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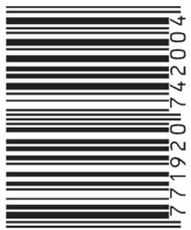
The Multiple Paths to a Career in Emergency Medicine



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EDITORIAL

Healthcare In Canada: Privatization and How to Contain It Connor Forbes, Erica Tsang	4
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FEATURE

What Drives Continuing Evolution of Careers in Medicine and Healthcare? David F. Hardwick	6
The Times They Are A-Changin' Shelley Ross	7

REVIEWS

Polycystic Ovary Syndrome: Appreciating the Complexities and Implications of Diagnosis Kristi Panchuk, M. Judith Lynam	10
How Genomics is Changing Medical Practice Ruth Thomas, Shelin Adams, Lesley Phillips, Marion Thomas	15

CASE AND ELECTIVE REPORTS

Rhabdomyolysis Causing Acute Kidney Injury in a Patient with Multiple Risk Factors and an Underlying Inflammatory Muscle Disease: A Case Report Christopher Little, Sean Hamilton, John Shik	20
Elective Report: A European Take on Neuro-Anesthesia Ambica Parmar	22

COMMENTARIES

Nurse Practitioners: An Underutilized Resource Danny Guo, Kevin Zuo	24
Online Videos: A New Tool for Medical Education Joseph Anthony Andrews	26

NEWS AND LETTERS

The Multiple Paths to a Career in Emergency Medicine Andrei Karpov, Maurice Agha	28
The Rural Medicine Conundrum: Steps in the Right Direction, and the Difficult Road Ahead Goldis Chami	29
Canadians Studying Abroad as a Solution to Canada's Health Human Resource Challenge: A Medical Student's Perspective Elisa Kharazi	30
On MD/PhD Programs and Becoming a Clinician-Scientist Ranita Manocha	32
Dr. Brian Day and Dr. Robert Wollard on the Future Role of Privatized For-Profit Medicine in the Canadian Healthcare System Marko Yurkovich	33
InspireHealth: Physicians Providing Integrative Cancer Care Lawrence Kei	34

On the cover

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No, that's not a photograph! Believe it or not, Anson Weese, an artist based in Port Stanley, Ontario, has digitally re-created the Brooke Claxton Building entirely through computer modeling. Go online to UBCMJ.com to view this stunning depiction in high definition and to find out how your art can be featured on our next cover.

Healthcare in Canada: Privatization and How to Contain It

Connor Forbes, BSc^a, Erica Tsang^a

^aMD Class of 2015, Faculty of Medicine, University of British Columbia

CONTEXT

In the ongoing debate on private versus public funding models for healthcare in Canada, it is interesting to note that the Canadian Medical Association (CMA) has supported privatization in the past¹ and chooses to keep the debate open.² As a powerful lobby and advisory group, their official position has transformative implications for the landscape of the job market in the form of possible remuneration model changes for physicians and other healthcare providers. Much of the discussion on whether these changes should occur centers on an evaluation of the value and pragmatism of equality in the system, but it must also be noted that the private market is not waiting around for the question to resolve itself. Regardless of whether or not it is the best option for healthcare consumers, certain factors are encouraging the growth of privatization. These factors must be addressed proactively should Canadians wish to prevent (further) tiering of the Canadian healthcare system.

THE PRIVATIZATION CREEP

In addition to supplementing the public system, the private system shows signs of infringing upon its domain. An evaluation of 130 private healthcare clinics across Canada found evidence to suspect the possibility of 89 violations of the Canada Health Act, including charging patients for medically necessary services that are covered by Canada's publicly funded universal healthcare system.³ These clinics allow Canadians who are willing and able to pay out-of-pocket to avoid lengthy public system wait times, effectively creating a tiered healthcare system.³ Similar tiering occurs through the parallel private insurance of Workers Compensation Boards (WCB) in Canada, which undermines the goal of equal access to care since Canadians who are injured at work can receive faster treatment.⁴ These two cases highlight the existing encroachment of privatization into the public system.

The impetus for this privatization of healthcare may be due to greater demands on the public system as a result of both changing demographics and the increasing availability of new technologies. In Canada, the percentage of the population over the age of 65 is expected to increase to nearly 24% in 2035, and healthcare costs per person rise substantially for this group.⁵ Further contributions

to increased healthcare spending come from advances in genetic research and personalized medicine. While these treatments can often be beneficial to patients, they are expensive. Costs per quality adjusted life year (QALY) for personalized drugs have been estimated between \$43,000 and \$170,000.⁶⁻⁸ Even if the cost of these treatments decline, increasing direct-to-consumer advertising of these genetic technologies can expand demand from Canadians.⁹

If the public system is not able to meet this increase in demand, the private system could snap up the excess and Canadian health care could quickly acquire a second tier. In 2005, a Supreme Court Case ruling in Quebec allowed an individual to access private health care as a solution to long wait times.¹⁰ This ruling sets a precedent for the nimble private market to fill in the gaps of the public system, pending rulings in other provinces across the country. In the *Lancet*, Kaczorowski suggests that such a model of universal coverage with additional private health insurance could help keep costs down.¹¹

PRESERVING THE PUBLIC SYSTEM

The easiest solution, however, is not necessarily the most desirable one. One objection to private health care is on the grounds that access to medical support should not be dictated by an individual's means to pay. Furthermore, between 93% and 98% of Canadians support the five principles of the Canada Health Act,¹² which confirms strong support for equal access to health services across socioeconomic groups in Canada.

The first thing that must be done in order to preserve the public healthcare system is for the Canadian government to save it now. Hogan and Hogan recommend exactly this, believing that the current financial climate allows for this kind of fiscal responsibility, and warning of dire consequences should Canada fail to prepare for the coming increases in cost.⁵ The lack of a contingency fund will allow the overflow in demand to be lapped up by the private system, accelerating its growth. A substantial preparatory fund will allow the public system to absorb any strain instead.

If Canadians want health care to stay public, there is also a need to change attitudes and expectations. Stuart and Adams argue that the sustainability of the public healthcare system depends on a cultural shift: consumers must accept that not all medical procedures will be covered by the public system.¹² To

Correspondence

Connor Forbes, Erica Tsang, internal.editor@ubcmj.com

keep healthcare public, Canadians will have to be comfortable with a system that does not provide low-yield medical treatment for all ailments.¹² Whether or not Canadians will be satisfied with this level of care or would prefer to push for the ability to spend on more extensive treatments remains to be seen.

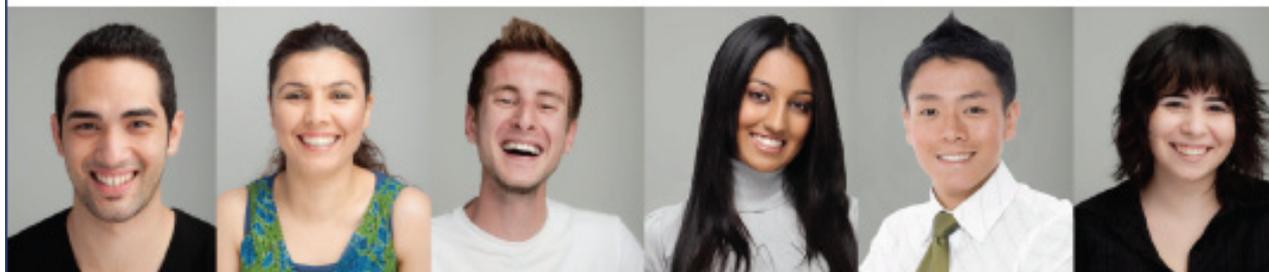
Ultimately, the debate of public or private is one that rests on the will of the Canadian people. It would be a pity, however, to see strong beliefs in equality buried by a lack of public preparation.



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What Drives Continuing Evolution of Careers in Medicine and Healthcare?

David F. Hardwick MD, FRCPC, FAHS, LLD^a

^aUniversity of British Columbia, Vancouver, BC

Two major phenomena have driven dramatic changes in medicine and healthcare careers over the past century. One critical factor has been the almost logarithmic increase in knowledge, a general phenomenon forcefully evident in medicine over the past decades. The other significant phenomenon relates to social and cultural changes with gradual development of more accepting attitudes in a diverse medical and healthcare workforce. Each of these is paralleled by consequential, organizational, family, and institutional changes.

Knowledge has expanded at about 2% per annum, compound, over the past 200 years, according to economic studies using translation of knowledge into productivity increases as a surrogate measure.¹ Creation of new knowledge has also led to innovative translation with huge changes in medicine. Whereas 100 years ago a single brain, that of Sir William Osler, could be the primary repository of what was known then in medicine and write the comprehensive textbook “Principles and Practice of Medicine”,² today, one single mind cannot contain all that is known in medicine. Accrediting bodies such as the Royal College of Physicians and Surgeons of Canada and the American Boards of Medical Specialties in the USA now recognize over two dozen specialties, each of which requires a whole career focus and is in itself a brain full of knowledge. This profound increment in medical specialties continues with new subspecialties proposed each year. Similar proliferation of roles have led to an expanded number of new professional careers in nursing, pharmacy, physiotherapy and occupational therapy, and other healthcare activities — unlike years ago where each was a single profession.

Nowadays, this requires collaboration facilitated by electronic communications with practitioners cooperating as inter-professional “communities of practice” in the best interests of patients. Additionally the patients and practitioners are now exposed to web based knowledge that accentuates the requirement for caregivers to also have immediate access to detailed current knowledge. It also emphasizes the need for all practitioners to use continuing education programs to maintain an up to date knowledge base! This, together with patient-rights initiatives, is gradually leading to a balance with physicians being seen as having expertise and authority over medical therapy and patients exercising more control over which options for care are implemented according to their preferences.³ This is, however, a

very complex set of interdependent professional relationships and will continue to evolve long into the future.

Fifty to one hundred years ago, single, apparently omniscient physicians, nurses, or others with comprehensive knowledge in their specialty or practice often presented themselves as authoritative, occasionally irascible bosses with structural authority.⁴ Such prescriptive behaviours often occurred in operating rooms or emergency rooms where definitive verbal orders were given with instantaneous action and compliance expected of subordinate nurses and others. Nowadays, there are numerous knowledgeable practitioners, each more accustomed to assuming the role of helpful expert to assist their teams, who display their own extensive knowledge as “sapiential” or “personal”⁴ authority, a much more benign professional presentation.

From a social and cultural perspective over the past century, major cultural shifts in Western-oriented civil societies have occurred: perhaps as a result of two World Wars and post-recession episodic changes. Changes in traditional family roles has been one of these shifts, with more women in the workforce at senior level workforce positions. If one reviews the pictures of UBC Medical graduates over the past 60 years in the Webber MSAC Alumni room, the number of female graduates in the 1950’s was 5-10% each year whereas in current classes 50-60% of graduates are female. Also, the racial makeup of classes has changed to more closely reflect population numbers. To a degree, these shifts seem to reflect a more balanced perspective towards a civil society with a move away from authoritarianism, thus encouraging a more egalitarian professional situation.

All of these social, cultural, and epistemic changes have impacted the overall orientation of healthcare and medical practice. While always required, added emphasis is now placed on empathy, dependability, and integrity as attributes required of our graduates and coworkers in addition to an ongoing need for critical analysis and reasoning skills leading to measurable clinical competence. This is not to imply that a focus on social issues never existed. I can personally recall having a medical school course on social and cultural values in the 1950’s and still remember and utilize the concepts today of a required essay⁵ where I proposed a balanced civil society that valued individual freedoms. Condemned was the authoritarianism of the “soulless”, and absolutist anarchic or regimented states!

A further cultural shift has been towards an increasing emphasis on the need for economic efficiencies. Indeed, in

Correspondence

David F. Hardwick, david.f.hardwick@ubc.ca

medical research, the requirement for effective “bench to bedside” translation is emphasized today with increasing calls for “ROI” or return on investment. This has led to the need for effective ethics review committees to protect patients’ interests⁶ and reduce pressures on medical researchers from undue market involvement of commercial entities such as pharmaceutical companies.⁷ A further problem arises with the increasing clash of professional and corporate interests. A professional by definition practices medicine to the standards of their profession in their community—not as an “occupational” working to the imposed standards of a boss!⁸ Pressure is exerted by some healthcare administrators for doctors to practice according to administrative budgetary requirements, thus being more efficient and perhaps less effective in care of their patients. A number of years ago at the Canadian Red Cross Blood Services, the physician in charge appeared to have rejected blood testing for donor blood infections due to testing costs on the orders of his funding agency bosses—in that case provincial government bureaucrats. His unprofessional behaviour was ultimately outlined in the Krever Commission Report.⁹ This led to him being professionally discredited, the Red Cross Blood Transfusion Service being terminated, and the Canadian Blood Services Agency being created.

