used in the above clinical scenario, that initially require neither emergency nurse nor physician management. In summary, the use of this approach, guided by the template developed will enable both clinical leaders and administrators to generate the ability to process patients efficiently, cost effectively and safely across the gaps between different levels in the health care system.

Context

The primary care arena in the early 21st century can be an administration nightmare. With the consolidation of hospitals and dramatic closures of hospital beds, primary care has inherited much of the load previously carried by inpatient medicine, while essentially being shut out from providing in-hospital care. (Pham, Grossman, Cohen, & Bodenheimer, 2008; Pringle, Levitt, Horsburgh, Wilson, & Whittaker, 2000) In virtually all cases the gap between primary and secondary care has paradoxically widened. A recurring issue with efficient patient care is that of poorly developed lines of communication between primary and secondary care and non existence of processes of care that span the interface between these two sectors of the health care system.(Sisler & McCormack-Speak, 2009) Family physicians (FPs) complain of isolation and the absence of support when trying to facilitate the management of patients that need the services of secondary care in a timely and appropriate manner. Patients find themselves 'suspended' in the 'no-man's land' between their family physician's offices and the hospitals, waiting for answers that no-one seem able to answer.

Primary care practitioners, or Family physicians (FPs) manage by far the largest numbers of patients in the system and act, to a large extent, as 'gatekeepers' to regulate the use of the more expensive and scarce post-primary services.(Grumbach et al., 1999b; Marinker, 1988a) By the same token they are responsible to a large extent, for identifying patients that require these services, and for facilitating the receipt thereof.(Grumbach et al., 1999a) In many cases FPs have very little support when trying to achieve this in a timely and appropriate manner.(Baron, 2009) From their perspective, publicly funded health care administrators tend to be based in hospitals, concerned with the smooth functioning of those large and interconnected 'machines', akin to mechanics trying to repair a huge engine while it is running at full steam. FPs usually have the responsibility to 'administrate' their practices themselves, and often feel that they and their concerns are beyond the 'system's' administrators area of interest.

This isolation of primary care providers has resulted in the evolution of practice patterns, (and thus resource utilization) that vary widely between both FPs and their consultants.(Coulter, 1998a; Eisenberg, 2002; O'Donnell, 2000; Stange & Ferrer, 2009)

This state of affairs has resulted in numerous problems, including overuse or inappropriate use of medical technology, prolonged patient waits, repeat referrals to different consultants to try to get the patient seen sooner, and the situation where FPs, in the belief that this is the only avenue for their patients, simply sending the patient without 'emergency' requirements to the emergency department (ED). This latter practice is inefficient, frequently non-productive, and leads to inappropriate blockage of beds in overcrowded EDs by 'non-emergency' patients, and consequently prolonged ED waits for patients with emergencies.(Shesser, Kirsch, Smith, & Hirsch, 1991) Their perception of isolation from the rest of the system and frustration by their not being given access to tests and services that would allow them to manage their patients has led to disenfranchisement of the community-based Family Physician sector (Somerset, Faulkner, Shaw, Dunn, & Sharp, 1999a) resulting in job dissatisfaction and disbelief that the hospital based sector of the system cares about FP patients.(Bodenheimer, 2006; Krasner et al., 2009)

In, The Emergency Department, things are not much better. The reduction in numbers of inpatient beds and the consequent greater dependence on outpatient care, has led to a predictably increased use of emergency services for when the latter fails; nursing and physician shortages present an increasing burden, and nowhere is patient care more impacted by hospital overcrowding,(Derlet & Richards, 2000) as admitted patients back up onto the emergency department when there are no inpatient beds to admit them to.(Olshaker & Rathlev, 2006)

Examination of existing processes of care at referral centres', shows that care is to a large part provided in discrete 'silos', where the caregivers, who specialize in a particular body part or disease process manage their loads in a linear pattern with little room for dynamic adjustments to meet urgent or unexpected needs.(Herbert, 2005) Patients enter these silos by a single 'front

door', one behind the other, with a process of faxed referral, and then wait passively for an appointment to be allocated with little input from the consumer. From the perspective of those accessing the referrals, it seems that this state of affairs has evolved more to meet the interests of the caregivers than the consumers of the care. Following consultation, patients wait while 'reports' are sent back to the FP who also waits passively, with little involvement in the process that goes on once the patient has left his or her office. In the Canadian context, the referral centers are very busy with long waits for elective consultation (Sanmartin et al., 2000) leaving very little incentive for caregivers to attract new patients to their heavy loads.

That the process of primary care needs to be reformed has been acknowledged at numerous levels and by several authorities. (Eccles, Deverill, McColl, & Richardson, 1996a; Franks, Nutting, & Clancy, 1993; Kvamme, Olesen, & Samuelson, 2001c) Primary care is, by definition, an extremely wide discipline in terms of scope, and efforts to address its isolation from the rest of the health care system have been slow and frustrating.(Eccles, Deverill, McColl, & Richardson, 1996b; Kasje, Denig, de Graeff, & Haaijer-Ruskamp, 2004)

Problem statement

Plainly speaking, the problem incorporates: the deficiency of processes of care that facilitate transition between levels of care, the absence of communication with and support of community-based caregivers, and the resulting inappropriate use of existing emergency resources to perform primary care activities or to attempt access to secondary services. Care practices, in both primary and secondary care are un-standardized, and occur in a 'stuttering', inefficient and disorganized manner. They have, however, been entrenched by years of use, and efforts to change these require intensive strategies to deal with change resistance.

Approach

My position as project leader of the primary-secondary care initiative (and my EXTRA intervention project) involved an investigation into the scope, depth and causes of the problems of communication and access barriers between the primary and secondary care arenas of our health care district, with the goal of rectifying them. The ultimate goal of the broad project was the erasure of the chasms between different levels or sectors in the health care system. One critical aspect was the development of processes whereby patients could smoothly navigate the different steps required in many directions through the organization in a safe, efficient and cost-effective manner. These processes need to be continually developed, as well as accepted and understood by all participants. They should be accessible, in such a way that makes it easier and advantageous for all stakeholders to use them, and they need ultimately to work to improve patient care.

Methodology

At the time of commissioning of this project, the context of primary-secondary relationship intervention was complicated by the fact that, although there were over 300 FPs in the district, they were an extremely heterogeneous group with different practice sizes, populations served, ranges of services offered and technological capabilities. Furthermore, there was no

representative body who could speak for the FPs as a group, and, in fact there was an amount of animosity between different subsections of the FP community, delineated by such boundaries as academic vs. community practice, full- vs. part-time, or those that provided after hours or obstetric services vs. those that did not.

After informal consultation with senior administrators who dealt with primary care practitioners at an organizational level, I identified FP's who were considered to have an interest in quality improvement, as well as being respected and influential members of the primary care community. Considering the variation in practice environments in primary care, representation from FPs from different types of clinic, and in different parts of the district was given special consideration. Those identified were invited to form the core group of the 'Primary-secondary committee' (PSC). Recruitment of individual FPs was made difficult by a degree of frustration expressed that many previous attempts to address issues of the primary-secondary interface had received little more than 'lip service' and going to meetings had historically not been seen as a good use of their time. In addition to an assurance of our commitment to ensure that this would not be the case in this project, we decided to compensate for the loss of earnings that busy FP's would incur from leaving their clinics to attend meetings, and to reinforce their sense of commitment to the project, by offering an honorarium for time spent on the project, equivalent to what they would earn in their regular line of work. Seven of ten FPs approached agreed to serve on the committee.

To this group of FPs was added, by invitation, 3 hospital based specialists identified as having in-depth insight and interest in issues pertaining to the primary/secondary care interface, (An internist and a radiologist (who was also the chair of the District Medical Advisory Committee). I assumed chairmanship of the committee in my capacity of project leader with the responsibility to address primary secondary care issues, but represented the perspective of the ED in my role of practicing emergency physician. Further invited members included the

administrator of the department of medicine, and the chair of primary care. The final member of the group was an industrial engineer with experience in process design, whose contribution would be to ensure that any processes designed were practical and serviceable, and had a good chance of being accepted and used.(Shortell, Rundall, & Hsu, 2007b)

The aim of the group was to develop a template that could be adapted to clinical management to:

1) Empower FPs to take control of the management of their patients, strengthening the doctor-patient relationship, and increasing work satisfaction.
2) Make the process of care across the primary-secondary interface less intimidating, cumbersome and inconvenient for patients.
3) Help patients participate in their care.
4) Maximize unused potential in the system by expanding the roles of allied health professionals in the provision of comprehensive health care.
5) Save money by reducing unnecessary testing and hospital admission.
6) Pave the way for a broader mechanism to improve the primary-secondary care interface.

These objectives addressed one of the core goals of our health district, that of strengthening primary care, and of improving the transition of patients through the system.

Although concerns regarding the primary-secondary interface had been voiced for some time (Coulter, 1998b; Kvamme, Olesen, & Samuelson, 2001b; Marinker, 1988b; Somerset, Faulkner, Shaw, Dunn, & Sharp, 1999b) it was clear that we needed to objectively evaluate the prevailing attitude of the primary care community toward the issue. We sought opinions in several ways; email and written letter surveys, small focus groups at primary care meetings and the solicitation of comments at the regional family medicine update conference. Individually, the FP members of the PSC, were asked to conduct further focus groups and enquiries with members

of their practice and to identify specific examples of issues that we might address as a first step in tackling the process.

The PSC determined to design and trial a template that could be used to create processes that would facilitate management of issues for which the progression of care spans the interface between primary and secondary care. We decided to select a specific clinical issue to demonstrate an evidence-based way of introducing such a change into a system with multiple discrete and independent ways of handling patients. The clinical issue needed to be primarily representative of the interface problem between the different sectors of the health care system in that the detriment to achieving optimal care that results from fragmentation of management was indisputable. The issue also needed to be of sufficient interest to staff that the impact of the process would be appreciated by the stakeholders involved, and common enough that the process could be trialed and adjusted in a reasonable timeframe. We realized, however, that the issue chosen should not be so common that continuous quality improvement attempts might be drowned under an excessive patient load.

