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## HEALTHCARE IN THE WORLD OF TOMORROW

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Gurdeep Parhar The Future Family Practice Medical Home – a Brand New Building or Just a Renovation?

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### Also submitted for our cover: Painting the Forces on our Faces

The cranium is most intuitively thought of as the brain's protective armour, but the craniofacial skeleton (CFS) as a whole is a seamless integration of dozens of functional units that form a mechanical structure of astonishing complexity. During my PhD conducted at Sunnybrook Hospital (U of T), I developed computational models from clinical CT images which predict the distribution of physiological forces within the CFS. The cloud of numbers and vectors represent micron scale deformations. Collectively they synthesize to unveil how each region of the CFS serves its precise structural purpose. These models form a rational, biomechanical basis that can guide CFS reconstructive surgeries, leading to fewer complications and better long-term outcomes for patients. This work was the culmination of nearly a decade of intense collaboration among surgeons, engineers, and medical physicists. It is a case example of medicine's future, where more collaboration and fewer disciplinary boundaries will lead to more innovations in healthcare.

-Amirreza Pakdel, Vancouver Fraser Medical Program 2018

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### About the cover

HEALTHCARE IN THE WORLD OF TOMORROW Phoebe Cheng VFMP 2018

This artwork aims to portray a child of the future, whose healthcare, beginning from birth, will heavily involve technology and its abundant possibilities, as depicted by the vibrant colours. With innovations such as mobile applications for diagnosing and treating illnesses, preventing disease, and monitoring patient lifestyles, the healthcare of tomorrow will potentially become more accessible, efficient, convenient, and personalized to individual health needs. By increasing the availability and sharing of data, wireless technologies can also encourage more extensive interprofessional collaborations within healthcare while prompting changes in medical education as future generations adapt to new methods of healthcare delivery and learning.

### EDITORIAL

Healthcare in the World of Tomorrow: What the Future Holds for Medical Education John Peel, Shelly Chopra, Andrew Purssell, Ruphen Shaw

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# Healthcare in the World of Tomorrow: What the Future Holds for Medical Education

John Peel<sup>a</sup>, Shelly Chopra<sup>a</sup>, Andrew Purssell<sup>a</sup>, Ruphen Shaw<sup>a</sup>

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n 1895, Wilhelm Conrad Röntgen accidentally discovered X-Rays and communicated his findings of a then-mysterious radiation to the scientific community. By 1913, William Coolidge had developed an apparatus that could continually produce X-Rays such that the technology could be feasibly introduced into practice. Today, X-Rays are the most accessible form of medical imaging, and their interpretation is a foundational skill in medical education. Such evidence-based transformations have revolutionized healthcare, raising the question, "how will healthcare evolve over the next 50 years"? Current trends suggest that medicine will need to accommodate the growing diversity of demands that patients have.1 A national assessment of primary care in the UK showed that patients had significant unmet needs. Specific requests included: improved emotional and social support; better strategies to overcome environmental, geographic, and community barriers in healthcare delivery; and a more accessible discussion of medical research to include patients in treatment decisions. The authors note that in order to make these improvements for patients, medical professionals in the future must have broader expertise and a greater aptitude for technology.<sup>1</sup> The onus for this is being placed on medical education and training programs, which are now being challenged to develop effective strategies to prepare physicians who are capable of meeting these future demands.

Medical school admissions tests are attempting to meet the increasing demands on physicians by selecting students with more diverse backgrounds. The Association of American Medical Colleges is updating their universally accepted Medical College Admissions Test (MCAT) for 2015 to integrate psychology, sociology, and behavioural science into the content of the test for the first time, thereby recognizing these specialties as relevant prerequisites for medical training.<sup>2</sup> This is a positive update, requiring students to have greater knowledge of a more diverse selection of medical sciences. However, success in medical careers has been attributed not only to sufficient knowledge, but also to non-cognitive abilities that are not yet well taught in medical schools.<sup>3</sup> Such non-cognitive skills include the ability to systematically interpret and respond to information. Given that physicians have greater access to medical resources than before, the ability to recall information is becoming less important, while the ability to demonstrate these non-cognitive skills is increasingly important.<sup>1,4</sup> In previous iterations of the MCAT, an essay section was included to challenge students to develop independent ideas and express them concisely in response to a prompt, but this section was removed to accommodate the additional psychology, sociology, and behavioural sciences section. As a result, a greater responsibility rests with admissions teams to screen applicants for these communication and analytical skills, so that successful candidates enter into medical school with a foundation of noncognitive skills already intact. Future efforts will need to address the lack of objective measures of non-cognitive skills in medical school applicants.