In medicine, a major initiative that has had a profound impact is prevention of infectious diseases by immunization. This and other preventive measures have led to the survival of many who might otherwise have died. Now we are faced with an aging demographic, many of whom through excess nutrition and salt intake,¹⁰ suffer from obesity,¹¹ hypertension, diabetes, and major cardiovascular issues. These will require additional attention in the decades to come!

So, what is the ultimate answer to the question posed at the beginning of this polemic? The enormous increase in medical knowledge, adapted to improve the quality of care of patients has led to an essential, major proliferation in types of healthcare providers. This in turn has led to significant shifts in professional relationships, not only of patients and doctors but also among healthcare providers. It is interesting to observe that such interdisciplinary activity is effected, based on a principle outlined by Adam Smith in the 1770’s as a significant concept

of the Scottish Enlightenment—the Division of Labour.¹² In that description, workers provided a defined activity based on their personal expertise and skill that built upon the different expertise and skill of other providers towards an ideal cooperative outcome. In Smith’s description, that outcome was the efficient manufacture of pins; in our current description for healthcare providers it is towards the optimum outcome of care for our patients in an increasingly complex healthcare environment. Cooperative inter-professional care will require greater provider empathy for all to understand and enable each other’s role in these complex, beneficent patient care related undertakings.

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The Times They Are A-Changin’

Shelley Ross, MD, CCFP, FCFP^a

^aPresident, BC Medical Association

As Bob Dylan so aptly sang, “The times they are a-changin’.” Nowhere is this truer than in the provision of health services. One need only look at the healthcare networks of other provinces, the use of multidisciplinary teams for the provision of health care, the increasing scope of practice of other professional groups, the inability of so many British

Columbians to access a family doctor, and the programs in place to improve the healthcare system to know, to borrow from the same Dylan tune, “we’d better start swimmin’ or we’ll sink like a stone.”

In July 2011, I had the honour of chairing the BC Medical Association (BCMA) working group that developed a position

paper on the health of the physician workforce entitled, “Doctors Today and Tomorrow: Planning British Columbia’s Physician Workforce”. I would like to acknowledge and thank both the physician and staff members of the working group for their contributions.

The position paper concluded that the current physician workforce planning process in British Columbia is too fragmented and too short-term in its focus, with the result that British Columbians’ access to timely, high-quality, and effective physician services is compromised due to shortages and vacancies. This is a time when the healthcare system continues to face growing pressures from the increasing complexity of patient case-mix, the resulting demand for more physician time and services, the ongoing evolution of the practice of medicine, and the changing demographics of the physician population.

In the position paper, the BCMA breaks the workforce into three groups: the physician in training, the practicing physician and the physician nearing retirement.

PHYSICIANS IN TRAINING

Following a decrease in medical school enrolment by 10% in 1992, the UBC Faculty of Medicine began increasing enrolment in 2001 from 120 spots to 288 today, including the Victoria, Prince George and Kelowna sites. Given the length of education and residency for today’s students, it will take a minimum of 6 years, and for some specialties up to 11 years, to have an impact on physician workforce needs. However, a mere head count of the number of graduating physicians does not take into account different practice styles of the future. As has often been the case, medical students need to realize that their dream of going into either general practice or a particular specialty will be influenced by the physician needs of the community, which will dictate the number of residency spots in different disciplines.

We also cannot have a system that simply has residency positions equal to the number of graduating medical students. There needs to be a greater number of residency positions to accommodate family physicians who would like further specialty training, as well as a growing number of international medical graduates (IMGs) looking to practice medicine here. This latter group is divided into IMGs who trained in foreign medical schools and were physicians before immigrating to Canada, and a second group who are Canadian citizens who, for various reasons, studied abroad in English-speaking medical schools and wish to return. There are barriers for both groups wanting to practice medicine in British Columbia. The BC Medical Association is looking forward to working with UBC and the provincial government to improve the residency process for IMGs.

THE PRACTICING PHYSICIAN

For the physician currently in practice, we know the number of hours of direct patient care over the past 20 years has decreased while activities such as teaching, research, administration, and continuing professional development, not to mention paper work, have increased. The average total hours worked per week appears to have remained fairly stable between 1997 and 2007 in British

Columbia for both genders, but fewer patients are being seen in the same time frame. In the BCMA’s 2010 Membership Survey, the most often-cited professional challenge was workload/lack of time. It is no surprise then that the delivery of physician services is moving away from solo practice to group practice and multidisciplinary practice settings where some elements of the workload can be shared.

While physicians are decreasing the number of direct patient care hours, the demand for physician services continues to escalate, driven by an aging population and the increase in chronic illness. By 2031, almost one-quarter of BC’s population will be 65 and older. With age comes an increase in chronic diseases. In 2011, according to the Ministry of Health Services, 80% of the combined physician payment, PharmaCare, and hospital care budgets were consumed by the management of chronic diseases.

Recruitment and retention of physicians is an ongoing challenge, especially in rural British Columbia. Joint committees between the BCMA and government such as the General Practice Services Committee, the Specialist Services Committee, and Shared Care have developed financial incentives for GPs, specialists, and rural physicians to increase their work satisfaction, make their practices more efficient, and deliver the most appropriate patient care. In a world where work/home life balance is of increasing importance, there needs to be more than just money to sustain the physician workforce. Physicians require time for family and leisure activities after their working day is finished, and they need to take a holiday or attend educational activities on a regular basis without the worry of leaving their patient load to their colleagues for lack of locum coverage.

PHYSICIANS NEARING RETIREMENT

It is a sobering fact that 42% of BC’s physicians are 55 and older. We know our workforce is aging, so it comes as no surprise that 21% of respondents to the BCMA’s 2010 Membership Survey said that they plan to retire within the next five years, and 46% within the next ten years. Physicians tend to retire gradually by cutting back their work hours and their scope of practice before entering full retirement. The rural population could be more impacted by the GP’s gradual retirement than the urban population because rural GPs tend to have a broader scope of practice than their urban counterparts. These physicians who no longer want to be in full-time practice need strategies to use their talents in part-time work or teaching.

HOW TO BEST MOVE FORWARD

A comprehensive approach to managing the physician workforce is necessary to ensure that patients have timely access to physician services and the profession has the right number and mix of physicians.

The physician workforce paper makes ten recommendations:

1. The BCMA, Ministry of Health, and health authorities should jointly establish a permanent provincial Physician Workforce Planning Committee to direct and coordinate the development of physician resource plans, and to

provide advice about strategies and mechanisms to meet the requirements of the plans. Additional members should include representatives from appropriate stakeholder organizations including, but not necessarily limited to, the Faculty of Medicine, the College of Physicians and Surgeons of BC, and the Medical Services Commission.

2. The Physician Workforce Planning Committee should develop a provincial analytical framework for needs-based physician resource planning.
3. The Physician Workforce Planning Committee should coordinate the development of a comprehensive provincial physician workforce database to form the basis of physician workforce planning and the development of full-time equivalent methodologies.
4. The Faculty of Medicine, in consultation with the Physician Workforce Planning Committee, should determine undergraduate medical school enrolment, and enrolment should be informed by long-term physician resource plans.
5. The Medical Human Resources Planning Task Force, in consultation with the Physician Workforce Planning Committee, should ensure that postgraduate training positions be allocated among the specialties in relation to physician resource requirements, as reflected in long-term physician resource plans.
6. There should be adequate government-funded postgraduate training positions available to accommodate the following:
 - Each year's graduating class through to certification and licensure.
 - Specified numbers of licensed physicians currently practicing in British Columbia who are qualified for reentry or enhanced skills training.
 - Specified numbers of international medical graduates who are Canadian citizens or permanent residents, and who are not currently fully licensed to practice medicine in British Columbia.
7. The Faculty of Medicine should consider strategies that support broad-based medical education and the provision of objective career information for medical students and residents.
8. Recruitment and retention programs should develop comprehensive and flexible incentives that address the professional and personal needs of physicians.
9. The Ministry of Health and the health authorities should ensure adequate resources and coordination for the development, implementation, and ongoing evaluation of physician recruitment and retention programs.
10. The Ministry of Health and the BCMA, in conjunction with health authorities, should develop strategies to support the retention of physicians who are nearing retirement.

According to Francois de la Rochefoucauld, a French classical author of the 1600s, the only thing constant in life is change. The BCMA is ready to work with all interested parties to ensure that the physicians of BC move forward with the right changes that ensure the citizens of BC have access to the best health care, delivered by the most appropriate person, when and where it is needed. 



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Polycystic Ovary Syndrome: Appreciating the Complexities and Implications of Diagnosis for Primary Care

Kristi Panchuk, MN, NP(Family)^a, M. Judith Lynam, RN, PhD^a

^aSchool of Nursing, University of British Columbia, Vancouver, BC

ABSTRACT

Polycystic Ovarian Syndrome (PCOS) is a common, complex endocrine disorder that has serious implications for women from adolescence to beyond menopause. This paper provides an overview of the diagnostic criteria for PCOS and outlines the goals of care to help physicians and other healthcare providers to move beyond the debates about diagnosis and to embrace an approach to management that is responsive to patients. Women with hyperandrogenism as a presenting feature of PCOS are known to have metabolic and cardiovascular risks, including type 2 diabetes mellitus and dyslipidemia. Despite the serious consequences of PCOS, women are not being identified early in the course of the disease or managed effectively across the lifespan in order to reduce their long-term health risks. Optimizing detection and management of patients with PCOS may reduce the prevalence of type 2 diabetes mellitus and unmanaged dyslipidemia. With effective management, women may be able to conceive earlier and experience fewer adverse obstetrical outcomes. PCOS affects women physically, psychologically, and socially, and challenges their healthcare providers to take a proactive and comprehensive approach to treat symptoms and manage long-term risks.

KEYWORDS: *polycystic ovary syndrome, hyperandrogenism, hirsutism, oligomenorrhea, amenorrhea, anovulation, obesity*

INTRODUCTION

Polycystic ovary syndrome (PCOS) is a common, complex endocrinopathy with lifelong implications for patients and their families. The genetic and environmental etiologies of PCOS are not yet fully understood,¹ but one hypothesis is that genetic factors promote fetal androgen secretion and this predisposes certain females to hyperandrogenism, oligo-ovulation or anovulation, with an associated increase in the number of follicles in the ovary.² The prevalence of the disease is commonly cited as affecting four to seven percent of women of reproductive age,³ though estimates based on diagnostic criteria that include ultrasound are as high as 17.8%.⁴ It is particularly concerning that 69% of women who met diagnostic criteria for PCOS in this study were undiagnosed.⁴ As a consequence of undiagnosed disease, many women are living with unmonitored and unmanaged physical, psychological, and social challenges. Evidence strongly suggests that in addition to their presenting complaints during their reproductive age, women with PCOS have significant health risks including obesity, the metabolic syndrome (METS), type 2 diabetes mellitus (T2DM), and certain cardiovascular risk factors.⁵ The high prevalence of the disease means identifying women with PCOS and managing their risks proactively across

the lifespan will potentially prevent or mitigate the consequences of this chronic disease.

THE DIAGNOSTIC CHALLENGE: A SINGLE PROFILE OR MULTIPLE PHENOTYPES?

In the last ten years, two consensus groups have revised diagnostic criteria and highlighted health risks associated with PCOS. Since PCOS is a syndrome with elements common to other disorders (including thyroid dysfunction, hyperprolactinemia, non-classical adrenal hyperplasia, and Cushing's syndrome), it is a diagnosis of exclusion in the presence of two of the following three criteria: oligo- or anovulation, clinical and/or biochemical hyperandrogenism, and polycystic ovaries on ultrasound. According to the Rotterdam Consensus Group, any two of these three criteria are adequate for diagnosis.⁶ The inclusion of ultrasound criteria (presence of 12 or more follicles and/or increased ovarian volume) is significant because prior to 2003, the diagnosis was based on the presence of two criteria, to the exclusion of other etiologies: chronic anovulation and hyperandrogenism. As a result of including the ultrasound criteria, there are four possible phenotypes of women who could receive the diagnosis of PCOS: women with all three criteria, women with hyperandrogenism and oligo- or anovulation, women with hyperandrogenism and polycystic ovaries, and women with oligo- or anovulation and polycystic ovaries. In an extensive review of

Correspondence

Kristi Panchuk, kpanchuk@interchange.ubc.ca

the Rotterdam criteria, Geithövel argued that these criteria may prompt over-diagnosis because the criteria are vaguely defined.⁷ He proposed using androgenization as the criterion for diagnosing the condition and distinguishing between phenotypes. The phenotypic diversity also presents clinical challenges because women with the same diagnosis may represent different risk profiles.