We embarked on a process of selecting a suitable issue to use as an example, that involved brainstorming of the group, a review of complaints from FPs about the system, and focus groups conducted by the FP members of the PSC, soliciting their colleagues at their places of work for suggestions. After much discussion of the merits of each of the many suggestions received, the issue chosen unanimously by the PSC was that of the investigation and management of suspected deep vein thrombosis, the management of which had been reported to be sub-optimal in the current medical system, principally because of the chasm at the primary-secondary interface.

Clinical details of relevance to administrators regarding the processing of patients presenting with suspected DVT

DVT is a clinical condition where blood coagulates pathologically in the veins of the leg, and patients with the symptoms thereof present frequently to family doctors. Apart from the

unpleasant symptoms of acute leg swelling and pain that follow the loss of functioning veins to transport blood back to the heart, deep venous thrombi can break off as the clot propagates. Pulmonary embolus (PE), a feared complication (which occurs in 60-80% of untreated DVTs, (Shortell, Rundall, & Hsu, 2007a)can result when pieces of broken clot are carried to the lung, where they block the flow of blood into the lung, causing significant morbidity and mortality. PE is the second most common cause of sudden death in the USA, and the 30% mortality can be reduced to below 5% with anticoagulation treatment.(Scarvelis & Wells, 2006b; Schoenenberger, Pearson, Goldhaber, & Lee, 1996a; Tovey & Wyatt, 2003b) In addition to acute complications of DVT, chronic complications include chronic thrombo-embolic pulmonary hypertension (in 4% of cases) and post phlebitic Syndrome, (in 40%) a condition caused by chronic venous obstruction, with pain, redness, thickening, and even ulceration of the skin. (Scarvelis & Wells, 2006c)

Because of this, and because this complication can be largely prevented by timely treatment with anticoagulants,(Tovey & Wyatt, 2003a) rapid confirmation or exclusion of the diagnosis is vital. Making the diagnosis of DVT can be difficult.(Scarvelis & Wells, 2006a; Tovey & Wyatt, 2003c) Calf pain, the most common presentation, is very common, and is usually a result of a more benign condition. Practice patterns in management of DVT have been found to vary considerably. (Schoenenberger, Pearson, Goldhaber, & Lee, 1996b) Clinical diagnosis is notoriously unreliable, and the traditional gold standard investigation, contrast venography, is associated with a significant complication rate.(Tovey & Wyatt, 2003e) Anticoagulant therapy is itself not without risk (Sachs, Smith, Kuney, & Paxton, 2003; Zidane et al., 2000a) emphasizing the need for a firm diagnosis. The mainstay anticoagulation therapy of the condition, oral warfarin, takes about 5 days to reach therapeutic levels, requiring the use of a faster acting anticoagulant at the beginning of therapy.(Tovey & Wyatt, 2003d; Wells et al., 2003f) The therapeutic window of the traditional anticoagulants is relatively small with un-fractionated

heparin, the fast acting anticoagulant traditionally used for the first 5 days of treatment, carrying a complication rate of up to 4%. (Zidane et al., 2000b) The use of heparin requires a continuous intravenous infusion with laboratory assessment of a coagulation indices conducted several times a day to ensure that coagulation is suppressed adequately, while not too much.(Wells et al., 2003e)

The principle referral centre of the Capital Health District is the Queen Elizabeth II Health Sciences Centre, a 860 bed teaching hospital with about 70 000 emergency visits a year. Over 1200 compression ultrasounds to investigate for DVT are conducted annually, of which 14% are positive for the diagnosis. 2350 D-Dimer tests (a blood test helpful in certain cases of suspected DVT) are ordered each year at the QEII sites of Capital Health. Approximately 200 patients per year are referred to the ED specifically by primary care practitioners to have the possibility of DVT investigated. (For a more complete discussion of the clinical issues of DVT management pertinent to this intervention, See Appendix 1)

Strategic approach to the issues raised by the clinical scenario

The challenge that existed then was firstly to define the optimal care process, and to give frontline FPs the tools to make the determination of which tests to use for each particular patient, and then timely access to the appropriate tool. Then, because of the 'step-wise' sequence, we needed a process whereby each stage could be quickly and effectively facilitated at the appropriate time and place

Toward this objective, the PSC embarked on the following courses of action (with many being conducted concurrently):

- Exploration of the status quo to understand the shortcomings of the existing system.
- Appraisal of current evidence on the best service that could be delivered.
- The 'design' of a 'perfect' process, with an investigation of where this might not be possible, and if not, how we could achieve as close to perfection' as we could.

- An appraisal of the evidence to guide the behavioral change and buy-in that is required to make any change accepted, used and successful, and the creation of a clear change management/implementation strategy.
- Appraisal of methods to monitor the effect of any change, with a view to continuous improvement thereof.

Methodology and evidence review

Phase 1: Exploration of the status quo

Contemporary management of suspected DVT involves a complicated sequence of tests, the next step in the equation being determined by the results of the previous one, (Wells et al., 2003d) with each subsequent test frequently being carried out by a different medical discipline. (Appendix 2) t the time, family physicians had neither easy access to the type of tests needed, nor access to 'specialists' that were able to arrange for them. Consequently it was accepted practice to refer the patient directly to the hospital for a compression ultrasound (CUS), or to the nearest emergency department to have this organized. With regard to the former option, ultrasound departments are frequently overwhelmed by the regularly scheduled patient load and the addition of 'emergency' cases is often at the expense of scheduled patients. Only 10-15% of CUS in our institution confirm the presence of DVT, suggesting an opportunity to decrease the number of CUS requests by more accurately selecting patients.

This practice also contributes to ED overcrowding, a very current and important issue in our institution. (Derlet, 2000) Patients referred to the ED to investigate the possibility of DVT block beds in an already crowded ED, waiting to have therapeutic decisions made that could easily have been made without the use of ED resources.

To further confuse matters, the discrete specialist groups involved in the process of DVT management had developed practice patterns that frequently differed from those of colleagues in the same discipline, as well as those responsible for the step that preceded or followed theirs.

Phase 2: Determining the best clinical approach

Before introducing a new process of providing care, we had to be certain that the care being provided was of the highest quality according to contemporary medical evidence, to ensure not only safe and good care, but also to ensure buy in from the many academic caregivers that would be expected to follow the process.

To this aim, a smaller group of clinicians involved in DVT management was formed, with the task of ensuring that the process that would be delivered was in accordance with the best current medical management. This 'DVT working group' consisted of:

1. Chief of haematology (nationally renowned for his expertise in the management of venous thrombo-embolism) – to give expertise and academic legitimacy to the initiative and to advise on issues pertaining to haematology.
2. Radiologist in charge of ultrasound, to deal with issues pertaining to radiology.
3. Two family physicians, to guide development from the FP perspective.
4. An emergency physician (the author) to advise on issues pertaining to the ED.
5. The industrial engineer (also on the PSC) – to advise on the design of a flow process according to engineering principles, monitor indicators, act as project coordinator and be first contact for daytime enquiries.

After a review of the available evidence and after weighing up the options, the risks, benefits, cost and availability of each, as well as the 'political' implications of choosing one of two different scoring systems (please see appendix 2. for a discussion of the Evidence appraisal and clinical decision), this group devised a clinical pathway that included a clinical scoring

system, and an algorithm to be followed by all practitioners managing suspected DVT (in any discipline). (Appendix 3.).

The process developed by the DVT working group centered upon the following evidence based assumptions:(Wells et al., 2003c)

1. The likelihood of DVT in a patient can be objectively quantified into 'likely' and 'unlikely' categories, according to a validated scoring system, that can be made accessed by all caregivers involved in DVT management.
2. Patients in the 'unlikely' category can have the diagnosis effectively ruled out by a negative D-Dimer.
3. A negative D-Dimer is not sensitive enough to rule out DVT in patients in the 'likely' category: these will need a compression ultrasound (CUS).
4. A positive D-Dimer (>200iu) is not specific enough to make a diagnosis of DVT, it can only identify patients in the 'unlikely' category who need a CUS.
5. Patients who need a CUS, but will not get one until the next day, should receive empiric low molecular weight heparin (LMWH).
6. The majority of patients with DVT can be managed by their family doctors as outpatients.

The findings of this group, combined with those of phase 1, assured us that there was a considerable gap between what was available to FPs and their patients and what could be considered 'good care' according to current evidence. It was also clear that new strategies for DVT management exist, and that this potentially life threatening condition can be ruled in or out, and treatment initiated by FPs without deferring decision making to specialists. Our choice of topic for clinical scenario to use to study the issue had been validated!

Phase 3: The 'design' of an 'absolutely perfect' process

The findings of the DVT working group were reviewed and approved by the PSC, who then set about planning a way to make the elements of the pathway achievable in a smooth and

efficient manner. The challenge was to provide FPs with a way by which patients could access the required tests, begin the empiric treatment of undiagnosed cases, and the initiation of anticoagulation in confirmed cases (that requires daily injections for 5 days), without having to make multiple frustrating telephone calls, and without patients being subjected to long waits at the hospital.

In the 'perfect' system 'brainstormed' by the PSC, the FP could calculate the probability of DVT, carry out 'point-of-care' D-Dimer testing and give the LMWH in the consulting room, and/or refer the patient for CUS (point of care CUS in the FP office was not considered an option). If the diagnosis of DVT was confirmed, the FP would give daily LMWH injections while starting and monitoring warfarin therapy. We had to acknowledge, however, (after consultation with the Chief of Laboratory Services) that point of care D-Dimer testing was not currently available in Nova Scotia, and was not likely to become so in the near future. The FP members pointed out that, although the potential exists for FP's to give LMWH, the cost of the medication (approximately $30.00 a dose), make it unlikely to be stocked in FP's offices. Furthermore LMWH is not currently stocked in community pharmacies, and although this could be arranged, the need for subcutaneous injection (as well as the cost) makes this practically difficult.

