Meeting Challenges in the Delivery of Surgical Care: A Financial Analysis of the Role of Physician Assistants

by

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Dedication

I would like to dedicate this work to my father, Eric Laurence Sigurdson PhD. His tragic death at the age of 41 forever changed my life. He was a great man and will always be a source of inspiration to me.

I would also like to dedicate this project to my wife, Leanne van Amstel. I am truly blessed to have married such a wonderful woman.
Acknowledgments

I would like to acknowledge the unwavering support of my wife Leanne van Amstel throughout my academic pursuits. She should also be credited for her commendable editorial and proofreading skills.

I would also like to thank my supervisor, Dr. Terry Wagar for his assistance with this project.
Abstract:
Meeting Challenges in the Delivery of Surgical Care
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April 26, 2006

Introduction: Looming demographic challenges may break the Canadian Health Care system -- a system which is already straining to deliver surgical services in a timely fashion. The current situation is opening the door to the rise of a parallel private care system which will forever change the nature of a sacred Canadian institution. Current shortages in surgical manpower cannot be addressed expediently due to 14-year university training requirements for new surgeons. A potential solution is to increase the efficiency of surgeons currently in practice. Physician assistants (PA’s), a ubiquitous specialty in the United States, may play a role in this regard by allowing surgeons to concentrate on their core competency, namely operating. The purposes of this investigation are to explore the inefficiencies in a current Canadian surgeon’s practice, examine the feasibility of PA employment and evaluate the financial impacts.

Methods: The study was performed in three parts. In the first part, operating room (OR) plastic surgery Surgiserver® data for the ten years ending in 2005 was analyzed to determine the allotted daily operating time used in performing operative procedures. In the second part, 4 months of detailed time series data was captured prospectively for every patient care event. The data was analyzed using SPSS (ver. 11.5) to determine the percentage and composition of events that could be delegated to a PA. In the third part, these delegation percentages were used to model different PA hiring scenarios using formal business case analyses.

Results: Over the course of 3635 days the mean operating time used in a ten hour surgical day was 5.93 hours. Of the 806 patients seen in 13 clinics, 53.5% could have safely been cared for by a PA. In the minor procedure area, 48.8% of surgical time was spent performing non-essential, PA compatible work. In the main OR, 25.9% of surgical time was PA compatible. Considering the weekly mix of activities, a PA could increase surgical productivity by 36.7%. The business case analyses indicate that hiring a PA was neutrally cost effective at the 37% productivity increase level. However, much greater discounted incremental cash flows, internal rates of return (IRR) and return on investments (ROI) were achieved when PA hiring allowed one surgeon to run two OR’s simultaneously.

Conclusions: Hiring and proper implementation of PA’s, in conjunction with increases in operating room capacity, have the potential to markedly increase the capability of surgeons to deal with lengthy surgical wait lists in a cost effective manner.
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Chapter 1: Challenges in the Delivery of Surgical Care

The Canadian health care system is under a great deal of stress. The situation will unquestionably worsen over the next decade due to evolving demographic trends. Waiting times for medical services are increasing and public satisfaction with our flagship national institution is plummeting. Politicians of all stripes have made health care their rallying cry with the issue appearing at the top of each party’s recent campaign platform. Public fears of an imminent collapse have spurred the injection of billions of Federal dollars back into the system. These Federal monies have targeted wait times in a number of priority services. Although benchmarks for acceptable wait times have been developed and the collection of waiting time data has become widespread, little has been done to actually improve the waiting times.

Physician resource limitations represent one of the largest impediments to improving waiting times. Implementation of the ill-conceived Barer Stoddart report resulted in reduced medical school enrollment by 11.3% over the early 1990s (Detsky & Naylor, 2003). Miscalculations stemmed from the growing proportion of women physicians who choose part time practices and reticence of newer graduates to work the same number of hours as their senior colleagues had in the past. As a result, there are widespread physician shortages across Canada such that our country now lags significantly behind the United States (US) and the United Kingdom (UK) (Figure 1).
More locally, physician supply and demand forecasts for Nova Scotia indicate that demand for surgical specialists will outpace supply (Basu & Gupta, 2005). Recently, Nova Scotia made national headlines by holding a lottery to select 1500 patients for a new medical clinic in Yarmouth from a group of 8000 without a family doctor ("Patient Lottery", 2006). The physician shortage can only be expected to intensify as our “baby boomer” generation ages.

The Canadian population is rapidly aging. The first wave of the “baby boomer” generation (born between 1947 and 1966) is coming into the prime health care consuming years. In the United States, about one quarter of the Medicare budget is spent
on beneficiaries in their last year of life (Hogan et al., 2000); forty percent of this is spent during the last 30 days. In the past, most Canadians died relatively quickly after the onset of disease. With the advent of medical technology, people are now succumbing to more chronic and financially costly conditions such as heart disease, cerebro-vascular disease, cardiopulmonary disease and cancer. End of life costs have been estimated at $37,581 during the last year of life compared to $7,365 for the non-terminal years after age 65 (Hoover et al., 2002). All indications therefore point to an unsustainable balance sheet for health care in Canada.

Nova Scotia is at particular risk as it has the oldest and unhealthiest population in Canada and already spends almost 50% of its budget on health care. The 2005/2006 provincial budget increased health care spending by 9.3% over the previous year to a record $2.56 billion ("NS Budget", 2005). Unlike many other provinces, Nova Scotia lacks the tax base and resources to lessen the blow. Demographic trends favouring the migration of retirees to Nova Scotia will further strain the situation. Waldo found that in 1987, the over 65 age group consumed 36% of total personal health care despite only making up 12% of the population (Waldo et al., 1989) Canada is just starting to witness the early stages of this expensive “boomer” health care cohort -- effects that will be felt on the macroeconomic level (see Figure 2).
Figure 2: Canadian and Nova-Scotian Demographic Cohorts

The line represents the current date position within the cohort.

Adapted from diagram on Natural Resources Canada Website ("Natural Resources Canada", 2004)

David Foot and Daniel Stoffman, in their now renowned treatise on the impact of Canada’s aging population, have warned about the upcoming “health care crunch” (Foot & Stoffman, 1996). The oldest of Canada’s 9.8 million baby boomers will turn 60 in 2007 and thus enter the prime health care consuming years. Their unprecedented health care needs will be serviced on a much smaller tax base supported by “generation X” (born 1960 to 1966), the “baby busters” (born 1967 to 1979) and “echo generations” (born 1980 to 1995) (Figure 3).
Currently there are 2.2 taxpayers for every retired person, in 15 years there will only be 0.9 taxpayers per retiree (see Figure 4 and 5). A daunting fact considering that the boomer generation is unlikely to accept a lesser standard of health care service than is available now.
Figure 4: Retired and Working Canadian Populations in 2015

Beige shading represents retired population over 60 years of age. Blue shading represents tax paying population between age 30 and 60. Figure created from Statistics Canada Data, http://cansim2.statcan.ca/cgi-win/cnsmcgi.exe?Lang=E&RootDir=CII/&ResultTemplate=CII/CII_pick&Array_Pick=1&ArrayId=510001. Accessed March 2006.

Figure 5: Comparison of Retired and Working Canadian Populations for 2006 and 2015

Without urgent attention to inefficiencies within our current system, health care costs will spiral out of control. Health care spending as a percentage of GDP has already risen markedly over the past few years. Throughout the late 1990s and early millennium, our health care spending growth outpaced even the US and the UK before dipping in 2002 (see Figure 6). Recent announcements of spending increases will likely bring us back into the lead.

Figure 6: Annual Growth Rate of Per Capita Health Care Expenditure

If these trends continue, which they likely will (the current Conservative government has pledged to further increase Federal health care spending), it is conceivable that our system will cease to be an ongoing concern. The Canadian public is becoming
increasingly concerned about the quality of health care and general state of affairs affecting our once prized system. Canadian perceptions of the value they receive from the system has changed markedly over the past decade according to a well established yearly opinion poll of the citizens of Canada, the US, Australia, New Zealand and the UK (Blendon et al., 2003). In their 2003 report, Canadians were significantly more likely than respondents from the other countries to report a deterioration in quality of care. Bolstered by this climate of discontent, proponents of the US-style medical care privatization have gained strength. A shot in the proverbial private care arm was handed to them with the recent Chaoulli decision of the Quebec Supreme Court (Ouellet, 2005). The court ruled that patients should not be disallowed from pursuing private care solutions when the public system cannot provide an acceptable standard of care. Flowing from this decision has been a great deal of political and public rhetoric regarding the benefits of allowing the private sector to have an expanded role in health care (McFarlane, 2005). Indeed, even the Canadian Medical Association, a long-standing detractor of private health care, came out with a position statement advocating for its role (Ouellet, 2005: page 896).

"The Canadian Medical Association supports the principle that when timely access to care cannot be provided in the public health care system, the patient should be able to utilize private health insurance to reimburse the cost of care obtained in the private sector."
Looming demographic challenges may break the Canadian Health Care system -- a system which is already straining to deliver services in a timely fashion. The mounting voids created by our current situation are facilitating the rise of a parallel private system which will forever change the nature of a sacred Canadian institution. As with many other medical subspecialties, current shortages in surgical manpower cannot be addressed expediently due to 14-year university training requirements for new specialists. A potential solution is to increase the efficiency of surgeons and anesthetists that are already in practice. Physician Assistants (PA’s), a well-established, ubiquitous specialty in the United States, may play a role in this regard by allowing surgeons to maximize their core competency, namely operating.

The purposes of this investigation are to describe the nature of PA’s and Anesthesia Assistants (AA’s) and to explore the inefficiencies in a current Canadian surgeon’s practice. The feasibility and financial impacts of PA hiring will also be examined using a formal business case analysis. The role that physician assistants might play in the delivery of surgical services in Nova Scotia will be explored.
Chapter 2: Physician Assistants

Description

A physician Assistant (PA) is a health professional who practices certain aspects of medicine under the direct supervision of a licensed physician. Physician Assistants work in close association with physicians. They participate in a team approach to managing patients with an emphasis on performing tasks and duties that are routine in nature. Physician Assistants can work in primary care or subspeciality areas including orthopedic and plastic surgery, diagnostic imaging and internal medicine. They can be certified to perform duties such as history and physical taking, surgical assisting, writing prescriptions and managing routine medical problems.

In the US, the scope of a PA’s practice is limited by the guidelines set out by policy H-160.947 of the American Medical Association (AMA) (Figure 7).
(1) The physician is responsible for managing the health care of patients in all settings.

(2) Health care services delivered by physicians and physician assistants must be within the scope of each practitioner's authorized practice, as defined by state law.

(3) The physician is ultimately responsible for coordinating and managing the care of patients and, with the appropriate input of the physician assistant, ensuring the quality of health care provided to patients.

(4) The physician is responsible for the supervision of the physician assistant in all settings.

(5) The role of the physician assistant in the delivery of care should be defined through mutually agreed upon guidelines that are developed by the physician and the physician assistant and based on the physician's delegatory style.

(6) The physician must be available for consultation with the physician assistant at all times, either in person or through telecommunication systems or other means.

(7) The extent of the involvement by the physician assistant in the assessment and implementation of treatment will depend on the complexity and acuity of the patient's condition and the training, experience, and preparation of the physician assistant, as adjudged by the physician.

(8) Patients should be made clearly aware at all times whether they are being cared for by a physician or a physician assistant.

(9) The physician and physician assistant together should review all delegated patient services on a regular basis, as well as the mutually agreed upon guidelines for practice.