As resource material is so readily available, it will be increasingly important for physicians to use technology to access and critically appraise medical literature during the clinical decision-making process.<sup>4</sup> The electronic health record (EHR) is an electronically accessible system that contains the complete health and personal history of, and health care provided to, a person from birth to death; as such, the EHR integrates information from all providers, test results, and appointments. A key challenge with EHR, however, has been the slow rate of uptake by physicians. In an international assessment of primary care physicians done in 2009, it was found that only 37% of Canadian family physicians had adopted electronic records-significantly lower than the US, Germany, France, Australia, and the United Kingdom, among others.<sup>5</sup> However, in the same study it was noted that the total functionality of EHR was not taken advantage of. Even where EHR has been adopted in Canada, no universal system exists so charts cannot be accessed across different hospital networks. While most literature cites security concerns and cost as leading barriers for implementing EHR, there has not been improvement even after those concerns have been largely addressed. Furthermore, most EHR use is limited to that of a record of activities and a pharmacological database, and the integration of internet resources into EHR has not yet been successfully done5. In addition, medical sciences and technologies have begun to advance so rapidly that clinicians have difficulty accessing the relevant resources to their discipline, and this concerning trend is expected to continue. One study in the New England Journal of Medicine found that only 54.9% of patients were receiving care in line with the most current guidelines, suggesting that a significant proportion of physicians have difficulty providing the best prescribed care to their patients.<sup>6</sup> Dr. Lori Heim, president of the American Academy of Family Physicians, suggests that access to the most current databases could be integrated into EHR,

but the future clinician must be able to efficiently find, analyze, and incorporate this information into a patient-specific plan.<sup>7</sup> In a systematic review of the effectiveness of critical appraisal skills training done in 2000, it was found that clinician skills improved significantly with training, but concrete methodologies have not yet been reported in the literature, suggesting that skills training is not effectively implemented in medical education.<sup>8</sup> Medical education must adapt to encourage effective use of EMR, and provide the skills necessary for physicians to take advantage of the tools available to them.

Complex decision-making skills are becoming increasingly important for the ethical dilemmas that future clinicians will encounter. As medical treatments improve, there is a growing discordance between quality-of-life and length-of-life. This complicates palliative decision making, as patients may be living longer but not necessarily better lives. Medical education has a difficult time broaching complex palliative discussions, with the bulk of the lessons centered on standardized approaches to ethical dilemmas. Further, health policies have not yet offered solutions for managing an older and more medically-complex population, though some progress has been made. In 2011, the Royal Society of Canada published "End-of-Life Decision Making", and this stimulated advancements in Quebec, leading to the production of "Dying with Dignity" legislation, the implementation of which the Quebec government committed to in 2013.9 However. Federal legislative action has been slower to change. The most recently proposed amendment to the Criminal Code, Bill C-562 (right to die with dignity), was dismissed in 2010.9 No further parliamentary action has been made to update policy regarding physician-assisted suicide, and the Library of Parliament notes that if new legislation were to be passed on this topic, a number of issues would need to be resolved. These issues largely involve how to define life and mental capacity, how to identify the ability to communicate in competent patients accurately, and what members of an interprofessional healthcare team should be consulted.9 Healthcare in the world of tomorrow must have solutions to these existing issues, and the role of euthanasia in medical care will be changed. Without sufficient exploration of these topics during medical education, or a thorough study of the currently unevaluated concerns with euthanasia, clear strategies can not be developed. As such, current clinicians are left without direction or the skills to make appropriate life-or-death decisions with their patients.

While these and many other gaps in medical education are now being realized, some progress has been made to improve clinician training in Canada. The Royal College of Physicians and Surgeons of Canada (RCPSC) directs Canadian medical training using their CanMEDS framework.<sup>10</sup> CanMEDS outlines the responsibilities expected of physicians at each stage of their training. The RCPSC is updating their CanMEDS model for 2015 to a competency-based training, reflecting an acknowledgement that a changing climate for healthcare professionals requires not only the knowledge of updated medical science in order to be successful, but also practical training in the necessary competencies of their discipline and profession.<sup>10</sup> Further, to assist with the RCPSC evaluation of the core competencies, two additional working groups have been created to better integrate new content related to Patient Safety & Quality Improvement, and eHealth into the existing seven CanMEDS Roles.<sup>10</sup> By mandating that physicians have a core level of competency regarding quality of care assessments and medical technology, the RCPSC is demonstrating an understanding of the direction that medical education needs to go to stay relevant.

Over the next 50 years, clinical medicine will change significantly, and current trends in healthcare have identified some weaknesses in practitioner training thus far. More unforeseen problems have yet to come to light as we rely on research to identify and assess the complicated problems facing modern healthcare delivery. The next 50 years in medical education must be a time of rigorous evaluation and problem solving so that approaches to physician training can be developed to best equip clinicians to handle the challenges of a rapidly evolving healthcare system. This issue of the UBCMJ highlights the work of clinicians and scientists who are answering tomorrow's medical questions. Our feature articles explore the future of end-of-life issues (Hébert), and the changing face of primary care (Parhar). The issue also contains articles discussing updated roles for first responders (Guy) as well as those for anaesthetic assistants in the anaesthesia care team model (Martin). It is through research like this that medical education will progress.  $\heartsuit$ 

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# The World to be Gained: The Future of the Doctor–Patient Encounter

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KEYWORDS: medical ethics, patient-centred care, changing medicine

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### INTRODUCTION

The following is a real situation, altered slightly for publication:

▲ Madeline Casey, a 60-year-old university philosophy professor, presents with an intensely itchy and uncomfortable generalized macular-papular rash of two months' duration. Recently, she has also noticed small masses in her neck and groin. It takes one month before her primary care practitioner can see her. The masses are noted but receive no attention.

Prof. Casey is referred to a dermatologist to 'rule out' bedbugs.

A diagnosis of idiopathic dermatitis is made, and various cortisone creams are prescribed. She is followed for six months, during which time the rash gets worse, more painful, and excoriated.