Further brainstorming produced a loose 'working plan' plan that was considered as close to perfect as could be achieved. In this vein, it was important not to discard elements of the old system that could be usefully adapted for the new, while making sure that previous obstacles to seamless transition were removed. The new plan had to be practical and cost effective in the light of our very small budget. We maintained an open mind should our further investigations show that the new plan could be improved upon in any way, or that suggestions thereof might later prove to be impractical. We also endeavoured to follow the recommendations of Grol et al,

regarding potential impediments to the successful introduction of clinical tools.(Grol & Wensing, 2004b)

Phase 4: Creating the framework to conduct the process

Armed with the 'working plan' two members of the PSC (myself and the engineer) met with stakeholders from each discipline traditionally responsible for providing the element of the pathway to ensure that the ordering of the element was accessible to the referring caregiver, and that the result of the element would steer the patient automatically to the next step, until the conclusion of the process. In cases where the diagnosis was ruled in, and where specialist treatment or follow up was indicated, this too needed to be facilitated automatically.

With this input, the PSC examined ways to make each step in the planned process achievable, and to link each stage in the process to the one preceding or following it. The need to keep the transit between stages smooth, easy and available 24 hours a day, 7 days a week was emphasized. After much brainstorming, several areas of obstruction were identified and strategies to overcome each were devised. Potential solutions were sought in areas not previously involved with DVT management.

The first obstacle was how to ensure that any family physician who suspected DVT in a patient could calculate the diagnostic likelihood score for that particular patient without having to remember complicated detail and arrange appropriate testing from his or her office. This was achieved by making the scoring system available, in an easy to follow format, to primary caregivers. This was provided both as a web-based program, and, considering that over 40% of FPs at the time did not have internet access in their offices, as a paper based file, that was mailed to them. This information was presented in the form of a 'Family Physician Toolkit' which included a number of other pieces of information that FPs had identified as being desirable for making their day-to-day work easier.

Access to d-dimer testing and compression ultrasound, was achieved after meeting with the departments of laboratory services and diagnostic imaging. 'Solitary number' telephone contacts were given so that the appropriate tests could be obtained by a single telephone call by the FP from his/her office. For instances where the FP could not personally arrange to have the appropriate testing done him/herself a process was designed to have the tests arranged at the hospital without having to wait in the ED line up. Each service agreed to assume the responsibility of steering the patient to the next step in the algorithm, without needing to be reviewed by the referring physician at each stage.

The FP members of the PSC explained that the policy prescribing 24 hour coverage of FP practices was not consistently followed, and that patients frequently had to wait until 'office hours' to access primary care. This included patients who had presented to walk in clinics, and those for whom the results of a test might only become available after the practice had closed for the day. It was clear that the practice of sending patients to the ED (or of patients 'ending up' in the ED) was not likely to end completely, and that this eventuality needed to be considered in our intervention.

The PSC hypothesized that patients with suspected DVT who present to the hospital emergency department (ED) need not be processed like undifferentiated patients awaiting emergency care. The services required were pre-determined, and they did not need an ED bed (shortages of which are the primary reason for prolonged ED waits). If they were going to receive ED services through a process parallel to that of undifferentiated patients, it was important that this process would not lead to any delay in treating other patients who had an urgent need for ED care.

We recognized the necessity of having a relatively independent health care provider available at the hospital that could provide the elements of service needed without neglecting the needs of other patients. A review of the particular skills required to administer testing or empiric

treatment revealed that these were neither complicated, nor did they carry a significant risk of complication or adverse event. After some brainstorming, combined with a thorough investigation of potentially available health care workers in the institution, ED-based advanced care paramedics were identified as candidates that might well be able to perform this role.

ED-based Advanced Care Paramedics (ACPs) had been employed in the ED at the Halifax Infirmary site of Capital Health for over five years. Their duties include assisting with resuscitation and with the transfer of critically ill patients, applying plaster casts, and facilitating ED procedural analgesia and sedation. Their duties are not restricted to a specific group of patients, and they are frequently available to do extra work, like helping nurses with blood collection or intravenous line placement. The group was seen as enthusiastic, and adaptable, and there were many instances where they had expressed interest in expanding their traditional scope of practice. A search of the literature showed that the concept of 'Expanded Scope Paramedics' has been reported and debated previously, (Petrie, 2000; Shoup, 1995; Spaite, Criss, Valenzuela, & Meislin, 1997) although the use of paramedics in the management of venous thrombo-embolic disease had yet to be described. Another advantage presented by this group was that the number of ACPs (9 working 'full time' in the role, with 6 'part time') was far fewer than the 130 ED nurses. We felt that this made the ACP group far easier to access for educational or quality improvement initiatives than other ED caregivers. The final aspect of the ACP position that made them ideal for the role of 'DVT work-up facilitator' is their 24 hour a day availability.

A proposal to use ACPs was made to ED administrations and hospital risk management personnel, and the idea was 'floated' across influential staff members to test the reaction to the new idea. A number of objections were raised almost immediately: Risk management administrators objected to the creation of new delegated medical acts by paramedics, and emergency physicians were concerned about medico legal exposure if their orders are carried out by non-physicians without them first seeing the patients themselves. ED nurses expressed

reticence to allow paramedics to perform acts that they believe are more in the realm of nursing, and some paramedics themselves felt they are having more work and responsibility pushed onto them without an increase in salary.

We did not think that these objections outweighed the advantages posed by the ACP position, and we developed strategies to deal with each objection. This involved some serious negotiation with the administrative authorities of both the ACPs and of nursing and physician staff. Targeted verbal reassuring communications, face-to-face for the individuals more vocally objecting to the idea and gently repeated where necessary were conducted. The goal of improved patient care was emphasized, as well as one of making life easier for stakeholders. Suggestions for adjusting the proposed process were solicited from the 'objectors', and these were used wherever feasible.(Keruso H & Engelstrom Y, 2003) Hospital risk management personnel were ensured that this change in traditional ACP practice would not involve any risk to patient safety. They did, however, insist that all patients referred to the ED would need to be assessed by an EP before discharge, remaining adamant that an ACP employed by Capital health could not follow orders written by a physician without hospital privileges (as is the case with most FPs). Reassured that there was insufficient resistance to sabotage our course of action, we decided to proceed with the plan to use ACP's as facilitators of the process.

A further advantage of this concept (unrelated to the subject at hand) was that it gave our clinical scenario, and the template that would result, an example of utilization of, untapped potential in the health care system!

The final proposal for implementation was a process that achieved the following:

Using the FP tool from the toolkit available in his/her office, a FP suspecting a DVT in a patient can calculate the 'pre-test probability' of the diagnosis, determine which tests are indicated for the particular patient, and enter them into the algorithm at the appropriate spot.

Where access to various tests, treatment or follow-up varies according to time and weekday, the algorithm is designed to be able to cater for all times at which a patient could present. Accordingly, on regular working hours, patients whose Well's scores indicates them 'unlikely to have DVT', can have the diagnosis ruled out by a negative D-dimer without needing to go to the ED. Patients in the 'likely to have a DVT' category, or 'unlikely' category, but positive D-dimer, the patient can proceed directly to the ultrasound department.

For patient encounters after hours, patients referred to the ED for assessment of potential DVT are met in the waiting room by an advanced care paramedic (without having to wait to be seen by an ED nurse or physician). The ACP applies the score, and orders D-dimer or CUS as indicated by the algorithm. Patients in whom DVT is confirmed are referred by the ACP to the haematology clinic, and those in whom the diagnosis is ruled out are referred back to the FP.

If the CUS is delayed, the ACP administers the appropriate dose of LMWH and arranges for CUS the following day. These patients are followed at the DVT clinic during the week and in the ED during the weekend. This means of follow-up represents a change following a PDSA cycle of the original protocol (as discussed in the next section), in which only those with confirmed DVT were referred to the DVT clinic. Patients returning to the ED for the CUS had to return to the busier of the two sites (from a CUS point of view), experiencing longer waits, and subsequently needing to be re-registered for the ED to see the paramedic. The DVT clinic is at a site with less demand for CUS, and can easily process those with 'negative' CUS, presenting a more 'patient friendly' option.

The algorithm (appendix 3) is designed so that patients can be entered into the process at any stage in the DVT investigation, and the ED/ACP option is available 24 hours a day, so that FP's can still use this avenue during office hours.

Phase 5: An appraisal of the evidence to manage change and the creation of an implementation strategy

The memories of most hospital administrators are crowded with great plans and interventions that were introduced with great gusto, but failed to produce any sustained change in the way care is provided to patients. It was clear that the implementation strategy is as important, if not more so, than the actual process needing change.

Our first step in this regard was to search the literature for evidence that would guide the implementation strategy, firstly from the specific perspective of the administrative aspect of DVT care provision, (specifically with significant non-physician involvement in care) (Deagle, Allen, & Mani, 2005; Gorski, 2000a)and then from the generic perspective of change management.

Concerning whether a pathway/guideline might be expected to improve patient outcome, I found that in what little research does exist, findings vary noticeably.(Grimshaw & Russell, 1993a; Lefevre F, 2004; Worrall, Chaulk, & Freake, 1997b) Multidisciplinary groups have been shown to be able to work together to provide better outcomes in specific clinical contexts, (Ahmed, 2002) although only one 'before-after' comparison dealt specifically with DVT management. This study found that the introduction of an ED based multidisciplinary process for managing DVT was associated with a lower incidence of hospitalization with similar clinical outcome.(Vinson & Berman, 2001) All studies reviewed suffered from reporting bias, and concerns about generalizablity. In studies of the effect of guidelines, compliance of stakeholders appeared as a recurrent problem with no interventions consistently being shown to improve compliance, although high intensity interventions and those with the most personal contact did

tend to be more successful.(Davis & Taylor-Vaisey, 1997) We thus planned to have a high intensity ‘campaign’ to introduce the process, and used as much personal contact as possible, including identifying and meeting with champions in family practice groups who could personally encourage compliance at their regular practice meetings.