(10) The physician is responsible for clarifying and familiarizing the physician assistant with his/her supervising methods and style of delegating patient care. (BOT Rep. 6, A-95; Reaffirmed: Res 240 and Reaffirmation A-00; Reaffirmed: Res. 213, A-02; Modified: CLRPD Rep. 1, A-03)

No such national guidelines are yet established in Canada.
Growth of the PA profession

Based on widespread enthusiasm and support by physician groups, the PA profession has grown rapidly in the US and select other parts of the world. There are currently over 60,000 PA’s employed in the US. From 1992 to 2000, the number of PA’s in the United States doubled. Legislation is now present in all 50 states and in the District of Columbia addressing the use of PA’s in medical practice. In 2000, there were 5.8 PA’s per 100 physicians (Wing et al., 2004). Newer specialties, such as interventional radiology, are also embracing the use of PA’s (Stecker et al., 2004).

Penetration of the specialty in the different states has been variable. Factors appear to be related to the favourability of practice environments as determined by legal restrictions, adequacy of remuneration and authority to write prescriptions (Sekscenski et al., 1994). Employment of PA’s is more common in practices with greater than 16 full time equivalent physicians (FTE’S). Interestingly, organizational characteristics such as large practices, rural locations and not-for-profit practices have been found to be more important than financial ones with regards to the employment of both PA’s and Nurse Practitioners (NP) (Kaissi et al., 2003).

Training trends in the US show that the rate of increase of PA graduates exceeds that of Nurse Practitioner graduates. Between 1994 and 2001, there was an average increase of 496 students per year in PA schools. In 2001, there was an almost 50% increase in the
number of PA graduates over the preceding 5 years (Hooker & Berlin, 2002). This is in contrast to the supply of physicians which has remained relatively constant.

Penetration of the PA profession in Canada has been limited almost exclusively to the military domain, though recently there have been some isolated forays into the public sector. The Armed Forces holds a dominant position in the training of PA’s in Canada. Between 20 and 24 PA’s are trained through the Canadian Forces Base (CFB) Borden facility each year. The PA program is generally restricted to military personnel whom have had at least 10 years of experience as a medic. The University of Manitoba has declared intentions of opening a civilian PA training program by 2009.

Within the civilian domain, there are only three PA’s currently practicing in Canada. All are located in Winnipeg, Manitoba. One PA works within Plastic Surgery, a second within Orthopedics and a third within Neurosurgery. The median salary in Canadian funds is $70,000 per annum. Two have trained through the military stream and one was trained in the US.

The Canadian Association of Physician Assistants (CAPA) has recently been formed and currently consists of 70 to 80 members. The association is primarily composed of military personnel -- a fact that is not surprising considering the profession had its genesis within the military.
History

The first documented use of physician extenders was in 1650 during the time of Peter the Great when German military medical assistants were introduced into the Russian army. The 1700s found physician assistants employed on ships by the British Royal Navy and the US Navy. The French used them during the 1800s to help address shortages of medical personnel in the civilian and military sectors. The majority of PA professional growth has subsequently taken place in the US.

Dr. Eugene Stead of Duke University in North Carolina is largely credited with the establishment of the modern PA training program. During the Second World War, Dr. Stead was asked to create a three-year fast track program for training physicians. Leveraging this experience in 1965, he founded the first PA training program at Duke University. The initial students were all ex-Navy hospital corpsmen. The discipline grew rapidly with the establishment of multiple other training centres. Duke University has remained a leader in the development of PA regulatory models (Estes & Carter, 2005).

The PA profession in Canada was created by the Royal Canadian Navy during the Second World War and extended to the Army during the Korean War. The profession was created in response to critical shortages of military physicians. The Canadian PA system has thus remained centred within the Armed Forces since its conception in that setting. Within the Canadian Department of National Defense, there were 130 PA’s in 2003 (Hooker et al., 2003). Physician Assistants who leave the Forces typically have difficulty finding work due to inadequate legislation which allows the squandering of this
valuable resource. The few non- Forces locales that have accommodated the profession include heavy industries and remotely located companies (e.g., oil rigs, mines).

**Future trends**

In 1982, Detmer anticipated a major growth of surgical physician assistants in the US (Detmer & Perry, 1982) and was proven right. It is projected that the demand for PA’s will continue to rise rapidly in that country. In addition to the demographic pressures which drive PA hiring, new rules limiting the number of hours surgical residents can work have left service voids within many surgical training programs. The need for more surgical manpower is also being realized in Canada as a result of new resident workplace rules. Indeed, many surgical training programs are struggling to meet “on call” conditions dictated by recently negotiated collective agreements. One proposed solution is the hiring of PA’s (Todd *et al.*, 2004).

**Other health care providers**

Other health care provider groups share similar scopes of practice to PA’s. These include Clinical Associates, Surgical Technicians, Surgical Assistants and Nurse Practitioners. A brief description of their roles follows:

**Physician Assistant (PA)** - A specially trained person who is certified to provide basic medical services (such as the diagnosis and treatment of common ailments) under the supervision of a licensed physician. Examples in plastic surgery practice would be the
treatment of finger tip amputations, minor wound complications and simple hand fractures.

**Clinical Associate (CA)** – Generally represents a foreign trained medical school graduate who has not met Canadian requirements for full licensure.

**Surgical Technician** – Surgical technicians work directly with surgeons in the operating room setting only. They are responsible for handing instruments and supplies to the surgeon during an operation. Other duties include sponge and instrument counts at the conclusion of the operation as well as cleaning and disinfecting. Their role is identical to that of a ‘scrub nurse’. Pay scales tend to be significantly less than for nurses.

**Surgical Assistant** – a general term that includes a variety of health care providers who assist surgeons in the operating room. It can refer to a Registered Nurse (RN) who has taken additional training thereby allowing him/her to assist in the performance of surgical procedures. In other cases, a Surgical Assistant may be a licensed physician. A third stream is available in the US whereby students with undergraduate degrees can take 22 months of additional training to become ‘“surgical assists’”(Crews, 2006).

**Nurse Practitioner (NP)** - A Registered Nurse who, through advanced training, is qualified to assume some of the duties and responsibilities formerly assumed only by a physician. Synonymous designations include: Adult Nurse Practitioner, Advanced Practice Nurse (APN), Certified Nurse Midwife, Certified Nurse Practitioner, Certified
Registered Nurse Anesthetist (CRNA), Clinical Nurse Specialist, Clinical Specialist in Mental Health Nursing, Family Nurse Practitioner, Gerontological Nurse Practitioner, Neonatal Nurse Practitioner, Pediatric Nurse Practitioner, and School Nurse Practitioner. Registered Nurse First Assists are expanded role nurses who work primarily as assistants in the operating room.

The greatest degree of overlap occurs with Physician Assistants and Nurse Practitioners. Both generally have the same scope of practice but differ in their desire for autonomy. Nurse practitioners desire increased professional independence whereas PA’s are comfortable in a more dependent role. In the US, there is a higher proportion of NP’s in the primary care setting than PA’s (Hooker & Berlin, 2002).

By definition, NP’s are professionally autonomous and assume liability as such (Larsson & Zulkowski, 2002). The relationships between physicians and PA’s tend to be more synergistic in nature. The employment of PA’s does not result in a substitution of physician services but rather acts to extend their services. Nurse Practitioners, on the other hand, can perform a number of services in place of a licensed physician with no requirement for physician oversight. For instance, a NP might examine a patient with chest pain and execute a management plan (e.g., prescribe a medication) without being required to consult with a physician. This autonomy derives from their status as licensed members of the nursing profession. The situation has provoked concerns among physician administrative bodies. An American Medical Association (AMA) report concluded that:
“physician care is based on cognitive and technical skills that are shaped by a unique education and experiences to form a foundation of clinical knowledge that allows physicians to decide what needs to be done across the wide variety of human maladies; that is irreplaceable by anyone with lesser training” (Rogers, 1994: page 14).

In a policy paper, the AMA has indicated that they will actively lobby against laws that allow advanced practice nurses to provide medical care without the supervision of a physician. The reticence of physician groups has caused legislators to be less than enthusiastic about allowing increases in the scope of NP practices (Gilliam, 1994).

An additional important deterrent to the widespread use of NP’s over PA’s is their unionized status. The nature of surgical care is such that surgical assistants must have significant flexibility in working hours and daily structure -- conditions that would violate most union regulations. Physician Assistant groups are generally non-unionized and recognize this as one of their main sources of competitive advantage. Despite their non-union status, PA’s tend to earn slightly higher salaries than NP’s.

Safety studies

Numerous studies have shown that PA’s practicing under supervision can do so with similar safety profiles as other health care providers. A two-year prospective cohort study on surgically induced abortions compared complication rates between those performed by
PA’s in a Vermont clinic and those performed by physicians in a New Hampshire clinic. In the study population of 1363 women, there were no statistically significant differences in complication rates between the two clinics (Goldman et al., 2004). A similarly conceived study on 2,458 first trimester abortions found that procedures performed by PA’s had complication rates of 27.4 per 1000 compared to 30.8 for physicians (Freedman et al., 1986). These authors advocated for the use of PA’s to offset the lack of physicians willing to perform abortions.

A satisfactory safety profile for physician extenders performing screening sigmoidoscopies has also been shown. A study published in the New England Journal of Medicine showed that Registered Nurses performed the procedure as safely as Gastroenterologists (Maule, 1994). Similar results were found in a study comparing 2,323 sigmoidoscopic examinations performed by non-physician providers to 1,378 performed by Gastroenterologists (Wallace et al., 1999). The costs were significantly less when performed by the non-physician providers ($186 compared to $283). A better designed randomized trial comparing nurse endoscopists to Gastroenterologists showed no differences in the detection of adenomatous polyps nor complication rates between the two groups (Schoenfeld et al., 1999). The conclusions of these papers collectively indicate that non-physician providers can play an important role in safely meeting the demand for screening sigmoidoscopies.

With respect to the safety of PA employment in other areas of medicine, the evidence is favourable. A retrospective study was performed after the introduction of PA’s into a
trauma services department. The substitution of PA’s for residents effected no significant changes in mortality and actually resulted in decreased length of stays (Oswanski et al., 2004). Similar findings were found when neonatal outcomes were compared for resident versus PA teams (Carzoli et al., 1994). With appropriate training and supervision, cardiology PA’s were able to perform cardiac catheterizations with similar complication rates as cardiology fellows with a trend towards the PA’s taking less time to complete the procedure (Krasuski et al., 2003). Similar results were found in an earlier study comparing cardiac catheterization outcomes between cardiology fellows and PA’s (DeMots et al., 1987).

**Benefits**

**Enhances physician productivity**

Physicians who employ physician extenders such as PA’s have been found to be more productive than those who do not. Physicians employing PA’s at the Mayo Clinic had increased productivity (Rodysill, 2003). Experiences with surgical PA’s in rural practice settings have resulted in significant time savings for general surgeons who could be freed up to concentrate on more acute and complex care needs (Maxfield, 1976). In family practice settings, the use of PA’s has been found to be cost effective with a compensation to production ratio of 0.36. The annual financial differential for the practice was $52,592 (Grzybicki et al., 2002). Similarly, PA’s employed in dermatology practices have been shown to generate up to six times their salaries in billings (Clark et al., 2000).
Productivity of physicians in a military clinic increased by up to 80.1% with the employment of PA’s (Cyr, 1985). Correspondence to many medical journals have described improved productivity and satisfaction with the employment of physician assistants (Morris, 2003).