Prof. Casey is referred to another dermatologist, but two months before seeing him, she has a painful occurrence of zoster. She has a strong sense that she is more ill than her doctors think. There is no change in the diagnosis of dermatitis.

The second dermatologist advises her to stop scratching herself and recommends meditation.

By sight, a third dermatologist diagnoses Prof. Casey's rash as being dermatitis herpetiformis, a painful rash linked to gluten sensitivity. Dapsone and dietary advice resolve the primary rash. Unfortunately, Prof. Casey feels no better. She is losing weight, and the swellings have become more discrete masses in her neck, groin, and upper chest. She is told she must have had a 'cold'.

Things are complicated now. She is very fatigued and considers long-term disability, but she is ineligible, as there is no 'serious disorder.'

### It has been said that the future of medicine lies in conversation ... It may seem at first glance that computerization in medical care will depersonalize healthcare. It need not do so.

Concerned about the results of some blood work that had been done, the third dermatologist refers Prof. Casey to a hematologist. His examination reveals that she has diffuse lymphadenopathy and an enlarged spleen.

Over the next few weeks, he assiduously orders tests, biopsies, and other specialist visits. These finally reveal the underlying cause of Prof, Casey's recent maladies; she has an advanced form of non-Hodgkin's follicular lymphoma (NHL).

Prof. Casey accepts the recommendations for chemotherapy, but in three months, her illness transforms into a more aggressive B-cell lymphoma. It has taken her two years to receive effective care.

Prof. Casey wonders if anything could have been done better and sooner. Were the lapses in her care due to miscommunication? Despite the limitations in the medicine of the present, Prof. Casey's care would have no doubt been more expeditious had certain care providers listened to her more carefully. However, patients who present with common problems are treated symptomatically and expectantly. Common diagnoses are considered first, and other, more ominous conditions are reserved for the more recalcitrant cases. It's often a hit–and–miss process, and in this case, the first physicians missed the mark because they did not consider the more ominous conditions that can lurk behind persistent, seemingly benign presentations. They failed to sufficiently take into consideration anomalous data, such as her swollen nodes and—perhaps most importantly—the patient's intuition that this wasn't a routine illness.

Each point in Prof. Casey's story is noteworthy, as there is considerable latitude for the management of her condition by practitioners who see her. What could that original rash have been? What, if anything, did it have to do with the zoster? How urgently should she have been seen? Should her lymphadenopathy and lymphoma have been handled in a different way?

There is something chaotic and haphazard in medicine of the present. Healthcare practitioners rely heavily on their intuition. How far do you, as a practitioner, follow a patient's symptom or sign? Is it something routine or something potentially more ominous? How beneficial will a particular drug be for a patient? Answering these questions, in turn, depends on many factors: how well you know and listen to the patient, how closely you follow them, what your previous experiences with similar complaints and illnesses have been, how much time you have, and how easily you can consult with others. In addition, obviously, it depends on how much is known about the conditions the patient is experiencing. In Prof. Casey's story there seems to be a considerable gap in skills and clinical intuition between her physicians.

This so-called 'empirical' approach to medical care is changing.

### **CHANGING MEDICINE**

Advances in the science of medicine have made choices and options available to patients and the public that were heretofore considered impossible, for example: hip replacement in a nonagenarian, HIV eradication in a baby, deep brain stimulation for movement disorders, thrombolytic therapy for acute cerebral and cardiac ischemic events, embryonic cultivation outside the womb, and intensive cardiovascular support for multiple organ failure. These advances offer the prospect of real choice to patients. They can choose from among the various ways of proceeding, including the option of doing nothing.

This changed medicine in the twentieth century in fundamental ways from that which had preceded it. What came before it was medical practice that was as secretive as it was ineffective. With medicine's scientific transformation came a gradual tectonic shift from physician–based medicine to patient–directed care. This shift has penetrated some disciplines more than others, some countries more than others, and some institutions more than others. It is a shift that medicine is still undergoing, and it will continue to dominate medical practice for the next century.

Pressures from the courts and from the public from the early twentieth century have resulted in medicine becoming more ethically sensitive as it has become more scientifically robust. Especially critical has been the elaboration of the rights of patients to be informed about and be empowered to participate in decisions about their care. The promise of future medicine is to continue that breach of the paternalism of traditional medical practice. That tradition included: (1) a hierarchical structure of healthcare, with the preferences of the patient at the bottom, (2) silence and secrecy regarding medical practice, (3) individual doctor–based decision–making, (4) idiosyncratic non–evidence based medical practice, (5) fragmented and heterogeneous healthcare, and (6) healthcare with little regard for the social determinates of well– being.

These characteristics do not exhaust pre-twentieth-century medicine, and they still persist in many areas of healthcare today. Let's just say that the tide has turned: away from hierarchy to transparency and trust, away from silence to truth-telling and open communication, away from physician solo-flying to interdisciplinary care, away from intuitive care to the incorporation of best-evidence into decision-making, away from simply accepting the regional variation in medical practice and safety to a better understanding of appropriate care, and away from episodic healthcare interventions to practices that are community-based and prevention-oriented.

These changes will not happen all at once. They require a commitment to continuous quality improvement. However, they are already being incorporated into healthcare management, and they will become increasingly important as the century advances. As well, the new digital technologies and information exchange will make it possible to realize the prospect of truly individualized care: not only as to the incorporation of personalized genomic medicine, but also as to an improved capacity for incorporating patient preferences and values into the decision–making matrix.