Concerning the search for guidance on change management in a distinctively multidisciplinary arena, Pub Med was found to be less productive for this search and most articles were retrieved via Ovid and, to a lesser extent, Google Scholar. One article in this vein that would prove useful in the design of our project was that by Jones, (Jones, 2006) who described some of the difficulties that he encountered with the introduction of a multidisciplinary care pathway, stressing the desire of clinicians for clear role boundaries, resistance to control over their practice by other disciplines and their unwillingness to accept plurality over roles. Rowe (Rowe, 1996) provides a good discussion of concepts that should be understood when planning multidisciplinary collaboration.

The preponderance of articles on change management in a healthcare environment came from the nursing literature, and the vast majority of articles in this field were in the ‘opinion’ or ‘anecdotal’ categories, with very little of outcome measurement or actual evidence that the proposed strategies worked.

A useful philosophical approach to our intervention was discovered in an article by Keruso and Engelstrom who described the concept of ‘productivity of resistance’. (Keruso H et al., 2003) This concept suggests that stakeholder resistance to change (often silent, and evident only in the failure to use the prescribed tools) can actually be used constructively, in that it points out areas in the intervention that are obstructive to smooth function thereof, and should be considered for ‘tweaking’ or redesign. We determined to embrace this philosophy as part of our PDSA approach, and to solicit the help of the ‘resisters’ in such adjustments.

Numerous further strategies in 'advice for managing change' articles came up repeatedly in different commentaries, adding to the strength of their individual (although not evidence-based) recommendations. These included the attention to appropriate timing, clear, honest, brief and repeated communication, timely troubleshooting, the solicitation and use of stakeholder input, and patience/realistic expectations.(2001; Beed & Howard, 1996; Boylan & Russell, 1997; Boynton & Rothman, 1995; MacDonald & Muir, 1996; MacKay L, 1993; Reid P, 2000; Skelton-Green, 1995)

We recognized that without the nurturing and support of stakeholders, the needs of patients were not likely to be maximized.(Jost, 2000) In the belief that a pathway designed to both improve care and make life easier for caregivers stands a better chance of success than those designed exclusively to improve patient care, our aim was to design, as far as possible, a process that would be easier for the stakeholders to follow than to ignore.

Being aware that, even though the role of non-physician caregivers was to be significant in the application of this initiative, physician buy in would be pivotal to the success of the project, another search sought evidence that described strategies most likely to specifically engage physicians and get them to adopt new ways of practicing. Articles in this category that proved useful included a review by the Technical Evaluating Centre in 2004 evaluating the evidence on interventions to change physician prescribing behaviour.(Lefevre F, 2004) Although this review of prospective controlled trials did not find any strategies to be universally successful, they did find that programs that included 3 or more strategies had a higher success rate than those that did not (reinforcing our decision to wage a 'high intensity campaign'). While Lefevre acknowledges the paucity of high quality randomized controlled trials in the area, and the limitations of generalizability of the results of individual trials, strategies identified included active and personalized intervention, face-to-face meetings, the use of the patient as the target of the

intervention, the targeting of 'high impact' physicians, intervening at several dimensions, and provision of feedback. (Lefevre F, 2004)

Another important fact identified regarding changing physician behaviour was the need to tailor approaches to the perspective of each stakeholder group.(Grol & Grimshaw, 2003) Thus saying, the same message might need to be communicated very differently between groups or even individuals.

A taxonomy of specific barriers and incentives to the adoption of change by physicians has been described. (Grol & Wensing, 2004c) We committed to refer to these repeatedly during the project.

Finally we looked for local evidence of success or failure with the introduction of clinical pathways. We found that the history of ED and in-hospital pathways in our district has demonstrated that compliance with new pathways and guidelines is poor - usually only between 40 and 60%, (Gorski, 2000b; Grimshaw & Russell, 1993b; Lefevre F, 2004; Worrall, Chaulk, & Freake, 1997a) although, anecdotally, greater success has followed interventions with a higher level of administrative support and buy-in. Experience with primary care driven pathways, at this stage remains limited.

Phase 6: Appraisal of methods to monitor the effect of any change, with a view to continuous improvement thereof

With regard to the evaluation, sustainability and continuous improvement of the initiative, our search of the literature included that for a structure upon which to base our intervention. By consensus, the PSC selected the 'Clinical Practice Improvement Methodology' approach described by the Northern Sydney Health (NSH) Clinical Practice Improvement Unit, in Australia.(2005b)

Although the details of this approach are delineated in full on the CPIU website, the approach entails:

1. Recognition that improvements are needed.
2. Identification of the processes of care involved.
3. Measuring the problem.
4. Identifying changes that could be made to improve outcomes.
5. Prioritizing and implementing changes using PDSA cycles.
6. Re-measurement to see if changes resulted in improvement.
7. Rolling out of successful changes across the service.

At the heart of this Clinical Practice Improvement Methodology is the use of Plan-Do-Study-Act cycles. This Quality Improvement methodology is based on the work of Nolan, Berwick, James, Shewart and other proponents of Quality Improvement, and involves the constant re-evaluation of the progress of the initiative with ongoing adjustment as unexpected opportunities to maximize the chance of success present themselves.

Introduction Strategy

To prepare for other challenges that might arise with the proposal of this initiative, the PSC considered the information gathered by the literature review and further brainstormed issues that might arise and response strategies that might be used if they arose.

These issues included anticipation that some Family physicians might see the initiative as another attempt by the 'ivory tower' to dictate practice to them, and to expect them (the FPs) to assume more work or administrative responsibilities, or make extra telephone calls with no extra pay; emergency physicians and radiologists might object to having referrals relayed to them by non-physicians; radiologists might also worry that agreeing to a process that involves 'adding' patients to booked up lists may oblige them to accept extra referrals. Finally, emergency physicians (EPs) might be concerned that making the process too easy for FPs to access may actually increase ED congestion, and take the ACPs away from their other duties. Each of these

potential issues was discussed, and for each a strategy considered that might be quickly employed if complaints were encountered.

Separate, one-page directions were developed for the ACPs (Appendix 4.), EPs and radiologists, and these and the algorithm were presented to a number of these stakeholders to determine if they found the instructions easy to follow and logical. Different clinical scenarios were presented to them to identify potential pitfalls, or cases in which patients might be inappropriately placed on the pathway. Where applicable, the findings of these exercises, and the advice of these stakeholders was used to clarify the communication tools.

Finally, the level of cynicism that exists among caregivers at all levels with quality improvement projects, which are often perceived as attempts to save money without regard to the improvement of patient care or of working conditions was born in mind. Guideline, clinical pathway, and protocol compliance and adherence in our institution have historically been abysmal without continuous and sustained administrative encouragement (policing) and support. We needed a strategy that would 'market' our initiative as different to the aforementioned guidelines, and would encourage compliance with the process.

Our aim was to design the pathway in such a way that all stakeholder caregivers and patients would gain a conspicuous advantage by using the process. The perspectives of each group were carefully examined, the input of each group into how the process should work was solicited, and the ability for any stakeholder to voice their concerns during the development and pilot phases was assured.

The advantages were clearly delineated, and communicated at meetings with all identified stakeholder groups that would be involved. At all such stakeholder meetings, the concept of 'rapid cycle improvement' was stressed. Participants were informed that the algorithm and forms used were 'works in progress' and that their feedback for improving the process would be essential to make the project a success. It was repeatedly stressed that this was not an initiative

where practice patterns would be prescribed and against which physicians could be judged as regards their competence. Physicians were reassured that they could override the suggestions of the protocol in cases where they felt that a particular patient might not be optimally served thereby.

Potential advantages for each discipline were explained as follows:

- The ***'win' for the patients*** is clear; shorter wait times, fewer steps in the process of suspected DVT management, clear education, with an enhanced ability to participate in their own care, more rapid initiation of treatment and a more rapid answer to the question of whether they have a serious condition or not. A large percentage of patients could safely avoid coming to hospital for CUS or empiric therapy, as a result of tests ordered by the FP. (Delineating the benefit to the patient was felt to be of pivotal importance, concerning the generally patient-centered attitudes of the vast majority of caregivers).
- The ***'win' for the FP*** is the ability to easily take control of the management of this clinical situation, enhancing a sense of professional empowerment and satisfaction. The process would also allow the FP to avoid having to refer up to 40% of DVT patients for secondary care.
- The ***'win' for the EP*** is that patients referred for DVT will no longer need an ED bed, nor will they need the EP's attention or decision making. Their 'responsibility' for the process in terms of their being listed as the physician in charge of the patient during the ED stage (as dictated by risk management) does mean that the patient is counted as one that they have 'processed' even with very little demand on their own time; this was seen to be a 'win' as individual EP productivity in terms of numbers of patients seen per hour is currently a quality indicator being used in the ED. Allowing the EP to access the services of the ACP for his or her own DVT patients would also take work off the EP's hands (while providing extra initial supervised 'practice' to the ACP in managing DVT patients).

- The ***'win' for the ACP*** is the potential for strengthening their role in the health care system, expanding their scope of practice, and becoming more skilled in the assessment of a particular group of patients.
- The ***'win' for the radiologist and ultrasonographer*** is the potential that 40% of CUS currently ordered in patients with a low pre-test likelihood of DVT, might no longer be ordered, decreasing the strain on the system, and making it easier to predict daily workload. The process of care for patients diagnosed with DVT by CUS was also standardized and clarified for the radiologists.
- The ***'win' for the hematologist*** is the ability to use this project to continue research efforts into the best way of managing suspected DVT. Since 1996, strategies to manage the condition have evolved, both in investigation and treatment options, and in the setting in which they are carried out. Initial studies were in hospitalized patients by hematologists, then in hematology clinics by hematologists, and then emergency departments by emergency physicians. *This course of action represents the first where the process is brought into the realm of the FP*.

A final, broader objective of the project that was communicated to all groups was that successful implementation of this process, following a PDSA, rapid cycling course of action might open up to the streamlined management of other conditions that are currently referred to hospital. This project became the first item of a dynamic and expanding 'toolkit' which the FP can use to manage a number of clinical situations that involve transitions between the primary and secondary care arenas.