The employment of PA’s as surgical assistants in community hospitals has been particularly gratifying as they are more specialized and less expensive than family practice residents or full-time surgeons (Heinrich et al., 1980).

Physician Assistants have become an integral component of cardiac care teams and have been instrumental in addressing the increasing need for cardiac services and the shortage of cardiologists (Lambrew et al., 2004). The use of PA’s in nephrology has been described as a necessity (G. O. Smith, 2004). Older research suggests a productivity advantage of PA’s over NP’s (Mendenhall et al., 1980).

**Lower costs**

Research shows that the employment of PA’s is very cost effective. Practices incorporating more PA’s had lower costs for minor severity visits such as upper respiratory tract infections. In the managed care organization setting, practitioner labour costs and total costs per visit were significantly lower among practices with greater use of PA’s (Roblin et al., 2004b). Encounter costs were found to be significantly decreased in similar cases managed by PA’s compared to physicians regardless of physician age, gender, health status and department (Hooker, 2002). In a study reviewing the work performed by PA’s and physicians in occupational medicine, the type of work performed
and efficiency were similar with the PA costing half as much in terms of salary (Hooker, 2004). A model applied to the HMO environment indicates that a primary care physician providing care to a baseline of 1,352 patients only needs to increase patient encounters by 650 in order to justify the costs of hiring a PA (Hummel & Pirzada, 1994). Moreover, PA’s have been found to use resources as or more effectively than residents in same practice settings (Van Rhee et al., 2002).

The use of PA’s has been embraced by US hospital administrators who view them as instrumental in maintaining standards of care in cost effective ways, relieving the burden on residents and helping to mitigate the impact of physician shortages (Cawley, 1991). It must be emphasized, however, that the cost-effectiveness of PA’s is related to the degree to which their capabilities are utilized (McKibbin, 1978).

**Lower training costs and times**

Tuition costs for two-year PA programs in the US are generally less than $50,000 US ("PA Tuition Costs", 2006). In contrast, medical school tuition costs can exceed $100,000 US for the four-year degree. Tuition for a medical degree at Dalhousie University is currently $12,806 per year.

Training a PA takes only a fraction of the time required to train a surgeon. A PA can be licensed to practice in six years after high school whereas a surgeon requires a minimum
of 13 years with most surgical residents choosing to pursue additional fellowship training (Figure 8).

![Figure 8: Professional Training Requirements](image)

<table>
<thead>
<tr>
<th>Degree</th>
<th>PA</th>
<th>Surgeon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate</td>
<td>4 years</td>
<td>4 years</td>
</tr>
<tr>
<td>Graduate</td>
<td>2 years (PA degree)</td>
<td>4 years (MD degree)</td>
</tr>
<tr>
<td>Post graduate surgical</td>
<td>--</td>
<td>5 years (FRCSC)</td>
</tr>
<tr>
<td>Fellowship</td>
<td></td>
<td>1-2 years</td>
</tr>
</tbody>
</table>

The shorter training times and lesser costs associated with PA education are much more feasible compared to surgeons’ training and can result in greater flexibility in meeting the manpower needs of surgical care.

**Decreased workload for surgical residents**

Recent mandates to decrease resident (surgery trainee) work hours to 80 per week in the US have necessitated the hiring of PA’s to fill the gap. A University of Pennsylvania study showed that 91% of their residents believed that the addition of PA’s was positive (Resnick et al., 2006). The introduction of PA’s in a university-based country hospital resulted in workload decreases from 102 hours per week to a mean of 87 hours per week over a 6-month period. Over the same period, 60% of the surgical residents perceived less stress at work. Each hour that the PA worked resulted in a one hour decrease in resident workload (Victorino & Organ, 2003).
Employment of PA’s will likely improve the quality of resident training as the PA generally takes on the less educationally valuable work. The increased productivity of their surgical teachers in combination with the residents’ extra time will allow them to see and participate in more surgical cases.

**Remuneration**

The median income for PA’s in the US is $73,778 with some interstate variability. For example, median PA salaries in Maine are $69,881. It is interesting to note that in the states where NP’s have received substantial autonomy, their incomes have lagged significantly behind PA’s (Michael *et al.*, 2005).

**Physician Assistant Training**

**Training programs**

The only PA training program in Canada is the Canadian Forces Medical Service School (CFMSS) in Borden Ontario. An initiative is currently underway at the University of Manitoba to open the first civilian PA training program in Canada. The curriculum, prerequisites and certification processes are to be modeled upon those currently active in the US. Accordingly, the following descriptions pertain to US training programs.

**Prerequisites**

The prerequisites for entry into a PA program are variable. Typical requirements include a bachelor level degree and a couple of years of health care experience. For example, Duke University requires a baccalaureate degree including at least five biological
sciences full credit courses. Courses in anatomy, physiology and microbiology are necessary. In addition, at least two chemistry courses with labs and a statistics course are required. Applicants must also take and submit scores on the Graduate Record Examination (GRE). The GRE is a general test that measures performance in analytical writing, verbal abilities and quantitative reasoning/problem solving. Applicants must also have completed a minimum of 1000 hours of hands-on patient care experience. Typical applicant groups include nurses, paramedics, nurse’s aides and health care technologists. Tuition fees are $24,996 for each of the two years in the Duke University program. Reduced fees are available to students at other academic centers (fees at the University of Wisconsin are $28,639 for the complete program ("University of Wisconsin", 2005).

**Curriculum**

The typical duration of a PA training program is 26 months. Most programs are completed over two years including summer semesters. The first year is didactic in nature and includes courses in basic medical sciences which are often taken with first year medical students. The second year is clinically based whereby students rotate through a number of different health care services.
An example of the PA curriculum at Yale University is reproduced below ("Yale University", 2005).

**Year 1 (didactic phase)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy (including dissection lab)</td>
<td>111</td>
</tr>
<tr>
<td>Introduction to research methods</td>
<td>25</td>
</tr>
<tr>
<td>Clinical practicum</td>
<td>45</td>
</tr>
<tr>
<td>Clinical psychiatry</td>
<td>15</td>
</tr>
<tr>
<td>Diagnostic imaging</td>
<td>20</td>
</tr>
<tr>
<td>Emergency medicine and trauma</td>
<td>515</td>
</tr>
<tr>
<td>Ethics</td>
<td>168</td>
</tr>
<tr>
<td>Human sexuality</td>
<td>5</td>
</tr>
<tr>
<td>Introduction to surgical skills</td>
<td>16</td>
</tr>
<tr>
<td>Medicine and surgery</td>
<td>262</td>
</tr>
<tr>
<td>Microbiology</td>
<td>41</td>
</tr>
<tr>
<td>PA profession</td>
<td>8</td>
</tr>
<tr>
<td>Pathology</td>
<td>21</td>
</tr>
<tr>
<td>Pharmacology</td>
<td>60</td>
</tr>
<tr>
<td>Physical examination and history taking</td>
<td>55</td>
</tr>
<tr>
<td>Physiology</td>
<td>60</td>
</tr>
<tr>
<td>Preventive medicine</td>
<td>10</td>
</tr>
</tbody>
</table>
Year 2 (clinical phase)

Involves 14 four week blocks in which eight are mandatory.

<table>
<thead>
<tr>
<th>Mandatory rotations</th>
<th>Elective rotations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency medicine</td>
<td>Ambulatory medicine</td>
</tr>
<tr>
<td>Primary care</td>
<td>Cardiology</td>
</tr>
<tr>
<td>General surgery</td>
<td>Cardiology</td>
</tr>
<tr>
<td>Internal medicine</td>
<td>Dermatology</td>
</tr>
<tr>
<td>Obstetrics and Gynecology</td>
<td>Diagnostic imaging</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>Endocrinology</td>
</tr>
<tr>
<td>Psychiatry</td>
<td>Gastroenterology</td>
</tr>
<tr>
<td>Geriatrics</td>
<td>Hematology/Oncology</td>
</tr>
<tr>
<td></td>
<td>Occupational medicine</td>
</tr>
<tr>
<td></td>
<td>Infectious disease</td>
</tr>
<tr>
<td></td>
<td>Neonatology</td>
</tr>
<tr>
<td></td>
<td>Ophthalmology</td>
</tr>
<tr>
<td></td>
<td>Orthopedic surgery</td>
</tr>
<tr>
<td></td>
<td>Otolaryngology</td>
</tr>
<tr>
<td></td>
<td>Pediatric cardiology</td>
</tr>
<tr>
<td></td>
<td>Plastic and reconstructive surgery</td>
</tr>
<tr>
<td></td>
<td>Pulmonary medicine</td>
</tr>
<tr>
<td></td>
<td>Sports medicine</td>
</tr>
<tr>
<td></td>
<td>Neurology</td>
</tr>
</tbody>
</table>

There are a number of US programs that will specifically train surgical PA’s. Physician Assistants enroll in the program after finishing their general PA training. Many of them are orthopedic based; a typical curriculum would involve: Spine service (2 weeks), Hand
service (2 weeks), Foot and ankle (2 weeks), Sports Medicine (2 weeks), General orthopedics (8 weeks), Physical Medicine/Rehab (2 weeks), Radiology (1 week) and Physical therapy (1 week) ("Physician assistant post graduate orthopaedic surgery fellowship program", 2005). PA’s may then write an optional component of the Physician Assistant National Certifying Exam (PANCE), which represents added qualifications to work in a surgical practice (see below). This added qualification, however, is generally not required to work in a surgical practice.

Military PA training is an alternate stream in the US. Despite some differences in their curriculum, on average, military trainees have been found to score higher than civilians on the certification examinations (Cody et al., 2004).

**Certification**

All PA trainees in the US must pass the Physician Assistant National Certification Examination (PANCE) which is administered by the National Commission on the Certification of Physician Assistants (NCCPA). The examination is standardized across the country. Successful completion of the PANCE examination allows PA’s to use the PA-C designation which is required by almost all employers.

In 2003, the CMA officially recognized Canada’s Military Physician Assistants. This crucial step in the PA profession will result in the development of standardized training
programs and a conjoint accreditation program in Canada ("CMA PA recognition", 2003).

**Accreditation**

In the US, the Accreditation Review Commission on Education for the Physician Assistant (ARC-PA) is responsible for defining the standards of PA education. These standards were updated in March 2005 and are set to become operational in September 2006. The standards are available at

http://www.arc-pa.org/General/standards/newStandards3.31.05.pdf.

There were approximately 133 accredited training programs in the US in 2002. Degrees are awarded at either the masters or bachelor level. The accreditation standards for PA’s have been drawn up with the cooperation of a number of physician groups including the American Academy of Family Physicians, the American Academy of Pediatrics, the American Academy of Physician Assistants, the American College of Physicians, the American College of Surgeons, the American Medical Association, and the Association of Physician Assistant Programs. Accreditation is currently a voluntary process that includes a comprehensive review of each program’s curriculum. Clear expectations regarding the administration, curriculum and evaluation process are found in the ARC-PA Accreditation Standards for Physician Assistant Education 3.31.05, Third Edition (Arc-PA, 2005).
**Liability issues**

Delegation of duties within a physician’s scope of practice may include:

- Prescriptions
- Physical examinations
- Diagnosing and treating illness
- Surgical assisting
- Many of the routine functions that the physician would otherwise perform

Currently liability coverage for the few PA’s that are currently working in Canada is haphazard. There are three categories of PA’s working in the civilian sector. The first group is employed by organizations such as oil and mining companies. They provide basic medical services to remote locations such as oil rigs, ships and mines. The second group is hired by medical services corporations to provide basic medical care to institutions such as Corrections Canada. An example of such a company would be Praxis, which is based in Halifax. Liability insurance for the PA’s working for these companies is generally purchased from private carriers such as Encon Canada. District health authorities employ the third group, the only example currently being the Winnipeg Regional Health Authority which employs three PA’s. Liability coverage in these cases is extended through the institution itself. Liability coverage for PA’s working in the military is covered by that institution.
The Canadian Medical Protective Association (CMPA) is the liability insurance carrier for physicians in Canada. They will extend coverage to salaried employees of physicians but not to NP’s. Nurse Practitioners are generally covered under an institutional policy or under the Canadian Nurse Protective Society (CNPS)(“CNPS”, 2004). The CMPA does not currently have a policy regarding extending liability coverage to PA’s though the issue is apparently under consideration (McEwen, 2006).