The most recent consensus group, formed by the Androgen Excess and PCOS Society, concluded that hyperandrogenism is a necessary criterion for diagnosis, in addition to at least one of oligo-anovulation or polycystic ovarian morphology.⁸ Under these criteria women with the milder phenotype of polycystic ovaries and oligo- or anovulation are not diagnosed as having PCOS. Significant endocrine abnormalities and increased body mass index and waist circumference are characteristic of women with phenotypes including androgen excess and oligo-anovulation, with only milder abnormalities evident in the phenotypes with only polycystic ovaries and either androgen excess or oligo-anovulation.⁹ The risk of cardiovascular disease is increased in the hyperandrogenic phenotypes of PCOS,⁵ however, this risk is yet to be confirmed in normoandrogenic phenotypes. PCOS patients lacking androgenic variations are at lower risk for metabolic syndrome and insulin insensitivity.¹⁰ These early insights about the characteristics of the main phenotypes demonstrate that women with PCOS are a complex population who could require different approaches to management.

Even with consensus guidelines, achieving an accurate diagnosis is challenging for clinicians because of variability in ultrasound evaluation, unreliability of serum androgen levels, subjectivity in measuring hirsutism, and inaccuracy in timing serum progesterone testing.¹¹ Lujan et al. conclude that a conservative approach to diagnosis (for instance, including androgen excess as an essential criterion) will promote research and intervention to improve care of women with PCOS.¹¹ Yet, these authors support the Rotterdam criteria because these criteria include the widest phenotypic variation. This tension can be attenuated with a clinical emphasis on identifying women with androgen excess as accurately as possible with current diagnostic capabilities, while researchers explore strategies for improving diagnostic investigations and clarify the variation in health risks among phenotypes. Until diagnostic standards and the related clinical implications are determined, managing lower-risk phenotypes should be a dynamic process of responding to individual needs in light of emerging research.

RECOGNIZING AND APPRECIATING THE IMPACT OF PCOS

As a syndrome, PCOS has multiple characteristics derived from common mechanisms.¹² The following discussion highlights

some common clinical manifestations and complications of PCOS. Hyperandrogenism is the most consistently emphasized diagnostic feature of PCOS, and manifests clinically or as elevated serum androgen levels. Hirsutism is the most common clinical manifestation of hyperandrogenism, and can be experienced by adolescent and adult women with PCOS, affecting 50-76% of women with the diagnosis.¹³ Adult acne or severe adolescent acne is also evidence of hyperandrogenism and affects 10-34% of PCOS patients.¹³ The second diagnostic feature central to PCOS is ovulatory dysfunction, which commonly (though not exclusively) manifests as menstrual irregularity or the absence of menses.

Impact of PCOS on health status

Obesity

Though not all women with PCOS are overweight or obese, the average body mass index (BMI) of women with PCOS is higher than normal, and obesity is common in women with PCOS.³

There is evidence that PCOS influences women's metabolic activity in cases of normal and high BMI. For instance, women of normal weight with PCOS consume an average of about 400 kilocalories less than women of normal weight without PCOS despite no significant difference in physical activity.¹⁴ Women of normal weight with PCOS also report difficulty maintaining their weight.¹⁵ The relationship

between obesity and PCOS is complex in that adipocytes in women with PCOS behave differently than those of women without PCOS with regard to appetite regulation and steroid hormone metabolism. Obesity worsens the PCOS phenotype, and hyperandrogenemia contributes to central (android) obesity, which worsens insulin resistance.¹⁶⁻¹⁹ Strategies for weight management that are broadly applied to people who are overweight or obese may need to be adjusted for women with PCOS as their metabolic environment is influenced by their disease.

Type 2 diabetes mellitus

Insulin resistance and impaired glucose tolerance (IGT) are precursors to T2DM. An estimated 40% to 58% of women with PCOS have insulin resistance,¹⁹ in contrast to 7.2% of lean women without PCOS.²⁰ IGT and T2DM may be present in 9.4% and 1.6% of women with PCOS respectively.²⁰ Other researchers found 10% of adolescents and 20% of adult PCOS patients have IGT, irrespective of BMI.²¹ Women with PCOS have a high rate of conversion from IGT to T2DM,²² and have a relative risk of 4.0-6.0 of developing diabetes. PCOS patients contribute 15% to 36% of the overall disease burden of T2DM in white women, which is consistent with the number of women with T2DM with undiagnosed PCOS.²³ Oligomenorrhea presents a 2-2.5 times greater risk of T2DM, regardless of PCOS diagnosis,²⁴ which points to a relationship between menstrual irregularities and systemic complications.

“ The prevalence of the disease is commonly cited as affecting four to seven percent of women of reproductive age, though estimates based on diagnostic criteria that include ultrasound are as high as 17.8 %

Metabolic syndrome

Insulin resistance has a number of systemic effects that increase the risk of cardiovascular events and T2DM, and these effects together comprise the metabolic syndrome (METS). In addition to diagnostic criteria for PCOS, the 2003 consensus group defined criteria for METS in women with PCOS to include at least three of the following: waist circumference >88 cm (35 in), triglycerides ≥ 150 mg/dL, HDL-C <50 mg/dL, systolic blood pressure ≥ 130 or diastolic blood pressure ≥ 85 , and fasting glucose 100-126 mg/dL or a glucose tolerance test with a 2-h glucose 140-199 mg/dL.⁶ Recent analyses suggest that the prevalence of METS is on the rise among women of childbearing age.²⁵ METS has up to a 46% prevalence rate in adults and adolescents with PCOS and is more common in women under 30 years old.^{26,27} Stress is one possible explanation for the correlation between PCOS and METS.²⁸ Women with a family history of T2DM, obesity, and elevated fasting insulin levels are more likely to manifest more components of METS.²⁷

Lipid abnormalities and cardiovascular risk

Elevated triglycerides and reduced high-density lipoprotein levels, which are exacerbated by obesity, are among the components of METS that are cardiovascular risk factors. As part of METS, lipid variances are common to women with PCOS regardless of BMI.²⁹ In addition, there are well-documented variations in markers of atherosclerosis, such as increased carotid intima-media thickness and coronary artery calcification.⁵ Research is wanting in terms of cardiac events, in part because of the lack of clarity around the risks associated with each of the phenotypes of PCOS.³⁰ One research group calculated that the risk of myocardial infarction increases four- to seven-fold in women with PCOS.²⁴ Multifactorial risk for cardiovascular disease in women with PCOS warrants careful consideration of screening practices and preventive management.

Gynecologic and obstetric complications

Infertility is a common presenting complaint for women with PCOS. Women who meet the waist circumference criteria for METS (greater than 88 cm) and have a BMI greater than 30 have a 50% reduced likelihood of spontaneous conception,²² regardless of their PCOS status. When obesity is combined with the irregularly ovulatory or anovulatory states typical of PCOS, the chance of conception is likely lower. Pregnancy is also associated with increased risks for obese women, who are at risk for gestational diabetes and hypertension during pregnancy and their children are at risk for congenital anomalies, including cardiac defects.²² Recurrent miscarriage is more common in women who are obese, however, there is no conclusive evidence for this association.³¹ In one study, 56% of women with recurrent miscarriage also had PCOS, and although this is a higher prevalence than the normal population, the authors concluded that PCOS was not an independent etiological factor for recurrent miscarriage.³²

Further reproductive health outcomes for women with PCOS include increased rates of hysterectomy (odds ratio of 4:1), usually for benign reasons like fibroids or persistent vaginal bleeding.³³ Given infrequent shedding of the endometrium in oligo- or anovulatory women, the risk of endometrial cancer

is increased in women with PCOS, though the precise risk has not been defined.³⁴ Clinicians should therefore maintain a low threshold for recommending endometrial biopsy in these women because they are at increased risk for hyperplasia and carcinoma.

Mental health issues and quality of life

PCOS frequently manifests itself at puberty or during young adulthood with features like hirsutism and obesity, which affect self-image, self-esteem, and quality of life of young women.³⁵ Women with PCOS experience psychopathology more often than women without PCOS. More than half of women with PCOS have anxiety on clinical assessment, and this anxiety is often undiagnosed.³⁶ Over 60% of women with PCOS have depressive disorders, but again, there is insufficient evidence as of yet to determine phenotypic variations.³⁷ Eating disorders affect 35% of women with hirsutism, many of whom have PCOS.³⁸ Obesity is closely associated with eating disorders, and eating disorders are ten times more common in hirsute patients than in the general population.³⁸ One explanation for the 16% of PCOS women with bulimia is that androgens stimulate appetite and decrease impulse control, so the circulating levels of these hormones promote inappropriate eating behaviours.³⁹

In addition to being over-represented in populations with psychiatric illness, women with PCOS rate their quality of life lower than not only healthy women, but in the psychological aspect, quality of life scores are 20% lower than people with many other chronic diseases like asthma, epilepsy, diabetes, and coronary heart disease.¹⁵ Among adolescents with PCOS, lower scores on quality of life indicators seem to correlate with increased BMI,⁴⁰ but in adult women with PCOS, the reduced quality of life is independent of BMI.³⁵

RESPONDING TO WOMEN WITH PCOS

Presenting to a clinician with sub-fertility is the only time in their lives when many women receive care for PCOS. This means women who meet diagnostic criteria for PCOS but delay childbearing, never attempt to conceive, or have no difficulty conceiving are unlikely to receive a diagnosis or management for PCOS. Clinicians should be alert to the variety of issues with which women with PCOS may initially present and maintain a low threshold for performing comprehensive clinical assessment to identify or rule out PCOS.

Goals and challenges of clinical management

The overall goals of care for women with PCOS are to promote regular menses, ovulation, and fertility, while reducing cardiovascular risk, effects of insulin resistance, hirsutism and acne, risk of endometrial carcinoma, and incidence of T2DM.^{41,42} Diagnosing PCOS in adolescence and offering early treatment may mitigate the effects of hyperandrogenemia on the hypothalamus and slow the evolution of PCOS,⁴³ and at the very least delay or prevent serious consequences: psychopathology, T2DM, and cardiovascular risks. Educating women about PCOS and management strategies is in itself an intervention that may improve quality of life.³⁵

Lifestyle interventions

Diet and physical activity guidance can dramatically influence the course of PCOS in women and should be implemented in the care of all women with this condition.⁶ The goal of diet and physical activity interventions, according to some authors, is weight loss, which can be difficult to achieve in PCOS.⁴²⁻⁴⁴ In addition to reducing metabolic sequelae of PCOS, weight loss will also promote fertility²² and quality of life.¹⁵ Other authors contend that women with PCOS achieve the benefits of physical activity and healthy eating regardless of BMI and that metabolic risk profiles and quality of life should be the primary goals of lifestyle management.^{45,46} Regardless of the goals, the interventions should be medically monitored,²⁴ and this follow-up seems more important than the composition of the recommended diet.⁴⁷

Pharmacotherapeutics

The use of pharmacotherapeutics in PCOS is largely informed by women's symptomatology and goals of care. The phenotypic diversity of PCOS brings different problems and priorities for individual patients, so there is no single stepwise treatment regimen. As many goals of care can be met with pharmacotherapeutics, Badawy⁴¹ offers a current overview of pharmacological strategies. In what follows, we summarize some general recommendations. All oligomenorrhoeic or amenorrhoeic women should receive some form of treatment to prevent endometrial hyperplasia, which is a consequence of chronic exposure to unopposed estrogen that results from oligo- and anovulation. For women in which lifestyle management or insulin sensitizers do not induce regular cycles, treatment can take the forms of cyclic progesterone to induce regular bleeds, or menstrual suppression with hormonal contraceptives. Women who are not receiving continuous menstrual suppression should have an induced bleed or menses at least every three months. Metformin (Glucophage) and statins can be used in PCOS to address the metabolic problems related to insulin resistance, including hypercholesterolemia. Spironolactone (Aldactone), flutamide (Euflex), and finasteride (Propecia) are various effective antiandrogens. Oral contraceptives are commonly used to induce regular bleeds (thus preventing endometrial hyperplasia and cancer) and to treat hirsutism and acne in women who also seek contraception. Many of these pharmacologic interventions that are useful for women with PCOS can be implemented in primary care, but more specialized treatments are appropriate for consultant practice in dermatology, reproductive endocrinology, or other areas of medicine.

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PCOS frequently manifests itself at puberty or during young adulthood with features like hirsutism and obesity, which affect self-image, self-esteem, and quality of life of young women

Monitoring

The first step in meeting some of the goals of care is regular laboratory screening. Though some suggest adhering to T2DM screening guidelines and offering women fasting blood glucose testing,⁴⁸ many other authors suggest this test is not sensitive enough in the PCOS population and routine, even annual, screening for IGT and T2DM with oral glucose tolerance testing is warranted in all patients from adolescence through post-menopausal life.^{20-22,43,49} However, this is not yet the standard of care for women with PCOS.²² Regular lipid profiles are recommended for all women with PCOS to assess those components of METS and overall cardiovascular risk.²⁹

CONCLUSION

Women with PCOS experience significant health risks and should have access to early diagnosis and management to prevent metabolic and psychosocial sequelae. Healthcare providers should maintain a high index of suspicion for the disease and offer risk-appropriate management to women presenting with signs of PCOS. Care by specialist physicians is often indicated for particular complications, but many important aspects of management are well-suited to a comprehensive approach in primary care. 