We were careful to visibly acknowledge that there were potential practical problems with the process itself, which might only become evident once the process was being used. These, and the strategies we planned to use to avoid them, included:

1. Non-DVT diagnoses may not be considered in patients entered into the DVT process (e.g. deep space infection or expanding leg hematoma).

Strategies to counter alternate diagnoses being missed include:

- The provision of a 'check list' for the reference of the FP.
- A handout is given to patients to instruct them what to watch for and when to return to their FP for review.
- The ACP is given the option to consult an emergency physician (EP) in cases where he/she is concerned about the diagnosis.

2. Patients with DVTs may actually develop a pulmonary embolism between seeing the FP and arriving at the hospital.

   Strategies to counter this eventuality being missed include:

- ACPs record the patients' vital signs on arrival at the ED.
- ACPs received specific training on signs and symptoms of PE and are instructed to consult the EP if any such signs exist.
- Any patients who do not fill the requirements of the FP and ACP checklist are taken off the pathway and placed on the regular ED triage list.
- Patient handouts given out by the ACP include appropriate symptoms for patients to look for that might indicate PE, and a need for re-evaluation.

3. The new easy-access to D-dimer testing for these patients might encourage the use of D-dimer in cases where it is not indicated, increasing the empiric use of LMWH and the demand on ultrasound departments (considering the high rate of 'false positive' D-Dimers).
    - One strategy to address excessive unnecessary use of these diagnostic modalities includes an educational initiative to instruct FPs and EPs about appropriate contemporary DVT management, and monitoring of test ordering to identify any changes from usual practice.
    - A clear and simple explanation of the correct use of d-dimer was included in the 'toolkit'.
    - For all groups, a 24 hour a day 'hot line' telephone access to a member of the implementation team (described below) was provided.

The strategy for implementation included the recruitment of a pilot group of FP's that referred to the Queen Elizabeth II Health Science Centre, the largest hospital in the Capital District, with the largest infrastructure regarding the required tests and specialists for DVT management.

The pilot phase was designed as a research study, and the protocol, which included a telephone follow up of all patients treated according to the guideline 3 months after the initial visit for DVT investigation, was presented to the institutional research ethics board (REB) with a request for formal approval. Obtaining the approval of the REB was felt to perform the following functions that would contribute to the project.

1. Framing the intervention as 'research' would ensure the support of a very academic hematology group.
2. By involving the hematology research 'team' we would be able to use some of their resources to evaluate the project.
3. By making sure we have addressed the many and stringent requirements of a meticulous REB, we would be assured that we were doing the evaluation correctly.
4. REB endorsement is required by most medical journals before they will publish the results of studies. Prior REB approval would enable us to report our experience with the project.

A meeting and educational session for the ACP's was organized, with care taken to ensure the attendance of the more influential and positive members of the group. The 'pioneer' aspect of the project was stressed, and the ACP's were encouraged to see this as 'their' project, both in terms of having their input solicited and visibly incorporated, and in terms of them 'going where no paramedics had been before'. Specific strategies to harness buy-in from ACP's and to manage the potential backlash from nursing staff were developed, including a consistent understanding of the reasons why ACP's were chosen for the job, and why participating in the process was in the

benefit of the ACP group as well as patients, and, in that it would help with workload, ultimately for the RN group.

An implementation team, to report regularly (every 6 weeks) to the PSC was formed, consisting of the engineer, emergency physician (the author), and the ED ACP educator. This group planned to have regular evaluation and troubleshooting sessions. Unanticipated issues were to be addressed as soon as possible, with timely feedback to people involved.

Finally, the strategy included the enlistment of as much administrative support in the institution as possible. The District Medical Advisory Committee (DMAC) Quality Committee, which had initially sponsored the project, had been given updates on our progress at each meeting. The concept and completed progress outline was taken to the DMAC itself and Clinical Affairs Committee, with a pledge of support from each. Department chiefs in all stakeholder groups were asked to urge their members to participate where possible.

Intervention Implementation

In the weeks leading up to the 'launch date' of the process, a campaign was waged to inform as many people as possible about the process.

The chief of haematology, a national authority on DVT management, presented the concept of a primary care-driven DVT process at a local primary care conference (with a request for 'volunteers' to sign up as participant in the pilot). This was further communicated in a primary care newsletter. Further letters and telephone calls were made to recruit specific additional FPs who were felt likely to provide useful feedback.

Each of a total of 80 FP's participated in the pilot phase of the project. Each was sent a 'Toolkit' folder that included the Well's score, instructions as to how to apply the algorithm, and a patient handout. Also included in the folder were lists of all specialists and clinics available to FPs in the district, with contact numbers and any idiosyncratic referral requirements to broaden the perceived value of the folder to FP's.

Emails were sent to the ED physician and RN group describing the initiative and the logic behind it. The initiative was presented to the EPs at a monthly staff meeting. The role of the radiologist was discussed with the radiology group and posters describing the same were put up in the ultrasound reading rooms. A 24 hour contact phone number was posted in a number of areas for queries regarding the process.

The proposed start date of the initiative was to be March 1, 2006. A number of issues delayed this date, including:

- An opportunity to meet with all ACP's at the same time was difficult to organize. We felt that the importance of ensuring the attendance of influential ACPs who supported the expansion of the traditional roles of paramedics was significant enough to delay the project kick-off until after this meeting.
- Approval of the research aspect of the initiative by the institutional research ethics board (REB) took far longer than they had projected.
- Delayed arrival of the patient care forms to be used for the process. This was due to the fact that the institution was going through a change in the patient record system that mandated that all forms be reprinted to fit a new format, creating a significant back log of forms waiting to be printed.

When it appeared that the latter two issues may take some time to be resolved, and with the perception that further delay might lose momentum that had been achieved by the recent caregiver stakeholder meetings, it was decided to go ahead on 15 March, with the intention to 'sacrifice' follow-up on patients enrolled onto the pathway before REB approval for follow-up was obtained. We proceeded with forms designed and printed by the implementation committee, in the realization that the forms would likely change several times, as a result of the PDSA implementation plan. We were able to do this because of the research aspect of the project,

which allowed us to use forms designed 'specifically' for the research project. This did, however mandate duplicate data entry onto the emergency chart.

The PDSA concept was almost immediately brought into operation as unanticipated issues arose (although 'unanticipated' issues had been 'anticipated' as part of the implementation plan!) Examples of early hurdles include:

1. Unbeknownst to the implementation committee, several EP's, as a reference to the Well's criteria, had kept instructions for a DVT process from prior studies done on DVT. In addition to an outdated list of the criteria, these forms included telephone numbers that had been used for previous studies, and were different to those in current use by the haematology team. This resulted in several patients being sent to the wrong clinic for follow-up, and forms being faxed to the wrong number. A search though drawers in the ED revealed more of these forms and even an outdated DVT management poster on a pin-board in the ED was discovered. All of these were discarded, and email reminders were sent to staff entreating them to avoid using anything but the new forms.
2. It was also found that telephone numbers supplied by the haematology clinic were for a general clinic, and not for the specific DVT nurse's clinic. In fact, we only discovered after rolling out the plan that, the RN who would do most of the processing of patients referred to haematology had not been involved in the planning phase, and was understandably annoyed! This was rectified as soon as discovered, and members of the team (apologetically) met with her to solicit and incorporate her suggestions. She subsequently joined the implementation team.
3. It soon became apparent that, in spite of the ACP group all professing an understanding of how the algorithm worked, and why, several of the ACP's were unable to perform their part when the need arose. This frustrated both the EP's, who had been told that the ACP's would be 'taking care' of the process, and the ACP's who were embarrassed at being expected to do what they were still uncomfortable with. This was addressed with the ACP educator, who went into the ED

with each ACP to go over, once again, their role. EP's were asked to be patient with ACP's and to assist them in the process until they were more comfortable. 24 hour a day telephone numbers were posted, and used occasionally by ACP's to clarify process issues. The poster, discussed below, (# 5) further helped address uncertainty in the ACP group.

4. As we anticipated, there was considerable reaction from registered nurses in the ED. They felt that the ACP's were performing 'non-urgent' patient care functions that included the administration of medication (LMWH) beyond the ACP scope of practice. This was, some RN's claimed, a nursing function, and that a primary health care RN should be hired, or the existing ED liaison nurse should perform this function. This disquiet was expressed in the form of grumbling in the nurse's lounge and in a flurry of angry emails, and was addressed at a number of levels.

Emails, (cc'd to the ED head nurse, who had been consulted early in the planning stage) were answered at once explaining that:

a) ACP's were the only staff available to go into the waiting room to assess and treat patients.
b) The ED budget did not allow the hiring of a primary care RN (a topic that had been investigated previously in another context), and in any case, the volume of DVT patients was too low to hire an extra staff member specifically.
c) The system did not preclude an RN entering patients onto the pathway – RN's were free to go into the waiting room if they identified such patients, and had the time. RN's were encouraged to enter patients under their care who had not (for some reason) been enrolled in the waiting room.
d) This was a pilot project designed to help patients, and that a patient focus should be maintained. The project was evaluating ways in which to streamline patients through the system, avoiding delays where possible. Success with the project would mean expansion to other patient groups, and this might give the ED administration a case to justify the hiring of a primary care RN.

At a less formal level, specific RN's (Charge nurses, those on the Continuous Quality Improvement Committee, and the more vocal critics of the project) were met in corridors, at the workplace and in the lounge, to discuss the project and address their concerns. This latter strategy had by far the greatest impact in obtaining RN buy-in. As a result of these meetings, posters, similar to those put up for the ACPs and EPs (as discussed under '5' below), were put up in areas where the RN's could access them more easily.

5. Within a month of implementation, it was clear that many of the stakeholders still found the progression of care confusing. Numerous mishaps occurred concerning the role of ED staff, including direction to the wrong clinics at the wrong times, incorrect doses of LMWH, and the practice of waiting until the patient got into an ED bed before starting the process. To clarify the process, a large color poster (3 feet x 4 feet) was posted in a prominent spot in the ED that demonstrated the process in the form of an algorithm with a text box at the end of each arrow, explaining exactly what to do with a patient that had reached the particular point, including tests to be performed, medication to be administered, and where the patient should be sent, complete with telephone and fax numbers and physical directions for patients. Staff were encouraged to write directly on the poster any feedback or suggestions. The poster was reviewed regularly, and was revised over 20 times (usually within 24 hours of the suggestions being posted).