Generally, if a PA is accused of malpractice, the supervising physician is also named in the suit. Charges are usually related to the nature of supervision and scope of practice that the PA has been delegated (Dorothy, 2005).

**Licensing**

Licensing is the responsibility of each state and will likely come under the purvey of individual provinces in Canada. The only province with legislation specific to PA licensing is Manitoba. Indeed, Manitoba has been very pro-active in this regard. Licensing PA’s in Nova Scotia would require appropriate legislation and, as such, PA’s cannot legally practice in this province.

**Maintenance of competence**

In the US, PA’s are required to perform 100 hours of continuing medical education (CME) every two years in order to maintain certification. In addition, they are required to write a recertification examination every six years.
**Physician acceptance**

Physicians receiving referrals directly from PA’s have generally been satisfied with the appropriateness of the referral. However, those employing a PA in their practice were even more likely to be pleased with the quality of the referral (Enns et al., 2003).

Despite evidence of their safety, there has been some resistance among Gastroenterologists to employ PA’s to perform more invasive procedures such as flexible sigmoidoscopy. Concerns regarding PA and NP endoscopy abilities resulted in only 3% of those surveyed employing them for this purpose (Sansbury et al., 2003). A 30 year review of the experience of the Emory cardiovascular surgery departments with PA’s has been positive with PA numbers increasing from 2 to 23 over that period (Thourani & Miller, 2006).

**Patient acceptance**

It has been suggested that patients may be reluctant to accept care by PA’s because they are less trained than physicians. Research indicates, however, that these concerns can be alleviated with patient assurances of proper PA supervision and knowledge of their training requirements (C. Smith, 1981). Patient satisfaction with PA encounters in the emergency department has been promising (Counselman et al., 2000). A national US survey of 3770 elderly Medicare recipients who identified PA’s as their primary providers found that most were satisfied with their medical care (Cipher et al., 2006). Patient acceptance of the quality of care provided by PA’s in the pediatric setting is high
(Wallen et al., 1982). Using logistic regression analysis, Roblin was able to show in a review of 41,209 surveys that patients were satisfied with the care provided by PA’s (Roblin et al., 2004a).
Chapter 3: Anesthesia Assistants

Anesthesia assistants (AA’s) are employed in a number of facilities throughout Canada. Their primary involvement is in the set up, maintenance and troubleshooting of anesthetic equipment. They are often present during the induction (putting to sleep) and emergence (awakening) phases of a general anesthetic and will assist the anesthetist (also referred to as anesthesiologist) with the multitude of activities required at this time. In addition, they will monitor the patient and anesthetic equipment for short periods. It is widely accepted that AA’s enable anesthetists to be more productive (du Boulay & Nixon, 2000).

The Canadian Anesthesiologists’ Society (CAS) supports a team-oriented model of delivering anesthetic care whereby AA’s work under the direct supervision of an anesthetist (Nugent, 2000). The anesthetist retains final responsibility for the patient’s care.

Anesthesia Assistants are generally drawn from Respiratory Therapist or nursing pools. These providers enroll in further training at institutions such as the Michener Institute for Applied Health Sciences in Toronto. The Michener Institute has developed a program in conjunction with the University of Toronto, which gives certification as either basic or advanced AA’s ("Anesthesia Assistant", 2006). Basic level trainees provide airway, equipment and IV fluid management assistance to supervising anesthetists. Advanced level trainees can perform additional tasks such as provision of conscious sedation, administration of anesthetic gases and medications and insertion of intravenous and arterial lines either under direct supervision or through medical directives. Each level
requires one semester to complete and includes online learning materials, classroom instruction and a short clinical component. The advanced certification is a new development (2005), which brings the scope of Canadian AA graduates closer to that of Anesthesia PA’s in the US.

Anesthesia PA’s administer anesthetics under the supervision of an anesthesiologist and participate in all components of the anesthetic process. They are able to initiate the anesthetic by performing intubations, administrating vasoactive substances and administering blood and other treatment modalities. Regulations in the US will allow one anesthetist to supervise up to four anesthesia PA-run operating rooms.

The first training program for anesthesia PA’s was founded at Emory University in Atlanta in 1971. The program is distinct from those training general PA’s in that the focus is entirely on anesthesia. The program is completed over 27 months and has similar admission requirements as general PA programs. There are three other anesthesia PA training programs located at Case Western University, South University and Nova SouthEastern University ("Anesthesia PA's", 2006). These programs are growing rapidly due to the support of US anesthetists who have witnessed significant inroads into their practices by Certified Registered Nurse Anesthetists (CRNA’s). CRNA’s, in contrast to anesthesia PA’s, can work under the supervision of any surgeon, dentist or licensed practitioner. While the scope of practice of both groups is similar, many practices have moved to CRNA’s as they are significantly less expensive. Anesthesia Assistants can work only under the supervision of an anesthetist.
At present, Canadian AA’s are not being utilized to the same extent as anesthesia PA’s in the US. The Dalhousie University Department of Anesthesia in Halifax has probably been the most progressive in Canada. Their use of AA’s is permitting individual anesthetists to run two ophthalmology rooms simultaneously. Thus far, the rooms involve low acuity cases under conscious sedation only. With further experience, it may be possible to run two general anesthesia rooms under the supervision of a single anesthetist.
Chapter 4: Current Inefficiencies in the Delivery of Surgical Services at the New Halifax Infirmary

Introduction

Surgical PA’s have the potential to play an important role in the delivery of surgical services in Canada. As described in the preceding sections, the bulk of experience with the implementation and use of PA’s has been in the United States. Fundamental differences in the administration and remuneration structure of the Canadian system create a unique context in which PA’s might have value. The purpose of this component of the investigation is to explore the inefficiencies within an individual Canadian surgeon’s practice and to identify the role that a PA might play in addressing them.

Methods

The investigation has been divided into three parts. The first is a feasibility study which analyzes historical operating room data at the New Halifax Infirmary and Victoria General Hospital in Halifax, Nova Scotia. The second involves a detailed prospective time series investigation of the daily inefficiencies in a surgeon’s practice with attention to the theoretical role that a PA might have. Using this information, a number of PA hiring scenarios are modeled in a formal business case analysis (part three).
Feasibility study

Detailed operative data for every surgical procedure performed at the New Halifax Infirmary and the Victoria General Hospital have been collected for the past ten years in a Surgiserver® database. The fields collected include: surgeon, procedure, date of surgery, time that room becomes available, anesthesia start time, procedure start time, procedure finish time and the time that the patient left the room. Data specific to plastic surgery procedures between 1996 and 2006 were used for the purposes of this study.

The data were imported into an excel spreadsheet. Procedure length was calculated from the start and finish times. In some cases, finish times were after midnight in which case the procedure length calculation was invalid. These cases were manually sorted and corrected to reflect the actual procedure length. The cleaned data set was then imported into SPSS ver. 11.5. The day of the week was calculated from the date fields allowing Saturdays and Sundays to be excluded from the subsequent analysis. In some cases, two operating rooms were run on the same day. Using the surgeon and date fields, recoding was performed to resolve the data into days of surgery. The file was then split into days of surgery with descriptive statistics being calculated. Mean operative time per day, with associated standard deviations, standard errors and 95% confidence intervals were determined.
Efficiency study

Start and finish times were prospectively collected for every patient encounter over a five-month period (November 2005 to March 2006) in a single surgeon’s practice. The data were collected using a Palm Treo 600 handheld computer running a HandBase® database specifically written for the project. Data were collected on each day that patient encounters took place. The nature of the patient encounters was dependent on the day of the week (Figure 9).

Figure 9: Weekly Work Breakdown

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waitlist OR</td>
<td>Elective OR</td>
<td>Minor OR</td>
<td>Clinic</td>
<td>Waitlist OR/ Minor OR</td>
</tr>
</tbody>
</table>

Waitlist operating room (OR) days are generally composed of trauma surgeries. These tend to be relatively fast paced cases such as facial fractures, hand fractures, burns and tendon/nerve injuries. On elective OR days, lengthier cases such as breast cancer reconstructions and microsurgical cases are performed. Minor procedures, such as carpal tunnel releases and skin cancer resections, are performed under local anesthesia in the minor OR and clinics consist of new patient consultations and post-operative follow-up visits.
Clinic Setting

A designated database was used to collect information from the clinic setting. The fields collected are shown in Figure 10. Whether the surgeon was required during the patient encounter was determined by resident staff based on their judgment as to whether they could have dealt with the patient independently, without direct staff supervision.

Figure 10: Clinic Data Collection Fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td></td>
</tr>
<tr>
<td>Event type</td>
<td>• New patient • Recheck</td>
</tr>
<tr>
<td></td>
<td>• Breast cancer • Hand • Other</td>
</tr>
<tr>
<td>Provider</td>
<td>• Surgeon • Student/resident</td>
</tr>
<tr>
<td>Surgeon needed</td>
<td>• Yes • No</td>
</tr>
<tr>
<td>Start time</td>
<td></td>
</tr>
<tr>
<td>Finish time</td>
<td></td>
</tr>
<tr>
<td>Booking time</td>
<td></td>
</tr>
<tr>
<td>Arrival time</td>
<td></td>
</tr>
</tbody>
</table>
Operating Rooms

A separate database was used to collect start and finish times associated with the different procedural components (events) of a given surgical case. The fields are outlined in Figure 11 for all of the operative areas. Figure 12 shows the sequence of events involved in performing a procedure in the minor procedure area. Anesthesia induction (patient put to sleep) and anesthesia emergence (patient woken up) data were included for the main OR.

Figure 11: Operating Room Data Fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td></td>
</tr>
<tr>
<td>Setting</td>
<td>• Minor procedures</td>
</tr>
<tr>
<td></td>
<td>• Main OR waitlist</td>
</tr>
<tr>
<td></td>
<td>• Main OR elective</td>
</tr>
<tr>
<td>Event type</td>
<td>• Clean room</td>
</tr>
<tr>
<td></td>
<td>• Check patient</td>
</tr>
<tr>
<td></td>
<td>• Marking</td>
</tr>
<tr>
<td></td>
<td>• Anesthesia</td>
</tr>
<tr>
<td></td>
<td>• Prep/drape</td>
</tr>
<tr>
<td></td>
<td>• Cut</td>
</tr>
<tr>
<td></td>
<td>• Sew</td>
</tr>
<tr>
<td></td>
<td>• Dressing</td>
</tr>
<tr>
<td></td>
<td>• Emergence</td>
</tr>
<tr>
<td>Start time</td>
<td></td>
</tr>
<tr>
<td>Finish time</td>
<td></td>
</tr>
</tbody>
</table>
Figure 12: Sequence of Events in the Minor Procedure Area

The operating room data were imported into an excel spreadsheet. The duration of each event making up a given surgical case was calculated from the start and finish times. Each data sheet was then imported into SPSS. Descriptive and frequency statistical functions were employed for data analysis.
Results

Feasibility Study

Over the ten-year period, 3,635 operative days were performed by the plastic surgery division. The mean operative time was 5.93 hours per ten-hour day (95% CI 5.86 to 6.00), equivalent to an individual surgeon operating only 59% of the time.