It has been said that the future of medicine lies in conversation: the conversation between the healthcare provider (who may well not be a doctor but will be part of a team that will include a doctor) and the patient.<sup>1</sup> It may seem at first glance that computerization in medical care will depersonalize healthcare. It need not do so. The new technologies of information may improve the prospects of patient–based care in being able to better capture and retain these conversations and to make them available to others in the patient's circle of care. This, in turn, may help to ensure consistency in patient care and to reduce fragmentation.

### THE PROMISE OF FUTURE MEDICINE

How might Prof. Casey fare under the improved care of the future?

First of all, she will not have to wait so long to see her healthcare provider. She will receive care in a multi–professional, community–based clinic that will accommodate requests for urgent assessment.

Second, from the get–go she will be knowledgeable about medical conditions by accessing information on the Internet, and she will be cautioned by her practitioner about serious conditions that she might have and about symptoms that might be concerning.

Third, all health professionals will have had training in the art and science of communicating with patients and other healthcare professionals.

Fourth, Prof. Casey will be more involved in the healthcare process. Rather than waiting several months to see what happens, she will be proactively encouraged to return to a multi–disciplinary clinic for an early re–assessment. Alternatively, this re–assessment will be done in her home via new modalities of information capture, such as the use of encrypted forms of e–mail and applications that are able to turn a digital phone into a hand–held medical monitoring device.<sup>2</sup> Professionals will be proficient in the use of such technology, for example, by encouraging patients and their families to submit pictures of rashes that could be shared with others to evaluate less common conditions.

Fifth, rather than relying on intuition as regards her diagnoses, the healthcare provider will have access to her genomic and exomic make up. So both she and Prof. Casey will know to which diseases she is susceptible and what serious problems might lurk behind common or seemingly benign symptoms or signs. As well, diagnostic procedures currently too complex or expensive to use in primary care—such as PCR testing, genomic profiling, quick section tissue diagnostics—will be readily available, making rapid diagnosis possible and obviating the need for some specialty involvement. While not currently present in the clinic, these procedures soon will be.

Sixth, once a serious condition such as NHL is identified, her own genomics and the genomics of the malignancy may tell her practitioners what drug regimen may work better for her. This will also help take some of the guess—work out of therapeutics.

Seventh, as science advances (and it will do so, exponentially), we will better understand the molecular basis of disease and will have interventions, such as directed antibodies, clonal therapies, or immune–boosting vaccines that will selectively target malignant tissue.

Eighth, effective therapies will not just eradicate disease and prevent premature death, but they will also improve the patient's quality of life. Appropriate medical decision–making will reflect patient values as to what is important and valuable to the patient. Better technology will not be better if not combined with assiduous attention to and communication with patients.

Prof. Casey's story could be one of many situations that will characterize twenty–first century healthcare. Conversations between physicians and patients will continue over assistance in dying and end–of–life care. Controversy will continue over the nature of life at its beginning and its end. Negotiation and consensual decision–making will typify the healthcare of the future.<sup>3</sup>

### CONCLUSION

In brief, the prospects for medicine are, in some ways, quite bright. Barring some worldwide conflict (unfortunately always possible), medicine can progress both morally and scientifically. However, it will not do so automatically. Situations of urgency and adversity in even the world's most advanced countries may cause some practitioners to act in questionable ways.<sup>4</sup> The continued progress in medical affairs will require a commitment to transparency and communication by ethically sensitive practitioners, and in this way, practitioners will show themselves worthy of the public's trust.

There are many problems that medical practitioners on their own cannot fix such as the persisting inequality of the sexes, the ever–growing inequality between the rich and the poor, and the insufficient attention paid to the famines, wars, and pestilence affecting billions of people on the planet.<sup>5</sup> These worldwide problems are where the real advances in healthcare must be made in the twenty–first century.<sup>6</sup>

### ACKNOWLEDGEMENTS

The author would like to express his thanks to Marlene Kadar in the preparation of this paper.  $\Im$ 

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# The Future Family Practice Medical Home – a Brand New Building or Just a Renovation?

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KEYWORDS: electronic medical records, optimization, community care, telemedicine

In September 2011, the Canadian College of Family Physicians (CCFP) released, "A Vision for Canada: Family Practice – The Patient's Medical Home."<sup>1</sup> The concept of the proposed medical home is one of many initiatives that inform primary care reform in Canada. This discussion paper defines the Patient's Medical Home (PMH) as a family practice where patients receive timely and comprehensive health care, and where all health professionals coordinate a wide range of health services.

While this vision of the PMH provides comprehensive goals for idealised patient care, the future of family practice will be most influenced by electronic medical records (EMRs), the role of all health care professionals, the principle of continuity of care, physician remuneration, and telemedicine technology.

### 1) Implementation of Integrated and Seamless Electronic Medical Records (EMR)

Unfortunately, Canada remains behind other countries in the universal implementation of EMRs.<sup>2</sup> Concerns related to cost, security, privacy, workload, design, and technology contribute to this.<sup>3</sup> One of the practical challenges with current EMR systems have been their inability to interconnect with separate EMR systems across community clinics, laboratories, consultants' offices, care facilities, and hospitals. It is expected that in the future, these non-collaborative EMR systems will be replaced with systems that permit the efficient flow of medical information to a family physician.