   This very visible application of the PDSA principle not only helped us continually clarify the algorithm, but, by visibly incorporating the suggestions of the caregivers, it created a further sense of ownership in the project by the caregivers themselves. This maintained interest and fostered buy-in. A similar (although smaller) poster demonstrating the process from the perspective of the radiologist was made, and put up in the ultrasound reading room. This accordingly led to the incorporation of feedback from radiologists.

6. Other 'mishaps' included FP's sending patients to the wrong places, applying the Well's criteria incorrectly, or not applying them at all. Each of these was dealt with by calling the FP involved

to clarify the process, and by revising the forms where directions had been determined to be confusing.

7. Another example if an unanticipated wrinkle was the discovery of a 'window' of time every weekday morning between 0800 and 0930 when the ultrasound radiologist (who was to be available all day) was not available on the telephone (because they attended rounds during this period). This caused some frustration for FPs trying to refer patients for CUS during this time. Although this was resolved to some extent after a meeting with the radiology department, reports of being unable to get anyone to answer the phone still occur, and a failsafe solution is still being sought.
8. Patients referred to the ED for DVT work-up do, on occasion, continue to be 'missed' at triage, and are made to wait, especially if the FP had not contacted the ED before sending them in. When these are discovered, the stakeholders that missed referring them to the ACP are reminded about the protocol, explaining that use thereof would have saved the patient's time and freed up and ED bed. FPs referring patients to the ED have been asked to tell them to remind the triage staff on arrival in the ED that they have been referred to the DVT protocol. Posters have been put in prominent places in the triage area, and ACPs have been asked to periodically remind triage personnel to watch for potential patients for the DVT pathway. Even when the patients do end up in an ED bed, the patients are still treated according to the protocol, which may involve them being sent back to the waiting room to wait for their D-dimer or CUS results, belatedly freeing up a bed. The number of patients missed like this is being monitored and the 'missing' of patients appears to be decreasing as the use of the protocol becomes more entrenched.
9. Our initial idea of sending the algorithm to a pilot group of FP's was intended in part to avoid using excessive resources by repeatedly mailing out new versions of the process to all 400 FPs in the district, potentially confusing many of them, and in part to compare the management of patients referred by FPs exposed to the intervention with those who had not been so exposed. It

soon became apparent, however, that the line dividing these two groups was becoming increasingly blurred as time progressed. FP's who heard about the initiative from colleagues called in to be included in the pilot project, obtained copies from their colleagues, or were informed about it by EP's when they referred patients in to the ED with suspected DVT's. EP's were given the option of using ACP's to process un-referred patients whom they suspected of having DVT, resulting in the fact that most patients ended up on the pathway, regardless of whether they originated at a 'pilot' FP's practice or not. It was subsequently decided to make the process available to all FP's in the district. To avoid the cost of sending a folder to each of the 450 FP's in the district, (including ones who might not use the tool), we decided to send folders only to physicians who wanted one. In a primary care newsletter, that included a new (unrelated to DVT) 'tool' to be placed in the folder, FP's who had not signed onto the project were asked if they would like the full folder sent to them. Those that did were mailed the latest version of the complete toolkit, including the DVT tool. Several multi-physician clinics asked only for one toolkit for the entire clinic. By the time of this report over 200 'toolkits' have been sent out to FP offices.

10. Finally, we discovered that data gathering that was predicted to be relatively easy did not turn out as such. Although data available on the emergency department information system, collected as part of a larger quality improvement exercise is still captured automatically, and that regarding individual visits of patients who consented to be in the 'study' was captured by the ED study RN and the haematology RN, 3 month follow-up data was limited by poor attainment of consent by the ACPs and by the frequent inability of the study RN to contact consented patients.

    Buy-in by the ACPs was (eventually) excellent in terms of using the protocol, however the five page consent form (essentially to ask the patient for permission to call them 3 months after the ED visit) proved onerous to the ACPs, who tended more often to process patients without bothering to ask for consent for follow-up. In spite of entreaties to the ACPs to be more diligent

in this regard, we were not able to improve this consent gathering. We felt that the low interest in research among the ACPs, was an area for future intervention, should this important potential source of research data go unwasted.

On the whole, the process was met with enthusiasm by the vast majority of stakeholders. Notable exceptions (and to a lesser extent those ambivalent to the change) were identified and encouraged toward a more positive attitude whenever possible. In one particular case, an ACP that had been reticent to participate was 'recruited' to the group monitoring the project, as part of a larger CQI role, which resulted in a dramatic increase in buy-in. Enthusiasts and champions were encouraged and congratulated.

Indicators of success

1. A telephone survey of 30 FPs drawn at random from the pilot group, performed 10 months after commencement, showed that 21 (70%) had used the pathway for their patients. When asked to rate the success of the project with regard to improving their ability to manage suspected DVT management on a scale of 10, where 10 represented perfection and 0 that the pathway offered no improvement, the average rating by those that had used the pathway was 8.99 (range 8.75-10). Of the 9 FPs that had not used the pathway, 7 declined to give a score because they had not experienced how it worked, while two gave scores of 8 and 10 respectively stating that it was so user friendly that they would be able to use easily it when the need arose.
2. A survey of all 23 EPs at our centre showed that 22 (60%) had used the pathway. Of these 21 (95%) felt that the process was worthwhile and improved patient care. A similar survey of 9 ACPs showed that 89% felt that the process was worthwhile and improved patient care.
3. As part of the quality improvement exercise, we intended for all patients to be called three months after the initial visit. Unfortunately the consent for this call, required as mentioned above by the local research ethics board, had only been obtained on 52 patients. 15 were lost to follow-up and one had died (neither of DVT nor pulmonary embolism). Of the 36 patients who were

contacted, six had the diagnosis of DVT confirmed, and two had been deemed 'inconclusive' on hematology follow up and anti-coagulated as if DVT had been confirmed. Regarding the efficiency of the process, 26 (72.2%) reported that it was efficient, 5 that they felt it was inefficient, 2 could not recall, and three had no opinion. Regarding the time taken, 20 (56%) felt that it had taken quicker than expected, 6 as long, and 6 longer than expected. Two could not remember, and two had no opinion in this regard. When asked about their satisfaction with the process, 18 reported being 'very satisfied', 14 were 'satisfied' (88.9% 'very satisfied' or 'satisfied'), two were dissatisfied and two could not recall the details of the process

4. With regard to length of stay in patients referred to the ED to have DVT ruled out, the length of stay in patients that had a d-dimer ordered decreased from 379.31 minutes prior to the pathway being introduced (N=68), to 284.74 minutes for the same time period starting 4 months after introduction of the pathway (N=73) (August – December 2005 vs. 2006). This decrease of 94.57 minutes suggests significant time savings for the patient, while indicating further opportunity to decrease this further.
5. The percentage of CUS ordered for the investigation of DVT that were positive for the condition stayed the same. (14.0% in December 2005 vs. 13.9% in December 2006). This surprised us somewhat, as evidence suggested that the judicious use of d-dimer decreased CUS use by 40% in one study. This could be an indicator of the fact that FPs are not adequately reassured by negative d-dimer tests to avoid CUS. A more likely explanation for this failure to decrease unnecessary testing, however, is that by reminding FPs to consider DVT as a diagnosis and by providing the option to order d-dimers easily, we may have caused FPs to order d-dimer tests more often, especially in cases where the likelihood of DVT was very low. If this were the case, the number of 'false positive' d-dimers would be expected to increase, increasing the number of CUS done on patients with a low likelihood of DVT, balancing out any decrease in CUS resulting from the appropriate use of the blood test. This explanation is supported by the fact that

the number of d-dimer tests ordered by FPs increased by 42% in the first year following the introduction of the new process.

6. Referrals to the DVT clinic increased by 14.2% between 2005 and 2006 (from 181 to 211). Referrals specifically from the ED increased from 35 patients in 2005, to 63 patients in 2006, with an increase from 18 (51.4%) to 55 (87.3%) being referred for one week follow up CUS, suggesting that clinic visits are being used more appropriately (considering an increase of referrals needing one-week follow-up of 35.9%) and that the recommendation of one-week follow-up in cases of high pre-test likelihood, positive d-dimer and negative CUS is now being followed more regularly. Anecdotal reports from the hematology nurses is that referrals have been far more appropriate than before the pathway was introduced.
7. Renewed interest in the indications for diagnostic imaging in venous thrombo-embolic disease as a direct result of radiology involvement in the pathway has led to two sessions of academic rounds in the diagnostic imaging department and standardization of advice given to FPs who call in, without having referred to the pathway instructions.

Ongoing activities with the project

The algorithm and clinical process for DVT management continues to be offered to more FPs in our district, and the process has been mirrored in other hospitals in the area, each tailored to the capabilities of the particular institution. Following publication of the results, (Campbell Sam G et al., 2008; Campbell et al., 2008) particulars have been requested by and shared with hospital administrators from several parts of the world, (and have been adapted as far away as New Zealand (2010b)).

Broader impact of the project

At the time of this report, the PSG has been disbanded and the responsibility for maintenance of the toolkit has passed to the newly formed Department of Family Practice. Currently, as a result of this project, and using the template developed, the toolkit includes

processes of care for a number of conditions for which care straddled the boundary between primary and secondary care. These include: cellulitis, warfarin management, clostridium difficile management, animal bites, and directions for both referring and consultant caregivers delineating their responsibilities with the primary secondary referral and feedback process (Table of contents is shown in Appendix 5). The work continues to identify other conditions or presentations can be similarly applied to the template, thereby standardizing the processes of care, making it easier for healthcare workers to manage their patients appropriately and make the management process more efficient and less intimidating for patients and their families.