Efficiency Study

Clinic

Data were collected for 13 clinics in which 806 patients were cumulatively seen. The number of patients per clinic ranged from 43 to 80. Recheck visits comprised 69.5% of the patient volume. The average encounter time was 5.7 minutes. Residents felt that the surgeon was required for 46.5% of patient encounters with breast cancer related visits needing proportionately more oversight from the surgeon compared to hand or other cases. With respect to recheck patients, the surgeon was required for only 39% of encounters (Figure 13).
Figure 13: Surgeon Necessity for Different Visit Types

<table>
<thead>
<tr>
<th>Visit type</th>
<th>No.</th>
<th>Surgeon needed</th>
<th>Mean visit time</th>
<th>95% CI (mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>99</td>
<td>77 %</td>
<td>8.2 mins</td>
<td>(7.3, 9.2)</td>
</tr>
<tr>
<td>Hand</td>
<td>334</td>
<td>39 %</td>
<td>4.9 mins</td>
<td>(4.6, 5.3)</td>
</tr>
<tr>
<td>Other</td>
<td>373</td>
<td>46 %</td>
<td>5.8 mins</td>
<td>(5.3, 6.3)</td>
</tr>
<tr>
<td>New patient</td>
<td>246</td>
<td>64 %</td>
<td>5.9 mins</td>
<td>(5.4, 6.4)</td>
</tr>
<tr>
<td>Recheck</td>
<td>560</td>
<td>39 %</td>
<td>5.7 mins</td>
<td>(5.3, 6.1)</td>
</tr>
</tbody>
</table>

Further analysis of the data using 2x2 tables showed that the surgeon was necessary for only 27% of hand rechecks but 76% of breast rechecks. The PA could potentially see the 53.5% of patients that don’t need to be seen by the surgeon. Considering that the surgeon would be seeing the longer duration breast related cases the overall increase in the surgeon’s productivity by having a PA in clinic would be 51%.

Operating Room

Operating room data were collected for 979 events over the course of 17 minor OR days and 22 main OR days (14 elective, 8 waitlist). The relative times to complete each step of the procedure for the minor OR and main OR days are shown in Figures 14 and 16, respectively.
Table 1: Mean Duration of Surgical Events – Minor Procedures

<table>
<thead>
<tr>
<th>Event</th>
<th>Minor OR (mins)</th>
<th>(95% CI)</th>
<th>Percent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark patient</td>
<td>5.2</td>
<td>(4.2, 6.3)</td>
<td>11.2 %</td>
</tr>
<tr>
<td>Prep/drape</td>
<td>5.8</td>
<td>(5.1, 6.3)</td>
<td>12.5 %</td>
</tr>
<tr>
<td>Cut</td>
<td>11.7</td>
<td>(8.8, 14.7)</td>
<td>25.2 %</td>
</tr>
<tr>
<td>Sew</td>
<td>12.6</td>
<td>(10.9, 14.4)</td>
<td>27.2 %</td>
</tr>
<tr>
<td>Dressing</td>
<td>4.3</td>
<td>(2.8, 5.8)</td>
<td>9.3 %</td>
</tr>
<tr>
<td>Clean room</td>
<td>6.8</td>
<td>(5.7, 8.0)</td>
<td>14.7 %</td>
</tr>
<tr>
<td>Total</td>
<td>46.5</td>
<td></td>
<td>100 %</td>
</tr>
</tbody>
</table>

Physician assistants can carry out the prep/drape, sew and dressing steps thereby performing 48.8% of the procedure that the surgeon would otherwise perform. The percentage time breakdowns with and without a PA are shown in Figure 15.

Figure 15: Provider Work Breakdown – Minor Procedures
Clearly, the use of a PA in the minor OR setting is beneficial. The majority of the surgeon’s time could be delegated to the PA thereby freeing the surgeon to perform other tasks.

Results from the main (elective and waitlist) OR were less dramatic. Similar to the minor OR, cutting and sewing were the two greatest time consumers. Proportionately much more time is spent cutting than sewing in the main OR. The event specific time series data for the elective operating room and the waitlist OR are seen in Figure 16.

Figure 16: Mean Duration of Surgical Events – Main OR

<table>
<thead>
<tr>
<th>Event</th>
<th>Elective OR (95% CI)</th>
<th>Percent of total</th>
<th>Waitlist OR (95% CI)</th>
<th>Percent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark patient</td>
<td>12.0 (9.7, 14.3)</td>
<td>5.2 %</td>
<td>4.8 (0.0, 11.3)</td>
<td>2.9 %</td>
</tr>
<tr>
<td>Check patient</td>
<td>14.3 (10.2, 18.3)</td>
<td>6.1 %</td>
<td>11.9 (8.1, 15.7)</td>
<td>7.2 %</td>
</tr>
<tr>
<td>Induction</td>
<td>23.6 (17.9, 29.3)</td>
<td>10.2 %</td>
<td>24.4 (18.6, 30.3)</td>
<td>14.7 %</td>
</tr>
<tr>
<td>Prep/drape</td>
<td>17.1 (12.9, 21.4)</td>
<td>7.4 %</td>
<td>11.8 (8.4, 15.2)</td>
<td>7.1 %</td>
</tr>
<tr>
<td>Cut</td>
<td>73.7 (53.2, 94.2)</td>
<td>31.8 %</td>
<td>56.7 (37.0, 76.4)</td>
<td>34.2 %</td>
</tr>
<tr>
<td>Sew</td>
<td>42.5 (25.7, 59.2)</td>
<td>18.3 %</td>
<td>15.8 (8.2, 23.4)</td>
<td>9.5 %</td>
</tr>
<tr>
<td>Dressing</td>
<td>6.9 (4.6, 9.1)</td>
<td>3.0 %</td>
<td>6.3 (4.0, 8.7)</td>
<td>3.8 %</td>
</tr>
<tr>
<td>Emergence</td>
<td>11.2 (9.3, 13.1)</td>
<td>4.8 %</td>
<td>9.1 (5.8, 12.4)</td>
<td>5.5 %</td>
</tr>
<tr>
<td>Clean room</td>
<td>30.9 (15.5, 46.2)</td>
<td>13.3 %</td>
<td>24.9 (18.5, 31.4)</td>
<td>15.0 %</td>
</tr>
</tbody>
</table>

Mean procedure times are longer in the elective OR than in the waitlist OR. Cleaning room times are shorter in the waitlist OR, likely as a result of the lower acuity of these
cases. Cases in the elective OR involved a greater degree of sewing and would therefore be a better match for a PA’s capabilities. In this case, the PA could perform 28.6% of the procedure in the elective OR and 20.5% in the waitlist OR. The operating room data were amalgamated to reflect event times for cases under general anesthesia (Figure 17).

Figure 17: Mean Duration of Surgical Events – General Anesthesia

<table>
<thead>
<tr>
<th>Event</th>
<th>Operating time (mins)</th>
<th>95% CI</th>
<th>Percent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark patient</td>
<td>10.7</td>
<td>8.4, 13.0</td>
<td>5.3%</td>
</tr>
<tr>
<td>Check patient</td>
<td>13.1</td>
<td>10.4, 15.9</td>
<td>6.4%</td>
</tr>
<tr>
<td>Induction</td>
<td>24.0</td>
<td>20.0, 28.0</td>
<td>11.8%</td>
</tr>
<tr>
<td>Prep/drape</td>
<td>14.6</td>
<td>11.8, 17.4</td>
<td>7.2%</td>
</tr>
<tr>
<td>Cut</td>
<td>65.4</td>
<td>51.4, 79.3</td>
<td>32.1%</td>
</tr>
<tr>
<td>Sew</td>
<td>31.5</td>
<td>20.7, 31.5</td>
<td>15.5%</td>
</tr>
<tr>
<td>Dressing</td>
<td>6.6</td>
<td>5.1, 8.2</td>
<td>3.2%</td>
</tr>
<tr>
<td>Emergence</td>
<td>10.2</td>
<td>8.3, 12.0</td>
<td>5.0%</td>
</tr>
<tr>
<td>Clean room</td>
<td>27.5</td>
<td>20.4, 34.5</td>
<td>13.5%</td>
</tr>
<tr>
<td><strong>Total time</strong></td>
<td><strong>203.6</strong></td>
<td><strong>100%</strong></td>
<td></td>
</tr>
</tbody>
</table>

The percentage time breakdowns with and without a PA for cases under general anesthesia are shown in Figure 18.
Figure 18: Provider Work Breakdown – General Anesthesia ORs

<table>
<thead>
<tr>
<th></th>
<th>Nursing</th>
<th>Anesthesia</th>
<th>Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor OR</td>
<td>19.9%</td>
<td>16.8%</td>
<td>63.3%</td>
</tr>
<tr>
<td>Elective OR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waitlist OR</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The percentage work time contribution of each specialty group is shown in Figure 19 and 20. Clearly PA’s would have the greatest role in the minor OR setting.

Figure 19: Percentage Work Time Contribution per Provider

<table>
<thead>
<tr>
<th></th>
<th>Minor OR</th>
<th>Elective OR</th>
<th>Waitlist OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA</td>
<td>48.8 %</td>
<td>28.6 %</td>
<td>20.5 %</td>
</tr>
<tr>
<td>Nursing</td>
<td>14.7 %</td>
<td>19.4 %</td>
<td>22.2 %</td>
</tr>
<tr>
<td>Surgeon</td>
<td>36.4 %</td>
<td>36.9 %</td>
<td>37.1 %</td>
</tr>
<tr>
<td>Anesthesia</td>
<td>15.0 %</td>
<td>20.2 %</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100 %</td>
<td>100 %</td>
<td>100 %</td>
</tr>
</tbody>
</table>
Figure 20: Percentage Work Time Contribution by Setting

Figure 21 illustrates that the surgeon is performing core competency activities less than 40% of the time in each of the operative areas.

Figure 21: Percentage Work Time Contribution by Provider
Summary

The percentage work that could be delegated to a PA for each day of the week is summarized in Figure 22. The PA work profile is ideally suited for assisting in the clinic, minor OR and to a lesser extent the elective operating room.

Figure 22: Daily PA Enabled Productivity Increases

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waitlist OR</td>
<td>Elective OR</td>
<td>Minor OR</td>
<td>Clinic</td>
<td>Waitlist OR/Minor OR</td>
</tr>
<tr>
<td>20.5 %</td>
<td>28.6 %</td>
<td>48.8 %</td>
<td>51.0 %</td>
<td>34.7 %</td>
</tr>
</tbody>
</table>

The fact that the surgeons’ are only using their core competency 40% of the time in all surgical areas emphasizes the potential for increasing surgical productivity. This could be achieved by allowing surgeons to run two operating rooms simultaneously – a scenario which would effectively double surgical productivity.

Increasing the caseload efficiency of a surgeon would be best achieved through the hiring of a PA. The PA could prep and drape patient A, at which point the surgeon enters the room and performs the cutting portion of the procedure. As cutting proceeds, the PA would move to the next room to prep and drape patient B. After the surgeon finishes operating on patient A, he/she proceeds to operate on patient B while the PA carries out
final steps on patient A (suturing wounds, applying dressings, etc.) The PA and surgeon
then switch rooms again and the cycle continues allowing entry of patient C.