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How Genomics is Changing Medical Practice

Ruth Thomas, MSc^a, Shelin Adam, MSc^a, Lesley Phillips, PhD^a, Marion Thomas, PhD^a

^aBC Clinical Genomics Network, University of British Columbia, Vancouver, BC

ABSTRACT

Exponential improvements in genomic technology allows researchers to focus on the information contained in the human genome, in the hope of applying that knowledge clinically. The field of genomics, where all of an individual's genes are considered at once, has already begun to change medical practice. For instance, chromosomal microarrays are already being utilized to diagnose autism spectrum disorder, development delay, intellectual disability, and birth defects. By recognizing duplications and deletions, which are too small to identify with traditional chromosome analysis, we are able to improve diagnostic yield for these disorders. Whole genome sequencing has been used to diagnosis genetic illnesses, even in cases when the clinical picture or diagnosis is unclear. Through pharmacogenomics, which can help explain how genetic variants affect drug metabolism, we will be able to decrease the staggering incidence of adverse drug reactions, and guide physicians in medication choice for individual patients. With a better understanding of the relationship between genomic compositions, susceptibility to illness and treatment options, physicians will be able to practice more personalized medicine, offering more effective and safer treatment. Genomics has already begun to impact medical care and will likely revolutionize how medicine is practiced in the near future.

KEYWORDS: *genomics, personalized medicine, pharmacogenomics, chromosomal microarray, whole genome sequencing*

THE FIELD OF GENOMICS IS BORN

Following the completion of the Human Genome Project (HGP) in 2001, scientists and researchers were able to spell out the sequence, or code, of the human genome.¹ Since the completion of the HGP more than 10 years ago, there have been exponential improvements in the technology.² For instance, sequencing is now 100,000 times less expensive, and the newer generation machines are able to read sequences 50,000 times faster. While it took 13 years to complete the human genome project, it is now possible to sequence a human genome in a day.² With the technology ever-improving, scientists are able to focus on the information being produced.

THE TREMENDOUS POTENTIAL IN SEQUENCING THE HUMAN GENOME: PERSONALIZED MEDICINE

Advances in genomic research have resulted in an increasing awareness of the tremendous potential in interpreting and

understanding the sequence of the human genome. One of the early discoveries was its sheer complexity, as there is incredible variation amongst the genomes of even two healthy individuals.³ In fact, each individual differs in their sequence by as much as 0.5%. For instance, when compared to the reference human genome, each individual will have between 3 and 3.5 million single nucleotide variants (SNVs), and approximately 1,000 relatively large copy number variants (CNVs).³ SNVs involve changes to single nucleotides, such as the substitution of one base pair for another (single nucleotide polymorphisms or SNPs), or the deletion or duplication of a single nucleotide. In contrast, CNVs occur when a particular portion of the genome is either duplicated or deleted, and therefore leads to a divergence from each person having two copies of each gene, one from each parent.³ While seemingly daunting, for scientists, these variations were seen as an opportunity to harness these sequences in order to better understand disease and treatment options.^{2,3} Better understanding of the human genome will result in increasingly personalized medicine, "a form of medicine that uses information about a person's genes, proteins, and environment to prevent, diagnose, and treat disease."⁴ Genomics has already begun to impact medical

Correspondence
Ruth Thomas, rthomas@cfri.ca

care and will likely revolutionize how medicine is practiced in the near future.

MICROARRAYS: GENOMICS IS ALREADY IN ACTION, PROVIDING DIAGNOSES

Genomics has already entered the clinical realm to diagnose illnesses such as development delay, intellectual disability, autism spectrum disorder (ASD), and birth defects.⁵ It is estimated that 3% of the population has developmental delay/intellectual disability and approximately 1 in 110 individuals have ASD.⁶ Traditionally, when trying to diagnose these types of illnesses, physicians have relied on G-banding chromosomal analysis, which involves viewing chromosomes under a microscope to visualize and inspect chromosomes for missing or added segments.⁵ Chromosomal microarray (CMA) represents a newer genomic technology which utilizes computer chips and fluorescently labeled DNA, and offers significant improved diagnostic yield. For instance, CMAs have significantly improved resolution and can detect gains and losses which are ten times smaller than traditional chromosomal analysis, which translates to 10% more diagnoses.⁵ The American College of Medical Genetics now recommends that CMA should be the first test ordered for diagnosing patients with intellectual disability, developmental delay, autism, and multiple congenital anomalies of unknown cause.⁷ With more children receiving a diagnosis for their illness, physicians are better able to provide appropriate medical care and to offer accurate recurrence risk information to their families.⁵

Case example: Genomic sequencing provides an answer to a diagnostic dilemma

The following case demonstrates how genome sequencing can not only provide a diagnosis, but also guide the appropriate treatment. Fraternal twins were diagnosed with dopamine response dystonia (DRD) at the age of 5, after it was found that L-dopa relieved symptoms of dystonia exhibited in one of the twins.⁸ The twins were responding well to their treatment until the age of 14, when they started exhibiting a myriad of symptoms including tremors, dystonia, unsteady gait, bradykinesia, and difficulty breathing. Following this decline in their clinical presentation, it was clear that further intervention was needed.

In order to elucidate the cause of the new symptoms in these twins, researchers sequenced both of their genomes, and compared them to their healthy sibling and parents. It was found that the twins carried mutations in SPR, which is an enzyme involved in the molecular pathway that produces dopamine and serotonin. With a better understanding of where the defect in the pathway was, the physicians were able to prescribe 5-hydroxytryptophan (5-HTP), a serotonin precursor which these twins needed in conjunction with the L-dopa. Following the initiation of the new treatment, the twins saw improvement in their symptomatology.

While SPR mutations have been associated with DRD in the past, clinical genetic testing for mutations in this gene was not indicated, because the presentation in the twins did not fit the classical clinical presentation for individuals with SPR mutations, which includes intellectual disability and unresponsiveness to L-dopa.⁸ Had it not been for the ability to sequence the entire

genome, it is possible that a proper diagnosis would not have been reached. In this case, genomics was not only able to provide an accurate diagnosis, but was also able to guide to the appropriate treatment.

PHARMACOGENOMICS

A rapidly evolving area of genomics is pharmacogenomics which takes into account how particular genetic variants affect our ability to respond to and metabolize drugs.^{2,9} Using pharmacogenomics, we hope to decrease the staggering incidence of adverse drug reactions, as well as to guide physicians on which medications are the most appropriate for individual patients.

Adverse drug reactions (ADRs) are defined by the World Health Organization as a response “to a drug which is noxious and unintended, and which occurs at doses normally used in man” for prophylaxis, diagnosis, or therapy.¹⁰ It has been estimated that genetic factors may be responsible for up to 95% of the variability in drug response and have been shown to play a role in both incidence and severity of ADRs.¹¹ Previous studies have indicated that fatal ADRs represent the fourth to sixth leading cause of death in the United States.¹² It is estimated that between 5 and 7% of hospital admissions are due to ADRs, and the most commonly responsible drugs are ubiquitous medications such as aspirins, other NSAIDs, and antibiotics.^{9,13} The prevalence of ADRs is not surprising when you consider that Health Canada estimates that over 50% of newly approved therapeutic health products have serious side effects that are discovered only after the product is on the market.¹⁴

Pharmacogenomics will likely be able to lessen the economic and health burden of ADRs because if we know how particular genetic variants, in particular SNPs, will contribute to an individual’s metabolism of a drug, physicians will be better equipped to prescribe the right drug, at the right dose, for the right patient.^{11,12}

Case example: An ADR resulting from codeine use

For an example of pharmacogenomics in clinical practice, consider codeine, a commonly prescribed analgesic which is metabolized into its active form, morphine, by the enzyme CYP2D6.¹⁵ Until recently, it was common practice to prescribe codeine to new mothers for postpartum pain.¹⁶ This was the case when codeine was prescribed to a new mother in 2005, after she delivered a healthy, full-term baby boy. The mother took her son home but after a week the infant started to exhibit difficulty with breast feeding and lethargy. At a well-baby appointment on day 11, his pediatrician noted that the baby had regained his birth weight, but then only two days later, the infant passed away suddenly. Testing revealed that he had extremely high levels of morphine in his blood which had led to an opioid overdose and central nervous system depression. Analysis of the mother’s blood and breast milk indicated morphine levels that were much higher than expected from her prescription, indicating that she was metabolizing codeine into morphine at a much higher than average rate. Genetic analysis of CYP2D6 was later performed and confirmed that variants in the mother’s gene that resulted in her being an ultra-rapid metabolizer.¹⁶ The frequency of variants in this gene

differ between ethnic populations and can vary from 1% to as high as 29%, which demonstrates that testing for variants would be clinically relevant for many patients.¹⁵ Given the possible risk that codeine poses to infants, it is now recommended that should codeine be prescribed in the postpartum period, physicians, as well as parents, should be vigilant and well-educated regarding the risks.¹⁷

GENOMICS IS CHANGING MEDICINE

Genomics is a rapidly evolving field that will likely change how medicine is practiced in the near future. We have evolved from just having the sequence of the human genome, to harnessing that sequence to improve clinical outcomes and diagnoses in patients.^{5,15} With the continuing advances in genomic technologies, we will continue to answer more clinical questions and solve more diagnostic dilemmas.^{8,16} It is important that physicians become well-educated on genomics and stay abreast of the different advances, as genomics becomes incorporated into routine medical care.³ The BC Clinical Genomics Network (www.bccgn.ca), which is funded by the Michael Smith Foundation for Health Research, understands the importance of physician education on genomics and provides many educational opportunities through conferences, hospital rounds, educational films, and seminars. 

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Rhabdomyolysis Causing Acute Kidney Injury in a Patient with Multiple Risk Factors and an Underlying Inflammatory Muscle Disease: A Case Report

Christopher Little, MD^a, Sean Hamilton, MD, FRCPC^b, John Shik, MD, FRCPC^c

^aPGY-1 Internal Medicine, Faculty of Medicine, University of British Columbia, Vancouver, BC

^bAssociate Professor, Faculty of Medicine, Memorial University of Newfoundland, St. John's, NL

^cAssistant Professor, Faculty of Medicine, Memorial University of Newfoundland, St. John's, NL

ABSTRACT

A 33 year-old Caucasian male with underlying type one diabetes mellitus, dyslipidemia, hypothyroidism, and nephrotic syndrome secondary to membranous glomerulonephropathy (GN), presented with new onset tonic-clonic seizures (lasting one minute) after an episode of binge drinking in which there was a considerable period of immobilization. The patient was taking 80 mg of atorvastatin daily at the time of presentation. The patient was intubated and ventilated and initial laboratory investigations confirmed a creatine kinase (CK) of 12,000 U/L (normal 20-220 U/L) and creatinine of 3.1 mg/dL (normal 0.7-1.3 mg/dL), and associated symptomatic hyperkalemia of 5.6-5.9 mmol/L (normal 2.5-5.0 mmol/L). The patient developed acute kidney injury (AKI) presumed secondary to rhabdomyolysis, and required renal replacement therapy. His CK eventually peaked at 153,741 U/L on the seventh day of admission. The patient regained consciousness and improved clinically over the following weeks. A muscle biopsy performed on the 29th day of admission showed changes consistent with polymyositis. On follow-up testing, the patient's TSH was noted to be 101.99 mIU/L (normal 0.5-5.0 mIU/L) with a T4 of 5.5 pmol/L (normal 8.5-15.2 pmol/L) indicating uncontrolled hypothyroidism. This case highlights multiple potential etiologies causing rhabdomyolysis that may occur concurrently in a patient and contribute to AKI.

KEYWORDS: *rhabdomyolysis, AKI, polymyositis, CRRT*

INTRODUCTION

Rhabdomyolysis is a condition in which skeletal muscle cells break down, releasing intracellular proteins, including creatine kinase and myoglobin, intravascularly. Clinical symptoms may include the classical triad of muscle pain, weakness, and brown urine. Rhabdomyolysis has multiple etiologies and accounts for 7-10% of AKI in the United States.¹ Of these etiologies, statin use, alcohol use, seizures, immobilization and hypothyroidism have been well-documented in the literature.² Polymyositis induced rhabdomyolysis has also been documented.³ There is an increased incidence of rhabdomyolysis in patients possessing multiple risk factors.⁴ While most patients afflicted with rhabdomyolysis causing AKI recover renal function, some studies have suggested that those patients in ICU settings have a mortality rate nearing 59%.⁵

We report here on a patient who developed rhabdomyolysis secondary to a combination of all of the above-mentioned

etiologies and subsequently required the administration of continuous veno-venous hemodiafiltration during an extended ICU admission.

CASE REPORT

A 33 year-old Caucasian male presented to a community hospital after a grand-mal seizure occurring twenty-four hours after an episode of binge drinking, in which he consumed approximately 12 oz of liquor.