With regard to the use of ACPs in the ED, this project spawned a program in the new Charles V Keating Emergency and Trauma centre (built since conclusion of this project) where 6 beds in the emergency department are managed by ACPs independent of nurses. In addition to freeing up RNs to perform skills needed by sicker patients (providing some relief from the acute nursing shortage), this area provides an opportunity for patients with less severe conditions to move through the system without having to compete with sicker patients. In the period from September 2009 to February 2010, a full 23.5% of all patients treated in our emergency department received such care in this area (which is closed from midnight to 0800). In the earlier part of the day, this figure is over 30%. (QEII Emergency department information systems report 14 February, 2010) A recent independent review of the process was glowing in its approval thereof. (Marsh Canada Limited, 2009) Also since this project, a number of other hospitals in Nova Scotia have started using ACPs to help manage patient care in their EDs. Regarding our observation that ACPs were not committed to research into the provision of health care, our ACP group have been involved in a number of research publications, (Campbell SG et al., 2008) and are currently involved in a 1000 patient study on better ways to provide procedural sedation in the ED.

Discussion

The strengthening of the role of primary care has been recognized locally, (2005a; Rippley DM, 2003) provincially (STP Inc Capital Health, 2002) nationally, (2010; Kirby MJL, 2007; Romanow RJ, 2002) and internationally.(Kvamme, Olesen, & Samuelson, 2001a) The 2002 Kirby report included recommendations for primary care reform to correct: fragmentation of care and services, inefficient use of health care providers, and barriers to access of care.(Kirby MJL, 2007) These issues are all addressed by our initiative.

Using the community directed management of suspected DVT as an example, we have demonstrated how a multidisciplinary group can introduce a pathway that coordinates care by several different disciplines, for patients with particular and predictable health care needs, improving communication through different levels of the system, standardizing care, decreasing waste and improving the efficiency of care. The initiative has demonstrated a method by which primary care processes can be redesigned into smoothly functioning, interdisciplinary processes with a minimum of cost to the system.

The subject chosen for this initiative is a condition that has illustrated the disconnect between primary care and the referral centre. Our experience can be, and has been, easily used to guide similar interventions for other conditions for which the management is similarly constrained. These processes can decompress EDs, empower and free up the time of family physicians and, by standardizing care, can decrease the inappropriate use of expensive and sparse medical technology, while ensuring the efficient and patient responsive provision of evidence based care. Success with this project has resulted in the assumption of a new approach to the delivery of emergency care using allied health providers in new roles.

Ongoing development of this concept will continue to contribute to the destruction of the outdated ‘silos’ of care pervasive in health care systems, in that it brings different groups

together to plan processes where each group interacts and hands patients smoothly between each other, coordinated by the patients' familiar and accessible primary care practitioner. Furthermore, the change management concept may be used to guide interventions outside the primary-secondary care interface that involve different disciplines.

Specific lessons learned

1. Development of simple rapid responses contribute to success and ensuring that key stakeholders remain on board through implementation ups and downs. The process to perform this need not be onerous. In our case it involved the project coordinator walking through the ED on his way home every evening to check if suggestions or complaints had been left on the algorithm poster. These suggestions were addressed rapidly, with the 'updated' algorithm replacing the old one as he went home the following night. Other feedback was from the haematology nurses and FPs to an answering machine in the coordinator's office that was checked every morning, with suggestions being rapidly investigated and/or similarly implemented.

2. There is significant value in having 'outsiders' such as an industrial engineer who view the issues/concerns with a different lens and provide solutions outside the sphere of the usual approaches of clinical teams. A notable example of the engineer's perspective being applied was an instance where frustrated team members wanted to issue a communication admonishing ACPs to remember to fax referrals to the new haematology clinic number. The engineer's response was that telling people to do something was probably the least effective way of getting them to do it; rather build it into the system that it was a 'natural' thing to do, or link it to something that had already been successful. By marking a pre-programmed button on the fax machine as 'haematology RN', faxes to an incorrect number were eliminated!

3. Utilizing an evidence informed approach has positive learning spin offs for all members of the team. Learning together strengthens teams and contributes positively to the success of

initiatives. Team members became comfortable with the concept of finding and applying evidence correctly, but also became educated about other evidence that they perused while searching for evidence specific to this initiative. This concept of learning 'while' searching follows the analogy of bird watching in which the amateur ornithologist who spots a bird for the first time has to look though several pages of bird pictures before he finds the one he wants to identify. The process of 'screening' different pictures, however, exposes him to the knowledge of many other (as yet unseen) birds. When he sees these other birds, on a different occasion, he is already aware of them, and far quicker to identify them.

For organizations who are trying to create an evidence-informed decision-making culture, this concept has significant implications. Research evidence 'savvy' members of staff, will, during the process of performing projects, become constantly more aware of the research available, and, indeed, discoveries made during one evidence review, will often give good ideas as to unrelated initiatives that would benefit the institution.

4. Success of initiatives involving clinicians must take into consideration remuneration throughout the process as it is difficult to sustain 'volunteerism' over the life of a project spanning several months. We had greater success with retaining the services of FPs because their contribution to the project did not entail their sacrificing income. In our 18 month project, we only lost one team member, who moved to another province for unrelated reasons.

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Appendix 1.Clinical background of Contemporary DVT management and discussion of its pertinence to this intervention

Options for investigating DVT range from simple clinical history and examination, through blood tests or ultrasound to venography, each carried out by a different medical discipline. These investigations vary in terms of their reliability (sensitivity and specificity) as well as in their convenience to patients, discomfort, and potential for the test to actually harm the patient especially (in the case of venography, where patients are exposed to contrast medium and radiation).

The management of patients suspected to have deep vein thrombosis (DVT), has evolved considerably in the past few years. (Wells et al., 2003b) With regard to investigation, recent research has shown that patients can have their risk of DVT stratified in a relatively objective manner using a clinical evidence-based scoring system. In patients with a low clinical likelihood of DVT, testing the blood levels of D-dimer, a fibrin degradation product, can be used to effectively rule out the diagnosis. In patients with a higher clinical (pre-test) likelihood of DVT, however, a normal D-dimer level is not sensitive enough to exclude the diagnosis. (according to Bayesian theory, the higher the probability of disease before any testing is done, the higher the chance that a negative test for the condition will actually be wrong; i.e. a 'false negative'). In the last-mentioned patients, and in patients with a low pre-test probability of DVT but an abnormal D-Dimer level, the definitive test is a compression Doppler ultrasound (CUS) of the affected leg. (Tovey & Wyatt, 2003f; Wells et al., 2003a)

With regard to treatment, recently developed fractionated or 'low molecular weight' heparin appears to be far safer than un-fractionated heparin and, although it needs to be given parenterally, does not require frequent monitoring of their blood clotting parameters to prevent excessive or insufficient anticoagulation. (Levine et al., 1996)

Randomized control trials comparing the use of the two types of heparin, suggest that the use of low molecular weight heparin (LMWH) can allow patients that would previously been treated in hospital on intravenous heparin infusions to be treated as outpatients. LMWH therapy is considered sufficiently benign that in cases where definitive testing is delayed, empiric treatment with LMWH can safely protect the patient, pending the result of the CUS. (Hull & Pineo, 2004)

From the perspective of the primary care practitioner (FP) these new strategies for DVT management has meant that a potentially life threatening condition should be able to be ruled in or out, and treatment initiated without deferring decision making to specialists. This, however, was not the case, and the necessary tools were not available to family physicians in Capital Health.

The reasons for this deficiency in care are many, and include the fact that changes in practice patterns usually lag several years after scientific evidence has proven such changes necessary.(Grol & Wensing, 2004a) Busy FP's may not have the time to keep up with 'cutting edge' strategies to manage a condition that might, at a single family practice, only arise a few times a year. Another reason is an investigative strategy that involves one or more of several interventions carried out by one or more of several different disciplines frequently proceed in an uncoordinated and un-standardized way. Clear lines of communication have neither been constructed, nor have they evolved, and patients frequently have to sit and wait for decisions to order interventions and then again to wait for the test to be conducted when the need for such interventions could easily have been predicted, and for which 'best evidence' based practice has been clearly defined.

Issues contributing to this include the closed silos in which each discipline (Primary care, emergency, radiology, hematology) functions, and the fact that personnel (independent from any particular discipline's 'point of view') are not available to take on the role of steering patients through the system. The issue is not felt to be important enough (and it is perceived that it would

not be cost effective) to hire someone specifically to fulfil this role, and existing nursing and physician staff cannot be pulled away from their active duties and responsibilities.

The system had also not considered the potential for non-physician, non-nurse health care providers, without individual patient-dedicated responsibilities to take on this role in addition to the one they perform at present.

For patients referred to the ED with suspected DVT, 'leg pain', is the most commonly recorded triage complaint, which results in the appropriate allocation of a high CTAS score (implying a low urgency to be seen relative to 'sicker' patients). Patients, therefore, frequently had to wait for several hours before being assessed by an emergency physician. As the current standard of care suggests investigation or empiric treatment within two hours of presentation, these prolonged waits mean that the quality of patient care is compromised. Apart from the considerable inconvenience to a patient incurred by waiting in a crowded ED waiting room when the correct plan of action has already been determined, the sitting position is potentially detrimental to patients with DVT in that the decrease in venous return (due to both gravitational slowing of venous blood flowing back to the heart, and due to the kinking of veins in flexed hip and knee areas) may encourage the propagation of existing clots, exacerbating the DVT and potentially increasing the chance of pulmonary embolism or post phlebitic syndrome.

Appendix 2.Appraisal of Clinical Evidence to design the tool

With reference to the evidence governing the best practice of DVT management, the first source used was PubMed, searching for current review articles on DVT investigation and management to gain a broad understanding of the specific issues involved. Following this, a search for reports of specific clinical research in the area revealed numerous reports of randomized control studies supporting a change from traditional DVT management.