These findings suggest the potential for significantly increasing productivity at lesser
incremental costs compared to hiring a second surgeon. There is a need to carefully
analyze the financial implications related to PA employment. Will the potential
productivity increases offset the costs of employing them over the long run? Can more be
done for less? What are the risks? These questions and others will be addressed in the
following business case analysis.
Chapter 5: Business Case Analysis

A Business Case for the Employment of Physician Assistants in Surgical Practice

Projections for fiscal years 2006 – 2016

Submitted and prepared by:

Leif Sigurdson MD, MSc, FRCSC

Completed: March 30, 2006

Submitted: April 5, 2006

Submitted to:

Dr. Terry Wagar – Saint Mary’s University Sobey School of Business
Honourable Chris d’Entremont – Minister of Health, NS Legislature
Cheryl Doiron – Deputy Minister of Health, NS
Dr. John Hamm – Former Premier, Government of NS

Disclaimer:

This report provides approximations of important financial and health related consequences that should be considered in the decision to employ Physician Assistants (PA’s) in a clinical setting. The analysis is based on information obtained from hospital databases and data collected by the author. The information is believed to be accurate. Costing and salary information is subject to change at any time.
Introduction

Subject:

This business case examines the potential costs and benefits that might follow the hiring of a Physician Assistant (PA) in a solo clinical practice setting. The hiring of a PA is proposed to increase the clinical efficiency of individual surgeons by allowing them to concentrate their efforts on their core competency, namely operating. Physician Assistants would be expected to shoulder much of the non-essential but important work that individual surgeons do on a daily basis. Increases in surgical efficiency should decrease lengthy waiting times for Nova Scotians. The proposal calls for several major actions, including the hiring of a surgical PA and increases in operating room capacity. The analysis covers the estimated consequences (both financial and non-financial) of these actions as they impact the Capital District Health Authority (CDHA) during the years 2006 to 2016.

Purpose:

The following business case is prepared for the purposes of assisting decision makers in evaluating the merits of hiring a new class of health care provider on a trial basis.
Objectives

The following are institutional (CDHA) based objectives that are potentially impacted by the hiring of PA’s in a surgical practice setting. They have been adapted from those published by the CDHA ("CDHA Strategic Plan", 2006):

Improve Care for Patients, Clients and Community

- Provide care that centers on the patient’s needs
- Improve access by managing waiting lists
- Improve the quality of our work by adopting best practices, using our resources wisely, integrating services, and continuously striving to improve health outcomes

Create a Healthy Workplace

- Achieve better balance of work, home and community by planning and recruiting to meet human resource needs; matching the work to available resources, and providing more flexible work arrangements
- Develop work environments that enhance safety, teamwork, communication, and valuing people
- Support career development that encourages personal growth and learning
- Meet and improve on prevailing standards of care with due consideration of the safety of patients
Build Knowledge

- Foster interdisciplinary care teams and share knowledge to improve care
- Support and promote research and education
- Continuously learn and improve by promoting a culture of evidence-based practice, inquiry, evaluation, and lifelong learning

Show Leadership and Advocacy

- Work together with other health care providers
- Promote partnerships in a broader approach to health
- Manage our fiscal resources responsibly

Financial and Institutional Performance

- Manage fiscal resources responsibly
- Reduce Costs
- Decrease surgical wait list times

Operations and Functions

- To increase the productivity of health care professionals
• To better utilize hospital resources

Employees and Work Environment

• To recruit top quality professionals
• To retain high quality employees
• To provide a rewarding work environment

Image

• To be recognized as a leader in health care delivery
• To be recognized as innovators of health care delivery
• To be recognized for delivering outstanding timely health care

Of the preceding objectives, the most important are managing fiscal resources in the most responsible manner to provide the most benefit to patients. Fiscal resources in this case include the broader scope of physician remuneration, which is not specifically influenced by the CDHA. Benefits to patients include timelier access to care and shortened waiting lists in an environment that emphasizes standards of care and patient safety. Overall costs would be expected to increase with the hiring of a PA as a result of amplified operating room utilization. However, marginal costs would be expected to decrease as a result of the improved output from fixed salaried surgeons.
Opportunities and threats

The Nova Scotia provincial health care system is under great strain. Waiting times for surgical services are increasing. There is growing public concern regarding performance of the system. The current health care infrastructure is ill equipped to meet the health care needs of the ‘baby boomer’ cohort and the many Nova Scotians returning to the province for their retirement years. Nursing and Medical schools have not met the current demand for health care providers and have no contingency plans for meeting the greater future needs. Almost 50% of the current provincial budget is spent on health care. The greater needs of the retiring ‘Boomer’ generation will be borne on the tax base supported by the much smaller “X” and “Y” generations, a situation that surely will create a financial crisis. The emasculation of our current publicly administered system and the rise of a parallel private one are inevitable. Increasing current enrollment in medical and nursing schools will not be timely enough and is prohibitively expensive.

There is an urgent need to investigate different models of delivering health care -- a model in which Physician Assistants could play an important role.

Limitations or constraints

There are a number of limitations and constraints regarding the implementation of PA’s. At the time of this writing, there is no legislation that specifically addresses licensure for PA’s in the Province of Nova Scotia. The only province that specifically supports the
profession is Manitoba. Physician Assistants currently work in the military setting with only a few working in the civilian sector using work around solutions. Hiring PA’s will require some up-front investment with a longer pay back period. In the short run, health care costs will increase.

The supply of PA’s is an additional limitation. The only PA training program in Canada is at Canadian Forces Base (CFB) Borden; their mandate is only to train sufficient numbers to meet the needs of the military. The available pool for civilian use is therefore only retiring military PA’s and US trained PA’s. A civilian PA training program is being established at the University of Manitoba which will likely supply regional needs. A future program in Halifax is feasible considering the high concentration of Universities in the city.

The position of Nova Scotia’s nursing unions regarding PA’s is unknown. The specialty may be perceived as a threat. Permission to tinker with aspects of the health delivery system will also require some courage on the part of provincial legislators and health care administrators.
Methods and Assumptions

Scope and boundary definitions

The analysis period for this business case spans September 1, 2006 through September 1, 2016. The scope of the case is primarily limited to the Plastic Surgery Division and the New Halifax Infirmary (NHI) operating and clinical facilities within the CDHA. Cost estimates cover the operations of the NS Department of Health and the CDHA.

Decision criteria

A number of financial and non-financial metrics will be targeted. Surgical productivity is the primary outcome variable and has been distilled in dollar figures (described later).

Financial criteria include:

Total net cash flow for the analysis period (a proxy for clinical productivity)

Total net cash flow represents the combined result of all estimated inflows and outflows. Net cash flow is presented in dollars for the ten-year period. Cumulative net cash flow for each year of the analysis period is also presented in the cash flow summary.
Net present value (NPV) of the cash flow stream

NPV reflects the value of cash flows discounted at a rate of 9% per annum and a second NPV reflecting discounting at 15% per annum. NPV is presented in dollars for the ten-year period.

Payback period

Payback period reflects the number of years required for the initial PA related costs to be recovered from the gains.

Return on investment (ROI)

The return on investment represents the projected incremental productivity gains (in dollars) from hiring a PA, divided by the investment costs. ROI is presented as a percentage, in which all values in excess of 0% represent a net gain from the investment.

Internal rate of return (IRR)

The internal rate of return is the interest rate that yields a NPV of 0 for this investment. IRR is given as a percentage.
**Modified internal rate of return (MIRR)**

Modified IRR takes into account: a) the interest cost of using the funds, and b) the interest that could have been earned on reinvesting the excess funds. In this case, the prevailing Bank of Canada overnight interest rate will be used (3.72%) ("Bank of Canada", 2006b).

**Productivity ratio (PR)**

The productivity ratio represents the amount of productivity that one dollar of costs will purchase. For example a PR ratio of 0.54 indicates that $1 of operating room personnel and material costs will purchase 54 cents of productivity as measured by shadow billings. Salaried surgeons are required to submit billings to the government for which they are not directly paid. These shadow billings represent a measure of surgical output.

Non-financial criteria include:

- Surgical wait list times
- Impact on residency training programs
- Patient safety implications
- Nursing acceptance
- Physician acceptance
Data sources

The data sources are derived from the results described in the previous chapter. Administrative Surgiserver data for the Plastic Surgery Division was analyzed for the past ten years to determine the potential for increasing surgical productivity. A second, more comprehensive data set was used to further refine and triangulate the results. These results are used to model four different scenarios for the sensitivity analysis.

Costing and personnel data were provided by nursing managers, specifically Heather Francis RN (NHI operating room) and Shawna Dunsworth RN (NHI minor procedures area). Some components of the anesthesia costing data were obtained from the clinical literature.

Major Assumptions

A number of assumptions are required for the purposes of the business case modeling:

• A PA is hired to begin working September 1, 2006 and all regulatory and licensing issues are resolved by that time.

• The PA continues to be employed for the ten-year period of analysis and no additional hiring occurs.
• There will be a break-in period for the PA that will extend over a three year term as described in the cost impact model

• Cost of living increases of 2.5% will be given annually to all employees involved in running the operating room

• Cost of operating and anesthesia supplies increase at the current rate of inflation (2.2%) ("Bank of Canada", 2006a).

• The operating room is utilized at its current maximum capacity of five days per week for 47.5 weeks per year.

**Scenario design**

The following scenarios will be used in the dynamic financial modeling analysis. The rationale for the development of each is described. The primary considerations in the scenario design are the effects on productivity by hiring a PA with or without increases in operating room resources.
10% Scenario

The 10% increase in weekly productivity scenario results from a 51% increase in the amount of time available for the surgeon to see patients in clinic averaged out over the week. The associated costs with the increased patient load would be expected to be minimal as the current nursing complement is underutilized. The material cost increase would be minor as dressings and casting materials are relatively inexpensive items (Figure 23).

Figure 23: 10% Scenario

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waitlist OR</td>
<td>Elective OR</td>
<td>Minor OR</td>
<td>Clinic</td>
<td>Waitlist OR/Minor OR</td>
</tr>
<tr>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>51%</td>
<td>0%</td>
</tr>
</tbody>
</table>

37% Scenario

The 37% productivity increase represents generalized productivity increase for the surgeon. As there is no additional operating room time available, the increase in
productivity would be similar to the 10% scenario with the additional capabilities for
doing other work. The percentage daily increases in productivity represent the projections
derived previously. The 37% increase reflects the weekly average (Figure 24). Under the
37% scenario, the surgeon could increase their clinical productivity by concurrently
seeing new patients in consultation. The time could also be used for non-clinical activities
such as teaching, administration or research. It should be noted that the latter activities,
although important, do not increase clinical productivity.

Figure 24: 37% Scenario

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waitlist OR</td>
<td>Elective OR</td>
<td>Minor OR</td>
<td>Clinic</td>
<td>Waitlist OR/</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Minor OR</td>
</tr>
<tr>
<td>21%</td>
<td>29%</td>
<td>49%</td>
<td>51%</td>
<td>35%</td>
</tr>
</tbody>
</table>

66% Scenario

The 66% productivity increase scenario is a conservative one, predicated on the provision
of additional operating room resources. Currently, 2.5 general anesthetic rooms and 1.5
local anesthetic rooms are used per week. Allowing a given surgeon to use two rooms
simultaneously would theoretically allow a doubling of productivity. In reality, however,
in efficiencies within the system as well as scheduling and coordination problems render
this expectation overly ambitious. A realistic situation would be a 70% increase in
productivity resulting from a doubling of operating room capacity (Figure 25). Factoring in the 51% increase in clinic productivity, one could expect a 66% increase in weekly productivity.