While implementation of the EMR system has been slow, there was an increase in the number of Canadian physicians using electronic records from 2004 to 2010.<sup>4</sup> This increased utilization of EMRs has implications for both family physicians and patients. Firstly, EMRs facilitate the collaboration of not only individual family physicians but also of other health professional team members. As opposed to paper charts, EMRs are conducive to multiple users accessing a patient's file simultaneously. Secondly, EMRs permit family physicians to systematically review their patient population to identify

### Whether or not the PMH as envisioned by the CCFP becomes reality, it is clear that ongoing implementation of new technologies and programs will shape the future of family practice in Canada.

specific at-risk groups in order to implement new initiatives. For instance, family physicians can quickly review their EMR database to identify patients with diabetes who are overdue for an annual renal blood test. Similarly, a list of patients can be identified that have a combination of co-morbidities for further attention and intervention, such as patients who smoke and have hypertension. Finally, the EMR has created the potential for records to be more accessible to patients. Most patients can now access their laboratory results directly online. It is expected that, in the future, patients will have access to all of their own medical imaging results and to most of the content kept in the EMRs by their family physician. While this ease of access of patient records improves efficiency for physicians and health professionals and provides more autonomy and control for the patient, it does bring with it inherent risks of safety and breaches in confidentiality that will need to be managed.

### 2) Optimization of All Health Care Professionals' Roles

One of the most dramatic changes in primary care over the past two decades has been the widened scope of practice for many health care professionals. The increased participation of other health care professionals providing services that have traditionally been in the domain of the family physician will have an impact on future family practice.

For example, while midwifery has been quite prominent in other countries of the world, it has only recently gained popularity in Canada.<sup>5</sup> Similarly, pharmacists in many Canadian jurisdictions are now permitted not only to adjust prescribed medications, but also to initiate prescriptions of their own,<sup>6</sup> provide prescription reviews, titrate anticoagulant medication, provide travel consultations/vaccinations, and more recently, to administer flu vaccines. Optometrists can now prescribe medications, and naturopathic physicians have access to publically funded laboratories.

These changes might result in a feeling of vulnerability and perhaps territorial competition amongst some family physicians. However, it should be perceived optimistically as an opportunity to review what aspects of primary care are truly in the domain of family medicine and what health care services can be provided more expertly and cost effectively by other health professionals. The ideal situation would be to explore the creation of health care teams that include the expertise of all professionals. These teams could help to determine how the entire group might function best in order to provide optimal health care to patient communities. Regardless of how enthusiastically accepted the involvement of other health care providers is by patients and family physicians, the reality is that future family practice will include these health professionals in more expanded roles.

#### 3) Provision of Continuity of Care

The fragmentation of family practice is an ongoing frustration for patients, family physicians, and specialists. The reliance on episodic care provided by walk-in-clinics is both a concern of patients and a challenge for family physicians and specialists. Family physicians are constantly trying to track down medical records and test results that exist at other clinics or hospitals. Specialists find it difficult to coordinate care for a patient when there isn't one family physician to follow through with their recommendations. Patients are confused as to whose advice to trust when it is clear that different medical practitioners are working with varying levels of knowledge about their medical condition.

Numerous studies have emphasized the positive health outcomes that result from a patient having a regular continuous relationship with a family physician. Visits to the emergency department are reduced, hospitalizations are decreased, patients are more satisfied, and preventative service delivery is improved.<sup>7</sup>

As the patient community begins to understand the true value of having an ongoing relationship with one family physician, it is inevitable that these consumer demands will shape future family practice to re-emphasize continuity of care.

#### 4) Restructuring of Family Physician Remuneration

One of the key hindrances to bringing about substantial improvement in primary care has been the traditional fee-forservice physician remuneration model. While this system of rewarding physicians for the services that they provide might seem fair, it is this same model—focused on the provision of services—that has proven to be a challenge to enhancing health outcomes. In particular, it is recognized that some aspects of health care, such as the family physician's role in the management of chronic diseases and lifestyle modification, cannot be fairly remunerated on a per–visit basis. Success in such areas requires long-term interventions and management plans that cannot be captured in a regular family physician visit. Recognizing this challenge, British Columbia has moved forward to develop more creative solutions for remuneration such as fees for the management of various chronic diseases and lifestyle management.

While salary models, blended models, and sessional payment schemes still have their challenges, family physicians across Canada have been moving towards alternate payment plans and becoming less reliant on exclusively fee-for-service.<sup>8</sup> In the future, this trend towards alternative remuneration models will continue.

#### 5) Increased Use of Telemedicine Technology

One of the other major shifts in family practice will be the incorporation of new technologies supporting telemedicine. Initial pilot projects allowing patients in rural and remote regions to access physicians in urban centres by video-conference have been successful.<sup>9</sup> More controversial is the use of telemedicine to replace in-person physician-patient interactions.

Besides the obvious challenge of not being able to perform a proper physical examination and not being in direct contact with a patient, it brings other challenges such as the inability to perform procedures, missing non-verbal cues not captured on video, potential breaches of confidentiality, and the inability to safely intervene should a patient's condition suddenly deteriorate. Nevertheless, patients and physicians are recognizing the convenience of telemedicine and thus several entrepreneurial ventures have capitalized on this enthusiasm to provide telemedicine to connect patients and family physicians.