These included a study by Levine et al in 1996, showing that patients with DVT randomized to LMWH treatment as outpatients did as well as those hospitalized for traditional unfractionated heparin treatment.(Oudega, Hoes, & Moons, 2005a) Wells et al. showed (also in a randomized control trial), that patients judged 'unlikely' to have DVT by a clinical model could have the diagnosis safely ruled out with a negative D-Dimer, avoiding an ultrasound in 39%.(Wells et al., 2003g) Numerous other studies were found that supported this approach. Some articles, however, were found that actually reached the opposite conclusion. (Oudega, Moons, & Hoes, 2005; Oudega, Hoes, & Moons, 2005b)

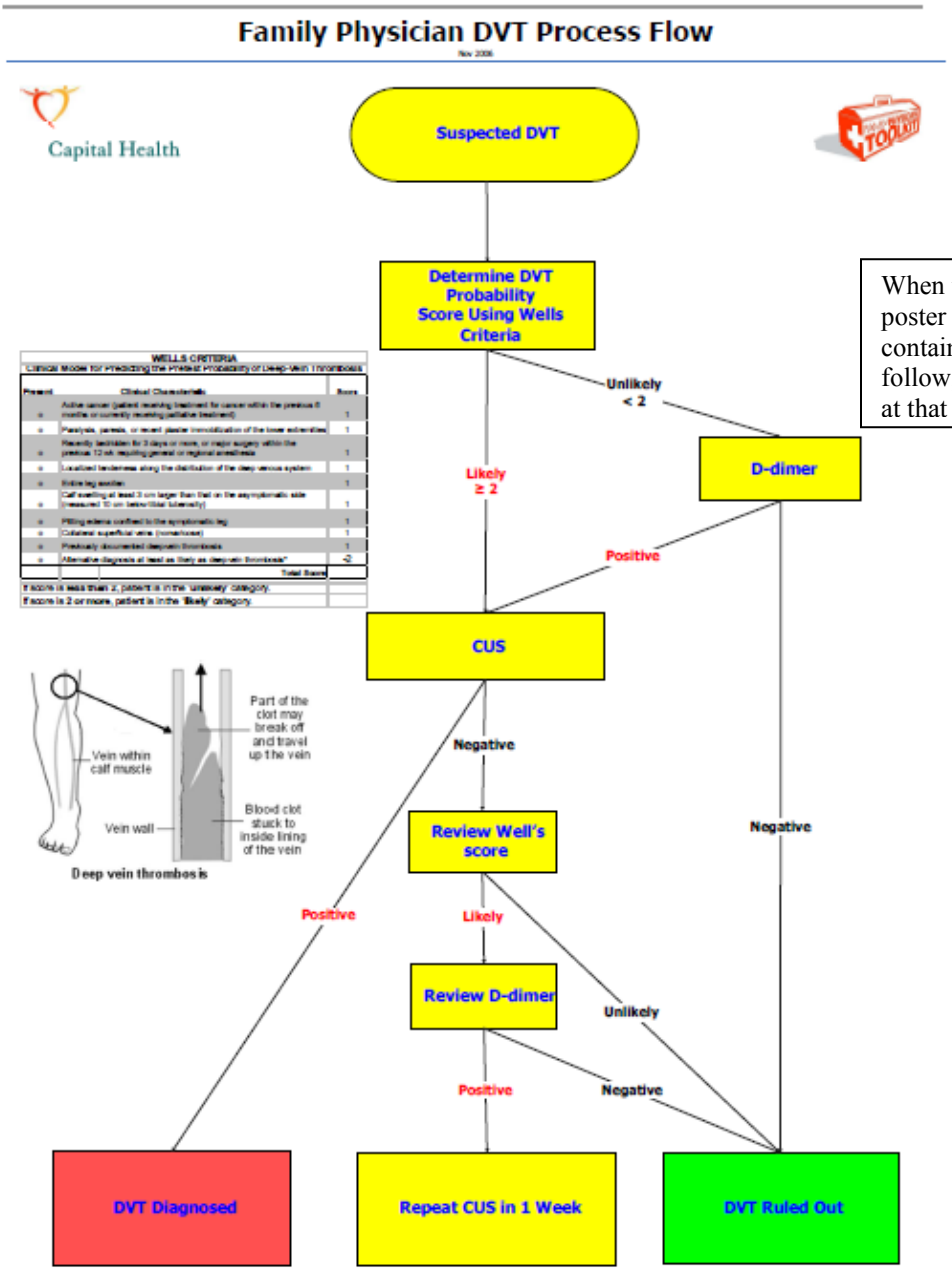
On further perusal, it was noted that these came from the same authors, reporting on less rigid studies, and who subsequently published their own algorithm, (Oudega, Hoes, Toll, & Moons, 2006) which has not since been supported by other published research.

The overwhelming support of the Well's approach by other authors as well as the recognition that one of the local academic leaders in the field of venous thromboembolism was a co-investigator in Well's studies, and that the approach has been accepted as 'best evidence' by the local academic haematology group, convinced us that this would be the best system to adapt for introduction to the primary-secondary arena, and strengthened our belief that we could expect buy in from local stakeholders.(Wells et al., 2003h)

Appendix 3.The Algorithm introduced to guide the process

(Please note that this is the 'final' version, that differed significantly from those developed as part of the PDSA process)

New Primary Care Pathway
Deep Vein Thrombosis (DVT) Workup



When this was displayed as a poster (4x3 ft), each box contained the details to follow, should a patient begin at that step.

This algorithm can be followed by the FP or the patient may be referred to the ED DVT process at the QEII after any of these steps.

Appendix 4: Directions for the FP

(Similar forms were developed specifically for each of: ACPs, Ps, and radiologists).

Scoring Guide and Referral Form
Deep Vein Thrombosis (DVT)
Instructions

1. Complete scoring system (overleaf) and order investigation as per algorithm.
2. Patients with a score of <2 are in the "unlikely" category and need a d-dimer test.

A **If the d-dimer is negative**, DVT has effectively been ruled out.
B **If the d-dimer is positive**, they will need a compression ultrasound (CUS).

The d-dimer test may be ordered by the family physician, or by referring the patient to the DVT pathway at the QE II ED by calling (902) **473-4444** or **473-2222 (ask for pager 1170)** with the patient's particulars. Ask for the DVT process to be initiated. This call can be made by your assistant or secretary; please ask them to quote the probability score.

3. Patients whose score is ≥ 2 are in the **"likely"** category and will need a compression ultrasound (CUS). To arrange this:

A If between 0800-1300 hrs weekdays:	**B At all other times, or if CUS will be delayed until the next day:**
Call **473-1640** to order ultrasound directly from a radiologist.	Call **473-4444** or **473-2222 (ask for pager 1170)** with the patient's particulars.
Please quote the probability score.	*Ask for the DVT process to be initiated.* *This call can be made by your assistant or secretary* *Please ask them to quote the probability score.*

4. **At all times, sign this form and give it, along with the patient DVT handout** (pages DVT 3.1 and 3.2)**, to the patient.** Please instruct the patient to proceed – **with the form** – directly to the ultrasound department, 3rd floor Halifax Infirmary (if an ultrasound has been organized) or to the emergency department after hours or weekends.
If a DVT is diagnosed, the patient will be referred directly to the hematology/anticoagulation clinic.
Patients in whom DVT is "ruled out" will be asked to return to your office for re-evaluation within 2 days (unless you have instructed them otherwise).

Scoring Guide and Referral Form
Deep Vein Thrombosis (DVT)

PHYSICIAN INFORMATION	**PATIENT INFORMATION**
Signature:	Name:
Name:	Health Card Number:
PLEASE PRINT	
Phone Number:	Phone Number:
Date:	Date of Birth:
	YEAR / MONTH / DAY

WELLS CRITERIA[1]: Clinical Model for Predicting the Pretest Probability of Deep-Vein Thrombosis[2]

Present	Clinical Characteristic	Score
	Active cancer (patient receiving treatment for cancer within the previous 6 months or currently receiving palliative treatment)	1
	Paralysis, paresis, or recent plaster immobilization of the lower extremities	1
	Recently bedridden for 3 days or more, or major surgery within the previous 12 wk requiring general or regional anesthesia	1
	Localized tenderness along the distribution of the deep venous system	1
	Entire leg swollen	1
	Calf swelling at least 3 cm larger than that on the asymptomatic side (measured 10 cm below tibial tuberosity)	1
	Pitting edema confined to the symptomatic leg	1
	Collateral superficial veins (nonvaricose)	1
	Previously documented deep-vein thrombosis	1
	Alternative diagnosis at least as likely as deep-vein thrombosis*	-2
	**Please specify alternate diagnosis:*	
	TOTAL SCORE	

If score is **less than 2**, patient is in the **'unlikely'** category.
If score is **2 or more**, patient is in the **'likely'** category.

DVT Score
Score:
'Likely' (≥2) Needs CUS
'Unlikely' (<2) Needs d-dimer

Phone Numbers	
Ultrasound Radiologist QEII	**473-1640**
Emergency DVT	**473-2222** *ask them to page 1170
Emergency Department	**473-4444** **473-4969**

For instructions, see reverse side of this sheet ▶

[1] Wells PS, Anderson DR, et al. Evaluation of D-dimer in the diagnosis of suspected deep-vein thrombosis. N Engl J Med. 2003 Sep 25;349(13):1227-35.
[2] In patients with symptoms in both legs, the more symptomatic leg is used.

Appendix 5: Table of contents of FP Toolkit

Toolkit Resources

GUI	Guidelines for Interaction Between Primary and Postprimary Care Physicians
DVT	DVT Process
CDD	Clostridium difficile Process
CEL	Cellulitis Process
APB	Antibiotic Prophylaxis of Bite Wounds
INR	INR Process
IWK	IWK Health Centre, Women's/Maternity Site
	Guidelines for Division of Gynaecology
RES	Physicians Resources
TRC	Travel Clinics

While every care has been taken in compiling the information contained in this toolkit, the development team / advisors cannot guarantee its applicability in specific clinical situations or with individual patients. Physicians and others should exercise their own independent judgment concerning patient care and treatment, based on the special circumstances of each case.

Anyone using this information does so at their own risk and releases and agrees to indemnify the development team / advisors and Capital Health for any and all injury or damage arising from such use.

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