Figure 25: 66 % Scenario

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waitlist OR</td>
<td>Elective OR</td>
<td>Minor OR</td>
<td>Clinic</td>
<td>Waitlist OR/ Minor OR</td>
</tr>
<tr>
<td>70%</td>
<td>70%</td>
<td>70%</td>
<td>51%</td>
<td>70%</td>
</tr>
</tbody>
</table>

**90% Scenario**

The 90% weekly productivity increase is the best-case situation. The scenario assumes a 100% increase in operating time, without attendant barriers to full utilization as well as a 51% increase in clinic utilization (Figure 26).
In addition to the models described above, a further variable representing the hiring of an anesthesia PA will also be investigated. The hiring of an anesthesia PA would allow one anesthetist to supervise two rooms, thereby further contributing to productivity. Note that hiring an anesthesia PA is only applicable if operating room resources have been increased. Therefore, six scenarios shall be modeled as summarized in Figure 27.

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waitlist OR</td>
<td>Elective OR</td>
<td>Minor OR</td>
<td>Clinic</td>
<td>Waitlist OR/Minor OR</td>
</tr>
<tr>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>51%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Figure 27: Scenarios Overview

<table>
<thead>
<tr>
<th>Operating Room Resource Increase</th>
<th>Case</th>
<th>Potential Productivity Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>With surgical PA</td>
</tr>
<tr>
<td>No</td>
<td>Worst</td>
<td>1) 10 %</td>
</tr>
<tr>
<td></td>
<td>Best</td>
<td>2) 37 %</td>
</tr>
<tr>
<td>Yes</td>
<td>Worst</td>
<td>3) 66 %</td>
</tr>
<tr>
<td></td>
<td>Best</td>
<td>4) 90 %</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With surgical and anesthesia PA</td>
</tr>
<tr>
<td></td>
<td>Worst</td>
<td>5) 66%</td>
</tr>
<tr>
<td></td>
<td>Best</td>
<td>6) 90%</td>
</tr>
</tbody>
</table>

**Data Structure**

Full value data for the business as usual scenarios (i.e., PA is not hired) and proposal scenario (i.e. PA is hired) will be used. The differences between the two will allow incremental cash flow projections. The financial metrics developed are based on the latter cash flow projections.

**Cost impact model**

An activity based cost impact model will be employed as labour is the overwhelming resource category.
**Personnel costs**

The salary range for Registered Nurses hired at the Capital District Health Authority (CDHA) is between $1,960.07 and $2,299.74 biweekly ($50,962 – $59,793 annually). The average salary would be $55,378 annually ("CDHA Career", 2006). At the CDHA, three nurses are assigned to each ten-hour operating room. One nurse is scrubbed in to assist the surgeon with instrumentation related to the procedure. A circulating nurse’s roles include charting, retrieving and opening instruments/sutures as well as other activities which do not requiring the wearing of a sterile gown. The third nurse is responsible for assisting as well as providing breaks for the others. To cover five, ten-hour rooms per week, 450 hours of nursing time are required. The nursing collective agreement ensures a 37.5 hour work week.

Nurses at similar salary levels also work in the Same Day Admission (SDA) pre-operative area where individual patients are readied before proceeding into the operating room. After the operation is complete, the patient is awakened in the Post Anesthetic Care Unit (PACU) by another group of nurses. In the PACU, one nurse is assigned to three patients whereas one nurse is assigned to five patients in the SDA area.

Anesthetic technicians are paid $50,000 per annum and are generally split between five operating rooms. They are responsible for assisting anesthetists with instrumentation and anesthetic machine set up. Patient attendants (orderlies) transport patients and assist the
nurses with cleaning and setting up the operating rooms between cases. The salary of a patient attendant is $14.55 - $15.74 hourly ($28,372 – 30,693 annually, mean $29,532) ("CDHA Career", 2006). Unit clerks are responsible for managing the booking of patients; their salary is $1096.14 - $1195.44 bi-weekly ($28,499 to $31,081 per annum, mean $29,790). Ward aids are responsible for general cleaning of instruments and rooms; they earn $998.95 to 1040.58 bi-weekly (mean $26,513 per annum).

Any increases in operating room use result in increased use and need for sterilization of surgical instruments in the Sterile Products Division (SPD). SPD technicians and SPD utility workers complete these roles. The SPD technicians are paid between $1183.73 and $ 1315.25 biweekly, which represents a mean annual salary of $32,487 (range $30,758 to $34,190). SPD utility workers earn $30,513 per annum.

The average MSI billings of a Plastic Surgeon in Nova Scotia are approximately $380,000. The value represents a gross amount from which practice related costs must be paid. The mean anesthesia salary in Nova Scotia is approximately $290,000 per annum.

Management at the CDHA has a personnel template for each ten-hour operating room as seen in Figure 28. Applicable full time equivalents (FTE) are indicated along with associated yearly costs. The total cost of personnel for a single ten-hour operating room per year is approximately $1,326,321.
### Figure 28: Operating Room Personnel Costs

<table>
<thead>
<tr>
<th>Personnel</th>
<th>FTE</th>
<th>Salary</th>
<th>Cost per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgeon</td>
<td>1</td>
<td>$380,000</td>
<td>$380,000</td>
</tr>
<tr>
<td>Anesthesia</td>
<td>1</td>
<td>$290,000</td>
<td>$290,000</td>
</tr>
<tr>
<td>OR Registered Nurse</td>
<td>4.8</td>
<td>$55,378</td>
<td>$265,814</td>
</tr>
<tr>
<td>PACU Registered Nurse</td>
<td>1.54</td>
<td>$55,378</td>
<td>$85,061</td>
</tr>
<tr>
<td>SDA Registered Nurse</td>
<td>0.96</td>
<td>$55,378</td>
<td>$53,163</td>
</tr>
<tr>
<td>Anesthesia Technician</td>
<td>0.96</td>
<td>$50,000</td>
<td>$48,000</td>
</tr>
<tr>
<td>Patient Attendant (orderly)</td>
<td>1.44</td>
<td>$29,532</td>
<td>$42,526</td>
</tr>
<tr>
<td>SPD Technician</td>
<td>1.92</td>
<td>$32,487</td>
<td>$62,375</td>
</tr>
<tr>
<td>SPD Utility</td>
<td>0.96</td>
<td>$30,513</td>
<td>$29,292</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>$1,326,231</strong></td>
</tr>
</tbody>
</table>

Note that personnel costs exclude management costs.

### Supply costs

In addition to personnel costs, variable costs associated with supplies consumed during a procedure must be considered. Examples of such costs include paper drapes, scalpel blades, sutures and plastic bowls. At the CDHA, 1.6 plastic surgery rooms are run per day for a period of 47.5 weeks per year. The plastic surgery supply costs for the 380 days of surgery per year is $511,044.00. The resulted daily and yearly supply costs per room are $1344.85 and $319,402.00, respectively.
Anesthesia material costs are more difficult to determine as there is significant variability among anesthetists in the composition and amount of anesthetic drugs and equipment used for a given case. In addition, the number of patients anesthetized per day will also dramatically influence these costs as most of the supply costs are generated when putting the patient to sleep (induction). In standardized orthopedic operations, anesthesia supply and drugs/gas costs per case have been estimated at $48.68 and $72.67, respectively (Gonano et al., 2006). Post Anesthesia Care Unit (PACU) supply and drug costs are $5.08 resulting in total costs per case of $126.43. In this study, the average case duration was 150.7 minutes resulting in a total case cost per minute of $0.84. The ten-year operating room data for the Plastic Surgery Division shows that the mean amount of time under anesthesia per day is 5.93 hours. By extrapolation, anesthesia supply and drug costs per day would be $298.49, with yearly costs being $70,891.04 (assuming a 47.5 week per year utilization).

The supply costs of running a ten-hour operating room are summarized in Figure 29.

Figure 29: Operating Room Supply Costs

<table>
<thead>
<tr>
<th>Supply type</th>
<th>Cost per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical supplies</td>
<td>$319,403</td>
</tr>
<tr>
<td>Anesthetic supplies</td>
<td>$70,891</td>
</tr>
<tr>
<td>Total</td>
<td>$390,294</td>
</tr>
</tbody>
</table>
Taking into account personnel and supply costs, the total cost of running a ten-hour operating room per year is $1,646,525 (see Appendix A-2).

**Benefits model and rationale: measuring productivity**

There are a number of methods for measuring surgical and anesthetic productivity. One possible measure is the number of cases performed in a given time period. The difficulty with this measure is that no accounting is made for duration of cases. It would therefore be possible to ‘game’ the system by performing a higher number of shorter cases. Measuring the duration of time spent in the operating room would be a more reasonable approach. It, however, is not ideal because it fails to reflect surgical efficiency and case complexity. For example, surgeon A might perform three cases of a given procedure in the same time that surgeon B performs two such procedures. The time-spent metric would not measure Surgeon A’s increased productivity. A problem that is germane to the case number and time-spent metrics is that both do not take into account the complexity of cases. Although not perfect, surgical billings do reflect the preceding concepts and to some degree the complexity of the case. A billing fee code and its associated tariff are heavily based on the time to complete a case. New fee code applications require the submission of operative records for the ten most recent consecutive procedures with start and finish times. The tariff is generally set at 100 units per hour with a slight adjustment for the complexity of the case. Units are translated directly into dollars by a unit value, which is negotiated under consecutive collective agreements. Billings, however, are not useful for comparing productivity between different surgical subspecialties as there are
many historical inconsistencies. For example the units billed for performing a cataract extraction and lens implantation has remained the same despite a marked decrease in the amount of time required to perform the procedure. Many ophthalmologists have seen significant increases in their billings as a result.

Surgeons and Anesthetists at the CDHA are currently salaried. Therefore, increases in productivity do not translate into higher incomes. Both of these provider groups are still required to submit ‘shadow’ billings for the purposes of monitoring. Over the three-year term of the current contract, allowances have been made for a 2.5% per annum salary increase. The physician salary costs will therefore be indexed at this rate. Surgical and anesthetic productivity will be modeled as ‘shadow’ billings (i.e., what these health care providers would have earned if they were still billing fee for service). Therefore, the measurable benefits will have to be similarly indexed. Physician Assistant salary costs will also be indexed at this rate to reflect the cost of living (COL). The starting PA salary is $70,000 per annum, which is comparable to wages in the US.

On-site job training of a new PA takes approximately one year. Training is an intensive process with most of the demand placed on the supervising physician. It is assumed therefore that physician productivity would decrease by 15% over the first year. During the second year, the PA is becoming more experienced and on occasion might increase the surgeon’s productivity. At this stage, the need for ongoing direct supervision would still be expected to offset any productivity enhancements. Therefore, the second year of employment would be neutral with productivity returning to the pre-employment level.
During the third year, the PA has acquired considerable expertise and would likely relieve the surgeon of some PA-compatible duties. It is assumed that 50% of the PA productivity potential would be captured during the third year with the balance being achieved in the fourth year. These estimates are conservative as the experience in Manitoba suggests quicker escalation than modeled herein (Eric Boehm, personal communication, March 16, 2006).