His medical history included a diagnosis of membranous GN proven by biopsy in 1998 as well as in 2009. He was showing signs and symptoms consistent with nephrotic syndrome two months prior to presentation. Prior to admission, the patient's baseline creatinine was 1.07 mg/dL with 4.20 g/day urine protein (normal <0.15 g/day). His nephrotic syndrome was also complicated by dyslipidemia. Medications on admission included insulin aspart 14 units TID, insulin glargine 26 units qhs, fosinopril 40 mg po od, ECASA 81 mg daily, atorvastatin 80 mg daily, candesartan 16 mg daily and levothyroxine 50 mcg daily. He was a one pack-per-

Correspondence

John Shik, jshik@mun.ca

day smoker and admitted to regular bouts of binge drinking.

The patient was intubated without sedation and physical exam showed no abnormalities except mild peripheral edema. Initial blood work showed a creatine kinase of 12,000 U/L and creatinine of 3.09 mg/dL. Intermittent hemodialysis was started and his potassium levels remained elevated between 5.6-5.9 mmol/L, which in turn was associated with a wide complex tachycardia. Head CT was normal. A bronchoscopy was also performed at this time and bronchial washing culture grew *Streptococcus pneumoniae* and *Haemophilus influenzae*.

The patient became anuric with refractory hyperkalemia despite daily intermittent hemodialysis and was diagnosed at that time with rhabdomyolysis causing AKI. He was hypotensive and was started on dopamine and norepinephrine infusion to maintain adequate perfusion. On day three of presentation, the patient was transferred to a tertiary care centre ICU and was started on continuous veno-venous hemodiafiltration secondary to persistent and rising potassium levels with EKG changes (Table 1). He was initially treated with Dilantin for seizure prophylaxis that was subsequently switched to valproic acid after he developed an apparent allergic reaction to Dilantin. Cefotaxime and vancomycin were started for treatment of his respiratory infection. The patient's liver function tests at time of transfer, aspartate transaminase (AST; normal values 0-35 U/L) and alanine transaminase (ALT; normal values 3-36 U/L) were 1511 U/L and 522 U/L, respectively. The patient's creatine kinase peaked at 153,741 U/L and creatine at 7.03 mg/dL on the seventh day of admission. The patient spent eighteen days in ICU, was dialyzed for approximately 26 days, and was discharged from hospital approximately three days after discontinuation of dialysis. On the day of discharge, lab work showed a creatinine value of 2.06 mg/dL, creatine kinase of 151 U/L, and LFT's within normal range.

There was an improvement clinically over the following weeks and a biopsy of the left deltoid muscle was performed on the day of discharge approximately thirty days after presentation. The results of this biopsy showed a chronic endomysial inflammatory infiltrate with degenerating fibers most consistent with polymyositis. This inflammatory picture showed a predominance of lymphocytic infiltrate which is consistent with the diagnosis of polymyositis, and not with alcohol or statin induced myopathy. On follow-up with a rheumatologist approximately five weeks after presentation, it was noted the patient did not present clinically with signs of polymyositis. In further follow-up, it was noted that since the time of his admission his TSH level had risen to 101.99 mIU/L from 16.16 mIU/L and his free T4 level dropped from 10.2

pmol/L to 5.5 pmol/L. The patient was discharged home on an increasing dose of thyroid replacement therapy, erythropoietin 4000 units IV weekly and the atorvastatin was discontinued. Creatinine returned to a stable value of 154 umol/L three months after presentation while the creatine kinase remains elevated at 854 U/L. The patient is clinically well.

DISCUSSION

While the etiological components leading to rhabdomyolysis are diverse, a common pathway of myocyte injury has been elucidated.⁶ The most fatal end result of this condition being AKI, with a mortality rate reported to be as high 50%.² The effects of these intracellular proteins on the kidney are multifactorial, with important components being hypovolemia, luminal obstruction by both myoglobin and uric acid casts, ischemia due to vasoconstriction⁷ as well as direct damage by ferrihaemate.⁶

Our patient presented after an episode of binge drinking associated with a tonic-clonic seizure and period of immobilization. There was an underlying component of chronic kidney disease and polymyositis as well as hypothyroidism. He was also taking a statin and had an underlying respiratory infection. One study described the top three causes of rhabdomyolysis were illicit drug and alcohol use, prescribed pharmaceuticals, and trauma.⁴

Interestingly, this group⁴ was the first to look at muscle diseases in a hospitalized population. They found that not only is polymyositis the most frequent muscle disease associated with rhabdomyolysis, but those with muscle diseases tend to develop rhabdomyolysis *de novo* and suffer from recurrent episodes. This finding is consistent with two case reports of a 39 year-old woman³ and 57 year-old woman⁸ who presented with distinct episodes of rhabdomyolysis in the context of an underlying polymyositis with no other risk factors.

Our patient's creatine kinase value was noted to be grossly elevated following admission to a tertiary care hospital. In most instances creatine kinase values rise shortly after muscle injury from 2-12 hours, peak in 1-3 days⁹ and then decline 39% per day.¹⁰ Persistently elevated levels may indicate ongoing muscle insult or the development of compartment syndrome.¹¹ Serum creatine kinase concentrations are not used to definitively define rhabdomyolysis, but many large-scale studies have assigned a value of five times normal as a diagnostic criterion.⁶ There is a linear relationship between creatine kinase levels and serum creatinine levels. However, there is conflicting evidence regarding the association of CK levels with AKI¹² and it is generally accepted that factors such as age and multiple insults influence AKI independent of creatine kinase. Patients suffering from multiple insults have been found to have an increase incidence of AKI independent of creatine kinase levels.⁴

The patient described here presented with multiple risk factors for rhabdomyolysis. His underlying chronic conditions set the stage for a sub-clinical myopathy that was exacerbated by alcohol, seizure, and immobilization. Muscle biopsy is an infrequently employed technique of diagnosing rhabdomyolysis but may have further clinical value if there is an underlying muscle disease. Few cases of polymyositis induced AKI have been described,^{14,15} but in the setting of acute on chronic muscle

Table 1. Indications for Dialysis^{16,17}

Acid base	Acidemia (pH < 7.1)
Electrolyte abnormalities	Hyperkalemia (>6.5 meq/L or rapidly rising), hypercalcemia (>3.5 mmol/L), tumour lysis syndrome
Ingestion	Methanol, ethylene glycol, ASA, lithium
Overload	CHF
Uremia	Pericarditis, neuropathy, encephalopathy, bleeds

injury this condition would likely contribute significantly. The most frequently used diagnostic test, serum creatine kinase, may not predict who will develop AKI in patients who suffer from multiple insults.⁴ The sustained increase in creatine kinase levels on follow-up two months later may indicate that there may be a sustained muscle insult, stemming from sub-optimal treatment of hypothyroidism or ongoing polymyositis. 

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Elective Report: A European Take on Neuro-Anesthesia

Ambica Parmar, BSc^a

^aMD Class of 2013, Faculty of Medicine, University of Alberta

ABSTRACT

The LKH-Universitätsklinikum Hospital lies within Graz, Austria, a small city of approximately 250,000 residents. From a North American perspective this is an unrecognized medical university. It has an incredible dedication to teaching and is frequently visited by both European and Asian medical students as a part of their medical training. My opportunity to complete a four-week elective in the Department of Neuro-anesthesia was an invaluable opportunity that improved my understanding of this particular anesthesia subspecialty and the technological advancements specific to it. Unlike the more popular third world electives carried out by many of my peers, the focus of interest was not on the development of underprivileged healthcare systems. Rather, it was on the importance of international collaboration towards the betterment of medical care.

KEYWORDS: *anaesthesia, neuro-anaesthesia*

ELECTIVE REPORT

Graz, Austria, is well-known throughout Europe as a university town with upward of 44,000 students who attend the six universities situated within Graz.¹ Although a popular site of study for those residing in Europe, it is largely unknown internationally. With over 2,000 research profiles and

60,000 publications, it is surprising that the Faculty of Medicine in Graz remains largely hidden from international recognition and affiliation.² Furthermore, the faculty's extensive experience with the education and training of European medical students suggests that the University of Graz is a well-qualified site for Canadian medical student's elective experience.

Luckily, I was granted the opportunity to spend four weeks in the Department of Neuro-anesthesia at the LKH-Universitätsklinikum Hospital in Graz. During this period, my

Correspondence
Ambica Parmar, ambica@ualberta.ca

personal objectives and goals were to: 1) gain practical skills and techniques in pre-operative assessments, intubation, intravenous (IV) line insertion and arterial line insertion; 2) differentiate anesthetic type and delivery with respect to various surgical indications; and 3) outline the steps and possible complications of induction and extubation. Furthermore, I was interested in comparing the similarities and differences in healthcare delivery between countries. Specifically, I wanted to better understand how different cultures shape the medical profession, and the professionals that they craft.

Early in my elective, I was fortunate to be paired with an anesthesiologist who was fluent in English. This made my transition to medical life in Austria easier, and helped me to more easily fulfill my objectives. My preceptors were more than eager to teach, and facilitated sessions with models and simulations to allow me to master basic skills, both during and outside of the operating room (OR). At the LKH-Universitätsklinikum Hospital, anesthesiologists are not limited to one specific subspecialty, but rather deliver anesthesia in a variety of settings. Although my elective was to officially take place in the Department of Neuro-anesthesia, my opportunities were not limited to this division. I was also exposed to various subspecialties of anesthesia including Radiology and Critical Care. Throughout my experience, I was able to participate in the induction, maintenance, and emergence from anesthesia. As the majority of patients required post-operative admission into the associated neuro-surgical Intensive Care Unit (ICU), I commonly followed the patients' recovery with the appropriate guidance from my preceptors. Through the encouragement of the neuro-anesthetists, I gained a lot of hands on experience with various procedures for airway management and vascular access. Although the language barrier hindered my experience with direct patient encounters, my lack of German fluency did not serve as a barrier to the teaching opportunities from the various physicians working on site. Although broad, I believe this experience allowed me to achieve all of my previously outlined objectives.

Being within a subspecialized discipline, I had the opportunity to learn about the novel techniques neuro-anesthetists were utilizing in patient management. For instance, I was exposed to the use of intra-operative Bispectral Index (BIS) monitoring for the depth of anesthesia. BIS monitors employ an algorithm to convert a patient's brain activity (monitored via electroencephalogram leads) into a number, which is thought to represent the depth of anesthesia.³ BIS monitors are routinely utilized in intra-cranial surgeries at the LKH-Universitätsklinikum Hospital in order to ensure appropriate titration of anesthesia to allow for surgical intervention, while allowing for a controlled, precise emergence from anesthesia. Although the literature regarding the use of this technology remains largely inconclusive, many anesthesiologists in the LKH-Universitätsklinikum Hospital commonly employ its use.^{4,5} I believe this experience has allowed me to gain a better understanding for the use and implications of BIS monitors. Furthermore, through my clinical exposure to the BIS monitor, I believe I am now better equipped to interpret the literature regarding its efficacy. Similarly, through my experience in the neuro-surgical ICU, I was exposed to the routine use of

evoked potentials as a prognostic tool for those who had suffered severe brain trauma. Through the monitoring of responses of the central nervous system (CNS) to various neural stimulations, evoked potentials allow you to evaluate the brain's recovery of function post-insult.^{3,6} Through my four-week elective, I was able to evaluate the efficacy of evoked potentials as a prognostic tool. While I may have been able to gain this knowledge by analyzing literature, I believe that I have gained a superior understanding of the role of evoked potentials by actually having had the opportunity in Graz to gain hands-on experience.

Overall, my exposure to Neuro-anesthesia in Graz was fulfilling and it has given me a better understanding of the discipline and scope of Anesthesia. Moreover, I feel this experience has allowed me to better appreciate the variability of healthcare delivery between countries. This was best exemplified in my discussions with out-of-country professors who frequently visited the Neuro-anesthesia operating suite to gain better understanding of the uses and implications of these various neuro-monitoring techniques. I now understand why international meetings are such an important way to share innovation in medicine, and to foster collaboration towards advancements in medical practice. For me, this experience highlighted how studying medicine in one location may limit a student's perspective on the scope of practice. The simplicity of "doing as one was taught" can foster medical practice based on tradition, as opposed to innovation and evidence. This international elective experience has given me insight into the advantages of obtaining medical experience in different locations, be they inter-country or international. Furthermore, I now realize the value of identifying these differences as a student. As medical students in the 21st century, the world we are preparing to practice in is ever more globalized and connected. It has become necessary for us to evaluate the various approaches to medical practice that exist between cultures. In doing so, we can use this information to better improve the care we offer our patients, wherever we practice. 