Undoubtedly, future family physicians—even those who avoided email and social media communication with their patients—will be pressured into telemedicine encounters. With the support and guidance of regulatory agencies to ensure safe professional practice is maintained, telemedicine will be part of a family physician's daily routine.

Is Family Practice as the Patient's Medical Home a novel concept or is this just the Reinvigoration of Patient Centred Care?

Whether or not the PMH as envisioned by the CCFP becomes reality, it is clear that ongoing implementation of new technologies and programs will shape the future of family practice in Canada. The integration of seamless medical records, the optimization of the role of all health care professionals, the provision of continuity of care, the restructuring of physician remuneration, and the increased use of telemedicine technology is about returning to models of care that focus on the needs of the patient. These innovations will permit a renewed commitment of future family practice to The Four Principles of Family Medicine:<sup>10</sup>

- 1) The patient-doctor relationship is central;
- 2) The family physician is a skilled clinician;
- 3) The family physician serves as resource to his or her practice population; and
- 4) Family medicine is community-based.



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### High-Intensity Telemedicine: An Innovative Healthcare Delivery Model to Reduce Emergency Department Visits for Seniors

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### ABSTRACT

Seniors are four times more likely to visit the emergency department (ED) than younger populations. A case series study by Shah et al. examined the use of high-intensity telemedicine for older, community-dwelling adults to reduce ED visits. The results of the study indicated fewer visits to and decreased time spent in the ED. However, the current literature on telemedicine as a health care delivery model has shown mixed results. Future research needs to identify the appropriate type of patients, health systems, and program factors that can predict the success of this health care delivery model.

KEYWORDS: emergency department, telemedicine, older adults, health care delivery

elemedicine is the use of health information technology for clinical care when distance and time separate the patient and healthcare provider. It can range from low intensity, which includes only video conferencing, to highintensity.<sup>1</sup> High-intensity telemedicine is an innovative health care delivery model designed by Shah et al. for non-urgent complaints that may not require emergency department (ED) resources.1 In this model, patients' medical complaints on the telephone are triaged by either a nurse or primary care physician to high-intensity telemedicine or traditional care. The medical complaint is assigned one of six clinical protocols-skin, fever, shortness of breath, pain, altered mental status, or other-that guides certified telemedicine assistants (CTAs) in gathering the clinical data that is required during the visit. CTAs are trained in practical skills and equipped with necessary digital tools to complete the visit at the patient's home (Table 1). The information gathered is collected by CTAs into a telemedicine electronic medical record (EMR). The EMR is accessed by telemedicine providers-physicians and nurse practitionerswho are notified of a completed home visit by a CTA and access the information remotely from any internet-enabled computer at any time. The telemedicine provider then completes the EMR, provides prescriptions, electronic orders, and a written discharge sheet to both the patient and primary care provider.<sup>1</sup>

Telemedicine emergency care services have already shown effectiveness for children in school centers,<sup>2,3</sup> and seniors in the context of stroke and nursing homes.<sup>4,5</sup> Older adults are often unable to obtain same-day primary care, and when available,

they face barriers related to transportation.<sup>6,7</sup> This leads to increased ED visits and ambulance transportation. Based on a qualitative evaluation of the high-intensity telemedicine model, clinicians, patients, and caregivers may benefit from improved diagnostic ability and more timely treatment.<sup>8</sup>

### With a high-intensity telemedicine model, clinicians, patients, and caregivers would benefit from improved diagnostic ability and more timely treatment.

Research in telemedicine has shown mixed results over recent years. A recent randomized controlled trial by Takahashi et al.9 studied a video conferencing telemedicine system with blood pressure, weight, glucose, pulse oximeter, and peak flow data monitoring. The study looked at patients with multiple co-morbidities and determined that there was no difference between patients receiving telemonitoring vs. usual care with respect to hospitalisation rates and ED visits. Furthermore, a study by Chaudhry et al.<sup>10</sup> focused on telemonitoring in patients with heart failure which found it did not improve outcomes or decrease ED visits. There are further studies focusing on disease management and intensive care unit monitoring which contribute to a growing body of literature that suggests home telemedicine does not reduce ED visits or admission rates.<sup>11,12</sup> Despite this evidence, telemedicine has been shown to be highly variable and context specific with possible success in certain population groups such as the elderly.<sup>13</sup>

Table 1. High-Intensity Telemedicine Capabilities<sup>1</sup>

Communication with patient

Telephone or video conferencing

Real-time model and store-and-forward model

### **History Taking**

Protocol driven data collection

Access resources including caregivers and facility staff

Perform medical reconciliation

### Physical exam

Digital Images (e.g. skin, tympanic membrane, throat edema)

Video (e.g. respiratory effort, gait, joint range of motion)

Audio (e.g. lung, heart, bowel sounds)

### Equipment

Digital stethoscope

Digital otoscope

12 lead electrocardiogram

Supplies to collect blood and urine samples

Digital pulse oximeter

High resolution digital camera

Web camera linked to a laptop computer

#### **Diagnostic testing**

Pulse oximetry

Electrocardiogram

Phlebotomy

Limited point-of-care (e.g. urinalysis, rapid strep)