For the purposes of the business case, productivity will be modeled using projected billings. Projected billings are easily translated backwards into hours worked by dividing by the unit value at that time.

**Business Impacts**

**Cash flow projections**

The incremental cash flow projections are derived from differences between the business as usual scenarios and the proposal scenarios. The business as usual case and associated costing assumptions are shown in Appendix A-1 and A-2 respectively. Clearly, running an operating room is a costly exercise with annual expenditures being $1,646,525. In this case, anesthesia and surgical productivity are equal to the indexed salaries they are paid because there have been no increases in efficiency.
Dynamic financial model

The cash flow projections comparing business as usual scenarios with the proposal scenarios are outlined in Figure 30.
Figure 30: Scenario Based Financial Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%, sPA</td>
<td>10%</td>
<td>37%</td>
<td>66%, sPA,</td>
<td>90%, sPA,</td>
<td>66%, sPA,</td>
<td>90%, sPA,</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
<td>OR</td>
<td>OR</td>
<td>aPA, OR</td>
<td>aPA, OR</td>
</tr>
<tr>
<td>Net cash flow</td>
<td>($576,855)</td>
<td>$97,327</td>
<td>$2,498,708</td>
<td>$2,633,933</td>
<td>$2,871,723</td>
<td>$3,290,283</td>
</tr>
<tr>
<td>(10 year period)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NPV 9%</td>
<td>($402,259)</td>
<td>($31,849)</td>
<td>$1,423,886</td>
<td>$1,458,949</td>
<td>$1,600,376</td>
<td>$1,795,274</td>
</tr>
<tr>
<td>15%</td>
<td>($331,789)</td>
<td>($73,412)</td>
<td>$1,022,786</td>
<td>$1,024,009</td>
<td>$1,128,791</td>
<td>$1,243,972</td>
</tr>
<tr>
<td>Payback period</td>
<td>-----</td>
<td>8.2 years</td>
<td>1.2 years</td>
<td>2.5 years</td>
<td>2.3 years</td>
<td>2.9 years</td>
</tr>
<tr>
<td>IRR</td>
<td>-----</td>
<td>6.0%</td>
<td>609.2%</td>
<td>140.9%</td>
<td>157.2%</td>
<td>105.1%</td>
</tr>
<tr>
<td>MIRR</td>
<td>-----</td>
<td>5.1%</td>
<td>85.2%</td>
<td>51.0%</td>
<td>54.0%</td>
<td>42.0%</td>
</tr>
<tr>
<td>ROI 3 year</td>
<td>(93.3%)</td>
<td>(78.8%)</td>
<td>19.1%</td>
<td>8.2%</td>
<td>8.5%</td>
<td>1.6%</td>
</tr>
<tr>
<td>4 year</td>
<td>(84.1%)</td>
<td>(50.3%)</td>
<td>40.9%</td>
<td>38.0%</td>
<td>28.4%</td>
<td>29.5%</td>
</tr>
<tr>
<td>5 year</td>
<td>(78.1%)</td>
<td>(31.7%)</td>
<td>58.4%</td>
<td>65.2%</td>
<td>44.3%</td>
<td>55.1%</td>
</tr>
<tr>
<td>10 year</td>
<td>(64.6%)</td>
<td>9.4%</td>
<td>110.3%</td>
<td>172.9%</td>
<td>91.7%</td>
<td>156.3%</td>
</tr>
<tr>
<td>Productivity ratio</td>
<td>0.46</td>
<td>0.51</td>
<td>0.47</td>
<td>0.49</td>
<td>0.45</td>
<td>0.49</td>
</tr>
<tr>
<td>Productivity (10 year)</td>
<td>$6,140,351</td>
<td>$6,960,536</td>
<td>$9,497,410</td>
<td>$10,239,940</td>
<td>$8,632,699</td>
<td>$9,650,562</td>
</tr>
<tr>
<td>Costs</td>
<td>$13,343,190</td>
<td>$13,489,195</td>
<td>$20,250,673</td>
<td>$20,857,977</td>
<td>$19,012,945</td>
<td>$19,620,250</td>
</tr>
</tbody>
</table>

Legend: NPV – net present value, IRR – internal rate of return, MIRR – modified internal rate of return, ROI – return on investment, sPA – Surgical PA, aPA – Anesthesia PA, OR – increased OR capacity
10% Scenario, PA hired, no increase in operating room resources

The incremental cash flow statement under this scenario is shown in Appendix A-3.

There has been a marginal increase in surgical productivity of $258,575 over the ten-year period. The increase in productivity, however, only minimally offsets the cost of hiring the PA ($773,526). Yearly losses total to a net loss of $576,855 by the tenth year. Payback periods and internal rates of return are not applicable due to the continued negative cash flow. ROI ratios are uniformly negative.

37% scenario, PA hired, no increase in operating room resources

Under the 37% scenario, ten-year surgical productivity has increased by $1,078,761 thereby offsetting the costs of hiring a PA by the beginning of the eighth year. Net present values at both the 9% and 15% discount rates are negative but only slightly. Net cumulative cash flows by the end of the tenth year are $97,327. The ROI calculations reveal a minimal return which is only realized towards the latter portion of a 10-year period. Clearly the 37% scenario represents a break-even situation. The increased costs of hiring a PA and the attendant increases in OR and clinic costs are offset by the increase in surgeon productivity.
66% scenario, PA hired, operating room resources are increased

In this case, operating room resources have increased, thereby allowing the surgeon to run two rooms simultaneously with the help of the PA. Opening another operating room generates increased resource requirements as anesthesia, nursing and other provider costs would double. Anesthesia and surgical supply costs would increase by 66%, as the surgeon is not using the room to its full capacity. In summary, the proposed scenario involves one surgeon and one PA running two fully staffed rooms at the same time. The comparable business as usual scenario would be to have one surgeon in each of the rooms and no PA.

The net cash flow increases markedly to $2,498,708 with discounted cash flows being $1,423,886 and $1,022,786, respectively. The incremental cash flow statement is found in Appendix A-5. Surgical productivity has actually decreased compared to that which would have been achieved by two surgeons. However, the dramatically lower costs for the productivity achieved in the one-surgeon scenario results in a healthy ten year ROI of 110.3%. The year one cash flow is slightly negative as a result of the foregone costs of hiring a second surgeon being offset by the initial decreases in surgical productivity and the material cost savings resulting from decreased productivity in the PA room. The spread is not larger due to the markedly lower initial productivity of the single surgeon PA combination. The discrepancy is significantly narrowed with the eventual productivity ramp up. The IRR at 609.2% is very high as the initial investment was very small. Similarly the payback period is very short at 1.2 years.
The costs of running a one surgeon, one anesthetist room is $1,646,525 per year.
Assuming a 66% utilization of the second room, the costs of transition from a one-surgeon room to a two-room surgeon/PA combination is an additional $1,204,606 per year.

90% scenario, PA hired, operating room resources are increased

This scenario represents best case conditions with the hiring of a physician assistant. The increases in operating room time allowed doubling of operating productivity. Operating room supply costs would increase proportionately. Net and discounted cash flows are increased over the previous scenarios. The ROI’s are very strong as is the IRR at 140.9%. The net present value at a discount rate of 15% is over $1 million.

66% scenario, PA hired, AA hired, operating room resources are increased

The situation in this case is similar to the previous one except that an anesthesia assistant has been hired, thereby allowing the anesthetist to run two rooms at the same time. The foregone costs in this case are a second anesthetist’s salary. Net cash flows and net present values increase once again as a result of the increased productivity outstripping costs. In this scenario the costs of adding the second operating room are only $984,606.
90% scenario, PA hired, AA hired, operating room resources are increased

This best case scenario results in the highest 15% discounted NPV of all the scenarios ($1,243,972). The payback period on the initial investment is only 2.9 years and the IRR is very strong at 105.1%.

Financial analysis

Risks and Contingencies

Clearly, there are benefits to employing PA’s in surgical practice as supported by the financial analysis. Particular risks and contingencies that would have to be addressed include the lack of legislation supporting the PA specialty and potential opposition from nursing unions.

The PA profession has no formal legislation in the Nova Scotian civilian sector. The College of Physicians and Surgeons of Nova Scotia (CPSNS) cannot govern the practice of PA’s unless our current minority government initiates legislation supporting the specialty -- a possibility that seems remote considering the potentially controversial nature of the issue. Legal counsel at the CDHA clearly opposes the concept of PA’s working in the hospital without the blessing of the College (K. Gaulton, personal communication, March 30, 2006).
Current CPSNS designations are full, temporary, defined and medical education registration ("NS College of Physicians and Surgeons", 2006). The first three require a medical degree and the latter requires enrollment in a recognized medical school.

Registered Nurses can be Delegated Medical Functions (DMF) or receive medical directives. A DMF refers to a procedure, treatment or intervention within the scope of a physician’s practice that has been deemed able to be performed by nursing personnel.

The College of Registered Nurses of Nova Scotia (CRNNS) and CPSNS have developed a coordinated policy for approving DMF’s ("DMF’s", 2005). Medical directives are slightly different than DMF’s in that they involve a written order in the chart. The policy on developing DMF’s and medical directives could serve as a template for those deemed within the scope of a PA’s practice. The CPSNS is currently reviewing an application for registration regarding midwifery, which may set a precedent for PA’s. Nonetheless, it is apparent that a long-term solution will require legislation.

Opposition from the Nova Scotia nursing unions is another potential risk. Physician Assistants should have no adverse effects on the Registered Nurse profession as there is no overlap between the two job profiles. Rather, PA’s will be taking on roles that are currently performed by surgical residents. Potential conflict however does exist with NP’s as there are some similarities in their skill sets and scope of practice. However, nursing manpower is a scarce resource and the profession is struggling to produce enough nurses let alone NP’s. The few NP’s that do practice in Canada tend to be concentrated in rural, community practice settings. Physician Assistants, on the other hand, have a
propensity to practice in urban hospitals and would thus have minimal exposure to potential NP role conflicts.

**Conclusions and Recommendations**

The dynamic financial modeling shows a benefit for employing physician assistants in surgical practices providing that operating room resources are increased. The net present values are slightly negative if a surgeon’s productivity is increased by 37%. This level of increased productivity therefore represents the break-even scenario for hiring a PA. The productivity gains just offset the additional costs associated with employment of the PA. Therefore, from a cost /benefit point of view, hiring of PA’s should be considered if productivity levels in excess of 37% can be assured; a situation that is guaranteed if additional operating room resources are provided.

Net present values in excess of $1.4 million are possible even if there is only a 70% increase in a given surgeon’s productivity. These values continue to grow with increasing surgical productivity. The addition of anesthesia physician assistants further strengthens the business model.

By all indications, there are significant inefficiencies in Canadian surgical practices that could be remedied with the employment of this health-care provider group. The marginal costs of increased productivity are significantly less with the PA model compared to hiring additional surgeons. The two-year training programs for physician assistants provide an extremely flexible workforce that can quickly meet and respond to upcoming
demands for surgical services. Physician assistants allow surgeons to focus on their core competencies, a development that most surgeons would embrace. The employment of physician assistants is a flexible, safe and cost-effective strategy for dealing with our current crisis in the delivery of surgical services.
References


Appendix A: Business Case Scenarios

A-1: Cash flow projections for business as usual scenario

A-2: Cost breakdown for running an operating room

A-3: 10% Scenario

A-4: 37% Scenario

A-5: 67% Scenario

A-6: 90% sPA, OR increase scenario

A-7: 66% sPA, 66% aPA scenario

A-8: 90% sPA, 90% aPA scenario