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Nurse Practitioners – An Underutilized Resource

Danny Guo, BSc, MSc^{a*}, Kevin Zuo^{b*}

^aMD Class of 2014, Faculty of Medicine, University of Calgary

^bMD Class of 2015, Faculty of Medicine, University of Alberta

* Both authors contributed equally

ABSTRACT

The nurse practitioner (NP) is a relatively new care provider in the Canadian healthcare system. NPs are registered nurses (RNs) with extensive clinical experience and higher education to conduct advanced health assessments, make diagnoses, order and interpret lab tests, prescribe drugs, perform advanced interventions, monitor outcomes, and make referrals to other healthcare providers. Although the positive impact of NPs in improving patient access to timely and quality care has been widely demonstrated, NPs continue to be grossly underutilized in Canada. We provide our thoughts on how to expand the role of the NP in healthcare delivery.

KEYWORDS: *nurse, registered practitioner, underutilized, interdisciplinary*

INTRODUCTION

Although the Canadian healthcare system provides universal coverage and demonstrates excellence in patient outcomes, long wait-times continue to be a major problem. One strategy to address this issue was to train more nurse practitioners (NPs) with the introduction of the \$8.9 million Canadian Nurse Practitioner Initiative in 2004.¹ NPs are registered nurses (RNs) with clinical experience and higher education who conduct advanced health assessments, order and interpret lab tests, make diagnoses, prescribe drugs, perform advanced interventions, monitor client outcomes, and make referrals to physicians and other healthcare providers.² As highly trained healthcare professionals, NPs have demonstrated improved access to timely and quality care, especially in remote communities and areas with physician shortages.^{1, 3-6} In spite of this, NPs represented only 0.9% of Canadian nurses in 2010.⁷ By reviewing current literature on the NP profession, this article will explore how NP collaboration with physicians can improve healthcare quality and accessibility, examine current barriers to expansion of NPs, and propose recommendations to improve NP integration in the healthcare system.

COLLABORATION BETWEEN NPS AND PHYSICIANS

While it is true that both NPs and physicians are qualified to diagnose illnesses and prescribe medications, it is a misconception to assume that these are antagonizing roles. When NPs and physicians are viewed as collaborators instead of competitors, the benefits of this cooperation become clear. With their extensive training and experience as nurses, NPs have exceptional patient

communication skills and are able to participate in both the care and cure of the patient.⁸ By bringing a diverse range of experiences, including comprehensive patient education and chronic care management, NPs promote greater flexibility and adaptability in team management.⁹ Indeed, in comparison to physicians, NPs have demonstrated improved patient outcomes in diabetes management and primary care consultations,^{3,4,5,7} as well as providing emergency patients with shorter wait times compared to physicians.¹⁰ By assisting in investigating, diagnosing, and treating common or familiar illnesses, NPs can effectively reduce the workload of physicians and increase overall team performance. In cases where NPs are uncomfortable with diagnosis or treatment, they will always have the option to consult medical specialists for advice. Finally, although NPs and general practitioners (GPs) are no different in their costs to healthcare funding,¹¹ historically, NPs have been more willing to practice in rural areas than newly trained GPs so the expansion of NPs may improve the access to care in underserved rural populations.¹²

LIMITATIONS TO NPS IN CANADA

Job opportunities and compensation

Despite the many years of clinical practice, advanced training, and tuition/licensing fees required for NP licensure, NP salaries in Canada vary radically between provinces and individual healthcare settings. In 2009, the average hourly wage of NPs across Canada ranged from \$29.00 to \$56.45.¹³ This phenomenon may be due to a lack of unionization for NPs, making compensation negotiations less standardized and thus generating large discrepancies in NP salaries across different provinces. Indeed, in BC, where NP compensation is comparatively generous, there is actually a job shortage of NPs.¹⁴ In 2011, the British Columbia Nurse Practitioner Association (BCNPA) reported that out of the 240 certified NPs (213 trained and 27 new graduates), 55 (22.9%) were actively seeking employment.¹⁴ While this trend may not

Correspondence

Danny Guo, dguo@ucalgary.ca or Kevin Zuo, kzuo@ualberta.ca

be present across Canada, it is crucial to recognize that the NP profession cannot expand unless job availability is ensured.

Role definition and acceptance from stakeholders

Besides variable compensation, another major barrier to enhancing NP integration is role definition. Explored in more detail by Sangster-Gormley et al., the general lack of role definition and role standardization confuses co-workers as to the NP's capacity and responsibility; in turn, this leads to a general lack of support and acceptance of NPs in the hospital environment.^{15,16}

In some extreme cases, GPs have voiced their concern that the introduction of NPs will disrupt continuity of care and therapeutic relationships between the family doctor and his or her patients, as well as ultimately replace GPs with NPs as the latter are less costly to employ.¹⁷ Other physicians argue that NPs have insufficient training and experience, and thus should have limited autonomy.¹⁵

NPs have also experienced difficulties in patient acceptance. Despite steady growth, the NP is still a relatively new profession in Canada and patients may not associate a nurse with someone who diagnoses, prescribes, and follows up.^{18,19} In fact, Sawchenko et al. conducted a survey about NPs in 2008 in BC and found that only 48% of the respondents had heard of NPs.²⁰ Once they were informed about the role of NPs, 73% of the respondents were willing to be assessed by NPs instead of physicians, while 23% were unwilling.²⁰ Clearly, patient awareness and acceptance are areas that must be improved in order to increase NP utilisation.

Table 1. Comparison of roles between registered nurses, nurse practitioners, and family physicians.

	Registered Nurse	Nurse Practitioner	Family Physician (General Practitioner)
Assessment	Limited	Yes	Yes
Diagnosis	Limited (nursing diagnosis only)	Yes	Yes
Intervention	Yes	Yes	Yes
Prescription	No	Limited (No controlled substances)	Yes
Evaluation	Yes	Yes	Yes

RECOMMENDATIONS FOR IMPROVEMENT

Reduce income variability and improve job availability

The transition of an RN into an NP results in increased responsibility and scope of practice; unfortunately, this promotion is accompanied by uncertain employment prospects and potentially less compensation. The creation of a common negotiating body and standardization of provincial policies for NP compensation can help address the issue of variable income, while close collaborations between educational institutions offering an NP program and policy makers who allocate funding for hiring NPs can help address the issue of unmatched supply and demand for NPs in each province.

Promote public awareness and understanding

As most nurses focus on supporting physicians and following their management orders, it is unsurprising that a large proportion of the

general population is unfamiliar with the concept of a nurse who can practice like a doctor. In order for more NPs to successfully integrate into our healthcare system, patient acceptance and appreciation of NPs as leaders in primary care needs to be established. Hence, increasing public knowledge, understanding, and recognition are important first steps in expanding the role of NPs. Possible strategies include creating media broadcasts, providing information pamphlets in care centres, and increasing exposure of educational websites.

Promote professional acceptance by better defining role boundaries

The role of NPs must be better defined in individual healthcare settings. Although an NP's legal scope of practice and professional capacity may not be significantly different from GPs (Table 1), their worksite specific roles vary greatly depending on location and situation. This role variability can become an advantage if it is well defined and understood by both the NP and the specific healthcare team prior to the onset of employment. This mutually accepted role definition allows for a framework for inter-professional cooperation that would provide a foundation for effective patient management in primary care settings with both physicians and NPs. By clearly outlining which types of patient situations are better suited for physician or NP management, healthcare centres will be able to promote more efficient cooperation and health care. Furthermore, NPs should be encouraged to consult medical specialists for advice in cases where they are uncomfortable with diagnosis or treatment. As an example, Sangster-Gormley et al. made three recommendations for improving NP integration, which can be summarized as:

1. Involving stakeholders, such as managers and physicians, in defining the roles of NPs in their workplace. As healthcare professionals generally work in teams, this will promote an understanding of the NP's scope of practice and how they can function in the team to promote patient care.
2. Accepting NPs as team members and placing value in their prior experiences by other members of the healthcare team.
3. Declaring the intention of integrating an NP into the healthcare team. By doing so, expectations and professional roles can be defined early to promote team logistics and collaboration.

CONCLUSION

As members of a patient-centred healthcare system, all healthcare professionals should work collectively to implement reforms that improve patient care. While NPs are not trained to provide care equivalent to physicians, they have demonstrated their ability to provide timely, quality care in rural and urban settings, and hence can work together with physicians to improve the efficiency of health delivery. Despite initiative by the Canadian government, poorly defined professional roles and scopes of practice, variable income, and lack of job opportunities impede the growth of the NP profession. With the current shortage of primary care physicians,

especially in rural areas, as well as the retirement of baby-boomers, now is the time when effective integration of NPs can help improve our healthcare system.²¹ By addressing the major barriers to NP expansion, healthcare systems can maximize the potential of NPs as experienced and flexible healthcare providers.



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Online Videos: A New Tool for Medical Education

Joseph Anthony Andrews, BHSc^a

^aMD Class of 2014, Faculty of Medicine, University of Alberta

ABSTRACT

Currently, most Canadian medical schools educate students on core biomedical knowledge through lecture-based courses. However, recent studies indicate that passive lecture-based university courses fail to educate students in an efficient manner. In response, Dr. Sebastian Thrun and Sal Khan separately developed successful online educational models that engage students with interactive online videos focusing on fundamental concepts. This use of online interactive videos represents a new educational tool medical schools can use to engage students in active learning and also as a way to provide standardized teaching to students dispersed across several hospitals or at different campuses.

KEYWORDS: *vodcasting, online education, lectures, video, medical education*

A NEW EDUCATIONAL TOOL

In autumn of 2011, computer science professor Dr. Sebastian Thrun created an online version of "Introduction to Artificial Intelligence" that ran parallel to his course at Stanford University. However, he made this online course available to anyone outside the university.¹ Two unexpected outcomes occurred. First, within weeks of offering the course 58,000

students enrolled, and in the end, over 160,000 non-Stanford students from across the globe completed the course.^{1,2} The second, and most unsettling outcome for Stanford, was that of the 200 students in Dr. Thrun's class on campus, 170 stopped attending class, preferring to learn through the online lectures.³

Dr. Thrun's online artificial intelligence course was a success in part because it was interactive. All of the videos involved him explaining concepts on a piece of paper with frequent pauses for multiple choice questions or requests for the student to correctly label part of a diagram.⁴ This teaching

Correspondence

Joseph Anthony Andrews, jaandrew@ualberta.ca

method forces students to think actively and the questions allow students to identify their level of understanding of a lesson through immediate feedback. In contrast, university lectures provide a passive lecture style where the only feedback many students receive is from a mid-term or final exam. Dr. Thrun's modality of teaching is an attractive benchmark for future teaching because it de-emphasizes the "weeder" method, where students are given substantial amounts of difficult material and either sink or swim, for a method placing emphasis on solidifying one concept before moving onto the next.

Another leader in online education is Sal Khan, a Massachusetts Institute of Technology trained electrical and computer engineer, who began in 2004 to teach his cousins simple math by creating short online videos.⁵ Khan's teaching method revolves around simplicity; just him talking with an electronic blackboard onscreen to illustrate concepts visually. In 2009, his videos garnered millions of views on YouTube, so Khan quit his job as a hedge fund analyst and formed a non-profit online educational website.⁵ By the summer of 2012 Khan's website had over 3,200 videos with more than 155 million views. In part, Khan's videos are an educational success because they allow students to learn at their own pace. However, the most important attribute of Khan's videos is their simplicity. As pointed out by Harden, a problem with current university lectures, and therefore recording of these lectures, is that PowerPoint has become a crux for ineffective teaching—with professors overfilling slides with detailed information that obscure the fundamental concepts.⁶ In contrast, Khan discards PowerPoint in favour of a simpler modality, an electronic blackboard. With this blackboard he breaks complex topics, such as linear algebra, into brief videos that focus on explaining core concepts.

Although extreme cases, Dr. Thrun's and Mr. Khan's online videos mirror an emerging trend in Canadian medical education—the use of vodcasting. Vodcasting is a method where a recording captures the PowerPoint slides along with the lecturer's voice and combines them into a video posted online for student viewing. Educational institutions are embracing vodcasting as a method to enable students to review conceptually difficult material after class and for absent students to learn the missed material.⁷ However, as noted earlier, the leaders of web-based education are supplanting passive lecture recordings by creating dedicated online videos with built in interactive features.