Collaboration with mobile radiology

<sup>1</sup>Adapted from Shah MN, Gillespie SM, Wood N, Wasserman EB, Nelson DL, Dozier A, et al. High-Intensity Telemedicine-Enhanced Acute Care for Older Adults: An Innovative Healthcare Delivery Model. J Am Geriatr Soc. 2013;61(11):2000-7

Seniors are four times more likely to visit the ED than younger populations and have extended wait times of 4 hours, compared with only 2.5 hours for adults age 20 to 64.<sup>14,15</sup> Of those ED visits, 20 per cent did not require ED services, but led to higher admission rates and more extensive diagnostic workups.<sup>16,17</sup> Once in the ED, seniors are more susceptible to acquiring delirium and falls and have increased rates of future repeat visits.<sup>18,19</sup> This increases the economic burden despite an already high age-related health care cost of \$30.9 billion in Canada in 2010.<sup>15</sup> Gaps in care for seniors that contribute to unnecessary ED visits have been attributed to ambulatory care-sensitive problems that may be treated outside the ED and self-care issues related to activities of daily living (ADLs) and instrumental activities of daily living (IADLs).<sup>20</sup>

High-intensity telemedicine may prevent unnecessary ED visits by seniors. A study by Shah et al.<sup>1</sup> looked at the use of high-intensity telemedicine for older community dwelling adults. This case series study included 388 patients with a median age of 85, predominantly female (74%) and of white race (90.5%). Patients were from assisted living facilities (40.2%) or

lived independently (59.8%). The authors employed the high intensity telemedicine model as described above. Follow-up surveys of patients' caregivers indicated that telemedicine saved a visit to an after-hours clinic or an ED 88 per cent of the time and saved an estimated 3.5 hours of time. Patients indicated that telemedicine saved a visit to an after-hours clinic or an ED 91per cent of the time and saved an estimated 3 hours of time. Both residents and caregivers reported great satisfaction with the high-intensity telemedicine program.

This study was a case series with no control group to compare rates of ED visits to those with traditional care, thus limiting the quality of evidence. Furthermore, it did not examine important outcomes related to cost-effectiveness or health outcomes that would strengthen the practicality of highintensity telemedicine. The results may not be generalizable to other populations since the study participants were predominantly female and of white race. Additionally, nursing home patients were not included in this study due to their access to medical services.

High-intensity telemedicine provides healthcare providers the opportunity to address issues related to ambulatory care and shows increased diagnostic potential. Due to its available technologies and thorough data collection, providers are able to obtain more information to make proper diagnoses and treatment plans. They can also identify patient issues related

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to ADLs/IADLS and make appropriate referrals to allied health professionals and home nursing care. Previous integrated telemedicine approaches were found successful for elderly patients with complex co-morbidities and lead to decreased length of hospital stays, ED visits and improved patient satisfaction.<sup>21</sup> An analysis of geriatric telemedicine strategies found an overall paucity of evidence within this population. However, there were successful telemedicine strategies in populations with chronic respiratory disease, diabetes and hypertension management with consistent qualitative reporting of high patient satisfaction within the elderly population.<sup>22</sup> With these promising results, the addition of a high-intensity model may address the identified care gaps leading to an appropriate context for success in telemedicine.

Limitations to a high-intensity telemedicine model do exist. At the systems level, telemedicine for the geriatric **6** High-intensity telemedicine has shown promise in reducing ED visits in older adults with high patient satisfaction. However, evidence relating to telemedicine continues to produce mixed results. Further research needs to identify the appropriate type of patients, health systems, and program factors that predict telemedicine program success.

population is often not considered a priority and requires organizational policy in order to normalize the intervention.<sup>23</sup> Similarly, innovative program implementation would be challenging, as organizations are largely resistant to change.<sup>24,25</sup> The start-up cost of technology and training a new health care professional (i.e. CTA) is costly and resource intensive and may be a considerable barrier to implementation. However, the longterm economic impact of reduced ED visits may prove highintensity telemedicine a worthwhile investment. Currently, there is a lack of research regarding the long-term economic impact of telemedicine.

High-intensity telemedicine has shown promise in reducing ED visits in older adults with high patient satisfaction. However, evidence relating to telemedicine continues to produce mixed results. Further research needs to identify the appropriate type of patients, health systems, and program factors that predict telemedicine program success. Study outcomes such as cost effectiveness and individual-level health outcomes need to be examined to determine the concrete benefits of this model before its wide spread implementation.

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# **Electronic Medical Records in Primary Care: Are we There Yet?**

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### ABSTRACT

Though the number of physicians using electronic medical records (EMR) is rising, not all physicians in Canada are readily adopting the technology. Recent data suggests that EMR are making a difference for physicians, patients, and the health care system by increasing efficiency, decreasing mistakes, and improving patient safety. Despite these benefits, significant barriers remain. As technological innovations in health care continue to evolve, increased adoption of EMR systems could become a key factor in improving the quality of health care delivery and producing better outcomes for patients in Canada.

KEYWORDS: electronic medical records, primary care, health information technology

s information technology advances and becomes more refined, its role in medical practice will continually increase. This is already being seen in many primary care offices across the country, with practitioners starting to switch from the traditional paper-based system of record keeping to electronic medical records (EMR).