Online video lectures represent a paradigm shift in the way of presenting educational material. The current university model, one in which a professor lectures to a substantial group of students, represented the best way of disseminating information in the past because it brought one expert and numerous students from different parts of the city, country, or globe together for a one-way exchange of information. However, as a class size increases, the knowledge acquired by students decreases in part because students are intimidated by large audiences and are less likely to ask a professor for clarification when a topic is troublesome.⁸ Thus, questions remain unasked and concepts go unlearned. However, as Ruiz et al. indicate, students prefer online videos because they can select a learning pace agreeable to their learning style.⁹ For instance, if a demanding concept arises, the student can rewind to review or pause to clarify with online resources

or textbooks. Students also prefer the advantage of being able to review the material by re-watching the video at a later date.¹⁰ Most importantly, though, the use of online educational tools by students correlates with higher examination scores as well as better long-term retention of knowledge.^{9,11,12}

ONLINE EDUCATIONAL TOOLS AND MEDICAL EDUCATION

With regards to medical education, online videos represent a unique opportunity to overcome challenges many medical schools face. For instance, with the increasing demands of clinic work it is difficult to recruit and retain clinicians for lectures. A web-based method for lectures would allow these clinicians to record lectures at a convenient time and post them online for students. Another problem medical schools face is the need to provide standardized learning for medical students dispersed over several hospital sites or even different campuses. Online teaching modules allow dissemination of one lecture to many students in differing geographical locations. However, despite the benefits of online interactive videos, two important hurdles exist when trying to utilize them in a medical education program. First, implementing a web-based learning environment is an expensive endeavour requiring a skilled information technology staff. The final obstacle is that the educational institution must realize the content provided by the interactive video is paramount to the sophistication of the technology behind the video. Thus every effort must be made when creating the video to ensure that medical learning objectives are being taught and that a competent teacher provides the information.

In the end, learning to become a physician involves a combination of small group learning, problem-based learning, clinical experience, patient interaction experience, and lecture-based courses. Online educational videos should not displace any of these components, but instead could represent an effective learning tool for use in the blended medical education curriculum offered by most medical schools. 

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The Multiple Paths to a Career in Emergency Medicine

Andrei Karpov, BSc^a, Maurice Agha, BSc^b

^aMD Class of 2013, Faculty of Medicine, University of British Columbia

^bMD Class of 2015, Faculty of Medicine, University of British Columbia

Having only been established as a separate specialty in Canada in June 1980, Canada is one of the only countries in the world with two routes of Emergency Medicine (EM) training.¹ Canadian medical school graduates can pursue either a five-year dedicated EM Residency Program administered by the Royal College of Physicians and Surgeons of Canada (RCPS), or a one-year EM Certificate Program in addition to the two-year Family Medicine Residency administered by the Canadian College of Family Physicians (CCFP).

In British Columbia, Vancouver General Hospital is currently the only hospital which exclusively hires Fellows of the Royal College of Physicians of Canada (FRCPC) EM graduates, while other urban EM departments are currently staffed by both CCFP-EM and FRCPC-EM graduates. In contrast, many rural emergency departments in British Columbia are staffed by Family Medicine physicians with no formal subspecialty training.²

As the Canadian Association of Emergency Physicians continues to engage with both the CCFP-EM and the FRCPC-EM programs to advance the vision of a unified EM training program in Canada, currently interested medical students are still faced with a difficult decision between the two programs.³ We met with University of British Columbia's (UBC) FRCPC-EM Residency Program director, Dr. Brian Chung, and the Co-Director of the CCFP-EM Residency Program, Dr. Brian Lahiffe, to explain to us some of the differences between the two programs, and provide our readers interested in Emergency Medicine with some advice in choosing the program that is right for them.

Both program directors agree that neither program is on the whole superior to the other and that both are capable of producing excellent EM physicians and distinguished leaders, educators, and researchers within the field.^{4,5} According to Dr. Chung, the programs are designed "to fill different niches within Emergency Medicine" and that there are unique advantages and disadvantages to both.⁴ Dr. Lahiffe states that he personally chose to pursue the CCFP-EM route because of the "flexibility it offers in terms of what you could do long-term."⁵ He explains that he enjoys both Family Medicine as well as Emergency Medicine and that he feels EM "is one of these careers where one of the risks is burnout, especially when you get older," and that "having the ability to stay in medicine and do family practice, or retraining for another designation is a fantastic way to go in terms of giving more career options."⁵ And while the majority

of CCFP-EM doctors practice EM exclusively, he suggested that for students who are exclusively interested in Emergency Medicine, the FRCPC-EM program might be a better option.^{5,6}

Compared to the twelve-month condensed training of the CCFP-EM program, the FRCPC-EM program begins with a broad based post graduate year (PGY-1), similar to the old-fashioned rotating internship, followed by four years of EM-directed training. Graduates of the FRCPC-EM program are expected to have completed a research project, and are provided with dedicated time to pursue a subspecialty interest in emergency medicine. Additionally, residents are expected to lead small-group classes and be involved with the education of junior residents as well as medical students. According to Dr. Chung, these are some of the built-in requirements of the five-year residency program that "would make graduates be more prepared to assume the role of an emergency medicine specialist," and perhaps reflect the "initial intent of the Royal College Program [to] create academicians who would then stay and practice in an academic urban centre."⁴

In terms of advice to medical students interested in EM as a career, both directors agree that the most important thing is to shadow.^{4,5} "The best advice is to try and shadow an Emergency Physician" says Dr. Chung, "because it is the best way to get to know what we actually do [and decide] whether you are going to be happy doing it on a day-to-day basis."⁴ Dr. Lahiffe echoed this sentiment stating that students should "start doing some shadowing, get to know some EM docs, ask them questions."⁵ As for research, Dr. Chung explained that it is not necessary, but would definitely help distinguish an applicant.⁴ Dr. Lahiffe agreed, stating that "if you have the opportunity and interest to do research you should do it."⁵ Ultimately, the most important thing is to "make an informed decision and be happy."⁵

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Correspondence

Andrei Karpov, akarpov@interchange.ubc.ca

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The Rural Medicine Conundrum: Steps in the Right Direction, and the Difficult Road Ahead

Goldis Chami, BSc, BA^a

^aMD Class of 2013, Faculty of Medicine, University of British Columbia

The global shortage of rural physicians is one that hits home for many people living in rural and remote areas of British Columbia. An aging Canadian population requiring more care, coupled with many rural physicians retiring, has put stress on healthcare systems which are already stretched to their limit. The result has been physician shortages in communities such as Burns Lake and Fort St. James, the latter having to temporarily close its hospital emergency room in March 2012, because while it previously had five physicians working in the town, it now only has one.

At the root of the problem is the recruitment and retention of physicians to rural areas, especially those who can be considered “generalists.” According to the Society of Rural Physicians of Canada, “with subspecialists and high technology of large cities distant, country doctors (...) require a broad spectrum of clinical skills.”¹

For many years, federal and provincial governments have offered incentives to encourage physicians to practice in rural areas.¹ These have included student debt relief for new graduates who decide to practice rurally,² mandating that international medical graduates complete a return of service contract in a rural area after completing residency,³ and providing improved payment and practice models.²

There are also programs in place to support existing rural physicians, since the demands of rural practice can sometimes make it difficult to take time off from work and can lead to burnout. In British Columbia, locum placement programs allow for rural family physicians and specialists to take time off from their practices for vacations, continuing medical education, or for personal reasons.

Motivated by research demonstrating that medical students who come from rural areas are more likely to return to rural and remote areas to practice,^{4,5} governments and medical schools have turned their focus to students to address the problem. The process of cultivating rural physicians has been termed the ‘rural pipeline,’⁶ and involves providing rural high school students with exposure to careers in medicine, recruiting, and admitting rural

students to medical schools, and providing adequate exposure to rural practice opportunities during medical training.

As such, a number of Canadian medical schools have developed high school outreach programs. According to the Schulich School of Medicine, “early exposure to the practice of medicine can help influence students career plans, ultimately increasing their chance of successfully entering medical school.”⁷ Secondary school students are taught how to deliver babies using a simulator, learn to read x-rays, and practice applying casts. At Memorial University, the MedQuest high school outreach program may be one of the reasons why greater than 30 percent of its medical students hail from small towns, compared to only 11 percent of students at other Canadian schools.⁸

Peter Newbery, a family physician in Hazelton, British Columbia, and a pioneer in the efforts to increase rural physicians in Canada, tells the UBCMJ that one way that Canadian schools are aiming to increase the number of rural medical applicants is by broadening the socioeconomic distribution of medical students. He explains that traditionally medical schools have admitted students who engage in time-consuming and sometimes expensive extracurricular activities that help distinguish them as well-rounded applicants. Schools have since realized that they may have been, in turn, rejecting a First Nations student whose summer holidays had been spent on a fishing boat so that his or her family could feed themselves for the next year. He says that medical schools are therefore broadening their approach to selections so that they “value those students who may not have the high profile achievements but who have been doing equally significant things.”

In British Columbia and other provinces, rural training programs are popping up as “satellite campuses” of a number of medical schools. The Northern Ontario School of Medicine has main campuses in Thunder Bay and Sudbury with multiple teaching sites distributed across Northern Ontario. Memorial University’s Family Medicine Residency Program has another site in Goose Bay, Labrador, allowing residents the option to do a considerable chunk of their training up North. Dr. Geoff Payne, the Assistant Dean for Education and Research of the University of British Columbia’s Northern Medical Program, says that there is very much the belief that,

Correspondence
 Goldis Chami, goldis.chami@gmail.com

Distributed medical training—where physicians live, learn and establish strong roots in these communities—presents one of the most promising prospects of meaningful and long-term engagement and service of medical professionals in underserved areas.⁹

As Canadian provinces and medical schools work together to roll out many of these initiatives, the question remains whether they will be effective. In many cases it is too early to tell, such as with high school outreach initiatives, which will only produce rural physicians many years down the line. Indeed, as Newbery states, “the issue of providing rural medical services is a complicated one, with many players and many perspectives” and schools and provinces alike can only hope that their efforts will pay off. 

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Canadians Studying Abroad as a Solution to Canada's Health Human Resource Challenge: A Medical Student's Perspective

Elisa Kharazi, BSc^a

^aMD Class of 2015, Faculty of Medicine, University of British Columbia

In the early 1970s Canada boasted one of the highest physician-to-patient ratios in the developed world.¹ However, following an ill-advised reduction of medical school enrolment in the 1990s, Canadians now face a growing health human resource (HHR) challenge.² In 2010, 4.4 million Canadians reported that they did not have a regular medical doctor.³ This dearth of access to primary care stems from a maldistribution of physicians, which has led to an increase of underserved communities, predominantly in rural Canada.⁴

A growing number of unsuccessful Canadian medical school applicants have chosen to study medicine at foreign programs, with the intention of returning to Canada for residency training in order to address the recognized shortage of physicians.⁵ It is estimated that approximately 3,500 Canadians study medicine abroad and 73.4% intend to complete residency in Canada.⁵ These Canadians studying abroad (CSAs) recently garnered the

attention of various local media outlets in British Columbia (BC) as they continue to advocate for increases in residency positions and the ability to compete in the first iteration of the Canadian Resident Matching Service (CaRMS).^{6,7}

While international medical graduates (IMGs) are an integral component of the current Canadian healthcare workforce, a number of considerations must be made prior to accelerating the expansion of IMG residency positions in BC.

CAPACITY OF MEDICAL TRAINING INFRASTRUCTURE

Adequate training of physicians requires an availability of clinical instructors and a sufficient capacity of physical infrastructure, such as teaching facilities. BC's taxpayers have made a significant investment in the education of the University of British Columbia's (UBC) medical students. In order to protect this investment, there is a commitment to create at least one residency position for every UBC medical graduate.⁸

Correspondence

Elisa Kharazi, elisa.kharazi@gmail.com

With the inception of the Southern Medical Program in Kelowna this year, an additional 32 medical students will graduate from UBC annually and seek residency training. In addition to residency positions for Canadian medical graduates, 19 BC positions are dedicated to IMGs each year, with a planned expansion to 58 positions by 2015.⁸ Thus, one must consider the consequences of straining an already congested system. Any effort to expand BC's residency programs should be executed in a coordinated and collaborative manner to ensure adequate student interaction with clinical instructors, optimal use of limited facilities and resources, and ultimately the preservation of the high-quality education that is demanded by North American accreditation bodies. Simply adding trainees to an overpopulated system without a parallel investment in infrastructure will dilute the high standard of medical education that British Columbians expect. According to Dr. David Snadden, UBC's Executive Associate Dean of Education,

The numbers are such that we have 19 IMG positions this year and we are going to be working up to 58 by 2015... if we stretch our capacity beyond that, then it is going to be very hard to keep the quality of the residency program. (David Snadden 2012, oral communication, March 28)

SELF-SUFFICIENCY IN PHYSICIAN SUPPLY

As defined by the Canadian Advisory Committee on Health Delivery and Human Resources, self-sufficiency in HHR is

The ability to attract, develop and retain the right supply and mix of skilled healthcare providers working within each jurisdiction's service delivery models to provide high quality, timely, safe care that meets the population's changing health needs.⁹

Although one cannot disregard the contribution of IMGs in our current healthcare workforce, the Canadian Federation of Medical Students (CFMS) recommends further investment in domestic physician training capacity as the optimum approach to meeting the future healthcare needs of Canadians.¹⁰ Investment in the expansion of undergraduate programs in satellite training sites across Canada can produce high-quality medical graduates who meet societal needs. Increasing the capacity of the undergraduate medical program will also allow Canadians to complete their medical education in Canada, instead of travelling to foreign countries at a greater expense.

HETEROGENEITY OF INTERNATIONAL MEDICAL GRADUATES

It is estimated that CSAs are studying at approximately 80 international medical schools.⁵ The criteria for admission and competencies of graduates are highly variable between these MD granting bodies. When asked to comment on the competencies of IMGs seeking residency training, Dr. Snadden expressed that,

They are in 80 odd schools in 40 different countries, all of which have different accreditation processes. Some are fairly robust and some are relatively weak.

There is no way we can make a judgment on their competencies based on the information we receive from their schools. (David Snadden 2012, oral communication, March 28)

It is recognized that IMGs are a highly heterogeneous group. Some are competent well beyond a typical Canadian medical school graduate, while others may not be as proficient. Before further expansion of the IMG program, reliable assessment tools and metrics should be developed to ensure that the IMGs accepted into residency programs would thrive in the Canadian healthcare system.

Given the investment that BC taxpayers have made in the education of UBC medical students, it is essential that these medical graduates have access to premium residency programs in order to qualify as practicing physicians who can serve the needs of BC communities. Therefore any efforts to further integrate IMGs into an already overcrowded system must be done in a manner that does not compromise this investment. 

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On MD/PhD Programs and Becoming a Clinician-Scientist

Ranita Manocha, BA, MD^a

^aMD Class of 2012, Faculty of Medicine, University of British Columbia

Do you think going through medical school is tough? Imagine going through graduate school at the same time. Michael Kozoriz and Clara Westwell-Roper are doing just that, through the seven-year University of British Columbia (UBC) MD/PhD integrated program. At UBC, trainees complete Year 1 MD requirements in their first year, and spend the next three years pursuing graduate courses and thesis research, as well as Year 2 MD requirements. Prior to starting Year 3 of the MD Program, the trainee defends his or her thesis and then completes his or her MD degree with two years of hospital-based rotations.

Kozoriz, a seventh-year in the MD/PhD Program, successfully defended his thesis on the role of the gap junction protein connexin43 in neuroprotection during stroke, and he is currently completing his final MD year. Fourth-year Westwell-Roper is working on her PhD research, investigating mechanisms for manipulating the immune response to islet amyloid polypeptide in type 2 diabetes. Although their research interests differ, both students entered the dual-degree Program because they enjoyed basic science and working with people. Westwell-Roper recalled an early summer job working on drugs for regulating immune cell function while watching a piano teacher cope with an autoimmune disease (Westwell-Roper C 2012, oral communication, March 30). Similarly Kozoriz saw the potential to combine his prior Masters in Science with his passion for working with the elderly and the disabled during a happenstance job as an in-home caregiver in England (Kozoriz MG 2012, oral communication, March 30).

Pursuing a concurrent MD and PhD gives trainees such an “opportunity to see basic science articulated and translated, and to take clinical questions and explore them at the molecular level,” says Westwell-Roper. Graduate studies, in particular, provide rigorous training in research methods and allow trainees to satisfy their creative side. “In medicine, people are often diagnosed with nonspecific “viral illnesses” or given arbitrary treatments,” says Kozoriz, “whereas in the lab setting, you ask questions and seek answers. What is the virus? What is the best treatment and can we come up with something better?” Clinical exposure, however, provides much-needed context on “understanding the disease [trainees] work on in the lab at the level of the whole person, and at the social level,” notes Westwell-Roper.

The MD/PhD Program also gives trainees a sense of how their future clinical and research practices might be integrated; though



In these photos: Dr. Michael Kozoriz (left); Clara Westwell-Roper (right)

this is not without its difficulties given the academic demands of both programs. Westwell-Roper recounts, “It’s challenging to spend the night in the lab and then go to [small-group] sessions in the morning!” It is also hard to predict how long one’s PhD research will take, which can extend the lack of earning years. Kozoriz, however, notes that there is plenty of financial support for MD/PhD students in Canada and says that most trainees graduate debt-free thanks to scholarships and research stipends.

The MD/PhD Program offers benefits over completing a PhD before or after medical school or residency. It provides training in critical evaluation of published work in parallel with education in basic physiology and clinical practice that may be relevant to research projects. Students’ research interests can also evolve with their exposure to medicine, according to Westwell-Roper, whose initial interest in the immune mechanisms of transplant rejection shifted to a focus on understanding protein aggregation in chronic disease as her clinical interest in geriatric medicine grew. The UBC MD/PhD Program also hosts seminars for trainees and advocates for scheduling to balance research and clinical demands, something that may not be available to graduate students with medical degrees.

Nevertheless, if you are a medical student or resident interested in graduate studies, it is not too late. Some institutions offer entry into an MD/PhD program after acceptance to medical school. Many residencies also offer the Clinician-Investigator Program to provide funding and time during residency for graduate studies and research. In addition, there are some MD-only Clinician-Scientists. “In Canada, there remains a shortage of Clinician-Scientists,” notes Kozoriz, and there is increasing support from Canadian and American funding agencies for scientists with clinical backgrounds. It seems that regardless of one’s path to becoming a Clinician-Scientist, the journey will have many challenges. But according to Westwell-Roper, “If you have enthusiasm for a scientific area, it’s a lot of fun and very rewarding!”¹⁰

Correspondence

Ranita Manocha, rmanocha@alumni.interchange.ubc.ca

Dr. Brian Day and Dr. Robert Woollard on the Future Role of Privatized For-Profit Medicine in the Canadian Healthcare System

Marko Yurkovich, BSc^a

^aMD Class of 2013, Faculty of Medicine, University of British Columbia

The Canadian healthcare system faces many challenges. Unequal access, bed shortages, long waitlists, and rising costs are all cited amongst the top issues facing the system.^{1,2} One proposed solution is to allow privatized delivery of health care according to a for-profit model: allowing patients to pay out of pocket or with private insurance for their own health services with prices set according to the market forces of supply and demand. This suggestion is highly contentious because of legalities in the Canada Health Act and complex issues associated with equality and privatization of a government service.³

I met with two prominent leaders on this issue: Dr. Robert Woollard and Dr. Brian Day. Dr. Robert Woollard, is the former Head of the Department of Family Practice at the University of British Columbia, a founding member and vice-chair of Canadian Doctors for Medicare and a professional firmly against for-profit health care in Canada. Dr. Brian Day is a past president of the Canadian Medical Association, the current President of Cambie Surgeries Corporation, and Medical Director at Cambie Surgery Centre. He is an outspoken proponent of for-profit health care.

When asked to provide the top three reasons why Canada should not allow for-profit health care in Canada, Dr. Woollard responded:

- 1) It's not fair, in the sense that medical services get delivered on the basis of how much money you have, and not based on medical need; 2) there is an issue of equality—everywhere we look around the world, it's pretty clear that not only is private for profit care more expensive, but it's poorer care; and 3) it fractionates care—instead of a system with continuous care absent of any concern over what's in their wallets, you are inviting a very complex situation. (Dr. Robert Woollard, oral communication, March 27, 2012)

In contrast, when the question was posed to Dr. Day to provide the top three reasons why we should allow for private health care in Canada, he responded:

- 1) Things aren't working in the system and the Health Canada Act is now 28 years out of date; 2) the evidence shows that countries with a competitive element to their healthcare systems perform better. However, the United States is an exception to this as it is one of the worst systems in terms of efficiency; and 3) it is immoral and illegal to deny a citizen to look after their own body with their own resources. The egalitarian argument doesn't work at all,

access to care is not equal across the country and those that are rich will go to the United States if they need to. (Dr. Brian Day, oral communication, April 17, 2012)

Regarding the argument that private for-profit healthcare delivery results in poorer care, Dr. Woollard cites a systematic review and meta-analysis of studies comparing mortality rates of private for-profit and private not-for-profit hospitals.⁴ The study by Devereaux et al. found that private for-profit ownership of hospitals results in higher risk of death for patients. When this study was discussed with Dr. Day, he responded to this study by stating that the data is flawed:

One of the biggest groups in the study was on hospitals looking after cancer patients. The death rate was in fact higher than the death rate in the private not-for-profit hospitals. But the reason was that as you got near the terminal stages of the disease, patients in the private not-for-profit hospitals were sent home, whereas the private for-profit hospitals kept the patients till the very end. (Dr. Brian Day, oral communication, April 17, 2012)

This one particular study highlights some of the difficulties in conducting research on an issue that is highly contentious.

With respect to the role of for-profit health care in the future job market for physicians, not surprisingly, both interviewees had contrasting views. Dr. Woollard doesn't see it playing any role in the future. When asked about the current lack of jobs for many residents graduating from surgical specialties, particularly in orthopedics, he offered some words of insight:

Medicine is a rapidly changing field, what may be seen to have a shortage now may be in high demand in a few years. [Likewise] If you're aiming to do a job 7 years from now that's paying very well now, that same job might not even be necessary in 7 years. Therefore my advice would be to go into something that you love, medicine is a wonderful career with so many options. (Dr. Robert Woollard, oral communication, March 27, 2012)

Dr. Day, on the other hand, offered a more specifically personal view of the situation:

I started the Cambie Surgery Centre because my OR time was cut to 5 hours per week. I was left with the choice to either take a job in the United States or fight it out here. We are training specialists to go down to the States, yet the market demand is here for their services. What has also happened now is that people aren't retiring anymore because of rationing of resources and OR time. So these people are blocking jobs. We have 100 doctors working at our clinic. We did a

Correspondence

Marko Yurkovich, marko.yurkovich@gmail.com

survey, and 23 said they could not sustain a viable practice if it were not for the extra OR time offered by the Cambie Surgery Centre. So we have actually retained 23 doctors. So this goes completely against the argument we are going to take away from the public system. The private sector will allow these people to stay and work. (Dr. Brian Day, oral communication, April 17, 2012)

As the debate over private for-profit health care continues, one thing is certain—this form of health service already exists in Canada—Dr. Day's Cambie Surgery Centre is a prime example. Its future effects on our unique Canadian system will not only be determined by a few select physicians and government policy makers, but also medical students, as the future physicians of this country. 

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InspireHealth: Physicians Providing Integrative Cancer Care

Lawrence Kei, BSc^a

^aMD Class of 2014, Faculty of Medicine, University of British Columbia

The treatment for cancer can be debilitating. In addition to the physical tolls, the psychosocial and financial challenges can make the patient's experience even more daunting. This may contribute to why up to 85% of patients with advanced stages of cancer seek complimentary therapies.¹ Recognizing the need for more support during cancer care, InspireHealth, Canada's only government sponsored cancer care center, was initiated in 1997.² The physicians of InspireHealth are trained in family medicine and work alongside a multidisciplinary team to supplement traditional treatments with programs in nutrition, exercise, and psychosocial well-being.² Dr. Theresa Clarke, a UBC Medical School graduate, is a physician at InspireHealth. In this interview, Dr. Clarke explains her current role at InspireHealth and how she got there:

Medicine is incredibly flexible. I was practicing as a GP [General Practitioner] for ten years, but felt that I wanted to spend more time with my family. I decided to stop practicing as a GP and trained in acupuncture, which led to a private practice. After a few years I applied for a position on a rehabilitation team. I didn't need any special training at the time and my role was mainly to assess chronic pain. After four years of working in rehab, I joined the InspireHealth team. (Dr. Clarke, personal communication, March 27, 2012)

Dr. Clarke explains how her daily routine allows her to build long-standing partnerships with patients:

We start off each day with a group meditation. Afterwards, I consult with up to five patients. Each session lasts up to 90 minutes, and any follow-ups are 30 minutes. The focus is to learn everything about the patient so we can help supplement their medical treatment with self-care, nutrition, and mind-body coaching. It's great for the patients. I find that I know them better after that first session than

I did after seeing them for ten years as a GP. (Dr. Clarke, personal communication, March 27, 2012)

Developing and implementing a variety of programs is what she enjoys most:

I really love being able to facilitate workshops and programs relating to anything from nutrition to mind-body coaching. Also, I get to attend and talk at many community awareness campaigns. I get to do all this with an amazing team. (Dr. Clarke, personal communication, March 27, 2012)

Despite the increasing demand for supportive care and research showing that a holistic approach improves quality of life in cancer patients,¹ Dr. Clarke explains that the most challenging part of her career is the stigma towards complimentary medicine and the attitudes of other physicians:

Our biggest challenge is that we still struggle to get referrals from oncologists and GP's. There's a stigma that we might interfere with their treatments. Reality is, we would never alter any treatment but only serve to guide the patient through their journey. I hope this stigma changes in the future because right now we are still relying on word of mouth. The biggest complaint from patients is why they did not hear about us sooner. (Dr. Clarke, personal communication, March 27, 2012)

Dr. Clarke encourages future physicians interested in incorporating some of these values into their career to join their mentor group or take an elective with InspireHealth as a medical student or family practice resident. 

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Lawrence Kei, lawrencekei@hotmail.com

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