As of June 2013, changes to British Columbia's Limitation Act and subsequent amendment of the Health Professions Act mean that physicians now have to store and retain patient medical records for a minimum period of sixteen years, an increase from the previous requirement of six years.<sup>1-3</sup> This increase means that physicians still using paper-based record keeping methods will have to find physical storage space for all that paper, unless they make the switch to EMR.

According to the 2013 National Physician Survey, 63.8% of Canadian primary care practitioners currently report using EMR.<sup>4</sup> Though this is a substantial increase from 27% in 2009, there remain a substantial number of physicians who have not adopted this technology.<sup>5</sup> In contrast, physicians in the United Kingdom, Norway, New Zealand, and Netherlands all report over 97 per cent use of EMR technology.<sup>6</sup>

### What makes EMR so great?

Numerous theoretical benefits of EMR technology for primary care physicians have been touted: digital storage of records, improved documentation, clinical tools and calculators, automated reminders, electronic messaging, computerized order entry, enhanced scheduling, and several others.<sup>7,8</sup> Taken as a whole, it is hoped these benefits will translate into increased productivity, increased efficiency, and It is estimated that two thirds of preventable adverse drug events could be avoided through the widespread use of computerized prescription entry programs by physicians.

improved patient care; but does the evidence support these benefits?

Recent data suggest that EMR actually have been making a difference for physicians, patients, and the health care system. A systematic review on the impact of EMR on physician practice in office settings found the greatest improvements occurring in the areas of preventive care, work practice, and patient safety.9 Furthermore, by reducing staff time spent on paper-focused tasks, EMR are able to provide greater efficiency. An example of this is seen through the 48 to 96 per cent reductions in the number of paper chart retrievals in physician offices with EMR.<sup>10</sup> A study conducted in 2009 shows further support, finding that implementation of EMR results in clinicians and office staff spending less time distributing charts, which allows clinicians to spend more time examining and accompanying patients.<sup>11</sup> EMR have also been shown to increase efficiency by reducing the time spent sorting and organizing laboratory and diagnostic test reports, saving approximately 15 minutes per report.<sup>10</sup>

Beyond individual physician offices, EMR benefit the health care system as well. Implementation of EMR can reduce adverse drug events, both improving patient safety and saving health care system resources.<sup>10</sup> By using this technology,

### Overall, the implementation of EMR in Canadian physician offices has been suggested to have had an estimated benefit of over \$1.3 billion between the years 2006 and 2012.

physicians can reduce problems caused by illegible handwriting and incomplete prescriptions, and will be alerted to potential errors including drug interactions and patient allergies. A study comparing the use of a computerized decision support program with a control found that those using the computerized support system wrote significantly fewer inappropriate prescriptions ([RR]: 0.82 [CI]: 0.69-0.98).<sup>12</sup> It is estimated that two thirds of preventable adverse drug events could be avoided through the widespread use of computerized prescription entry programs by physicians.<sup>8</sup> Simply stated, better technology means fewer mistakes and improved patient safety.

### Given these benefits, why is it that 36.2% of Canadian physicians are not using EMR?

Numerous studies have looked into identifying barriers to the adoption of EMR.<sup>10,13-15</sup> Financial concerns, time constraints, technical competency, limitations of current EMR systems, and lack of customizability have all been suggested as contributing factors.<sup>10,13-15</sup> In British Columbia, the top two reasons preventing physicians from setting up EMR systems are the time required and the financial costs associated with implementation and maintenance.13 Some physicians do not believe switching to EMR is worth the hassle, and are comfortable with the way their practices operate currently, while others who are considering adopting EMR state they simply do not know how to get started.13 Nevertheless, opportunities do exist to aid physicians who want to make the switch. Technical, financial, and peer support can all help physicians effectively implement EMR into their practices.<sup>9,10,13</sup> The Physician Information Technology Office (PITO), which provides guidance for physicians in British Columbia with regard to information technology, aims to provide this type of support and help physicians address the barriers to EMR implementation. The PITO program includes a funding initiative to help physicians offset the initial monetary cost involved with switching to the new technology, as well as programs for transition planning and peer support. Several similar programs have been established in other provinces as well, including Alberta, Saskatchewan, Manitoba, Ontario, and Nova Scotia.

Despite the barriers, EMR are capable of having a tremendously positive impact on the medical system. Overall, the implementation of EMR in Canadian physician offices

has been suggested to have had an estimated benefit of over \$1.3 billion between the years 2006 and 2012.<sup>10</sup> The recent data suggests that primary care practitioners are trending in the right direction with regard to the adoption of electronic medical records, and British Columbian physicians are faring better than the national average.<sup>4</sup> But, with one in four primary care practitioners in the province still not using the technology, there is still considerable room for improvement.<sup>4</sup> As technological innovations in health care continue to evolve, increased adoption of EMR could become a key factor that propels primary care physicians toward more efficient practices that produce better outcomes for patients.

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<sup>\*</sup>Editor's note: PITO has given a September 30, 2014 deadline to indicate a desire to participate in post-implementation support. See http://www.pito.bc.ca/2014/08/final-opportunity-for-emr-postimplementation-support-mu3

### **Community Paramedicine: A Preventive Adjunct toTraditional Primary Care**

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### ABSTRACT

Community paramedicine is an evolving field in which paramedics take on extended roles beyond emergency response. These responsibilities include monitoring of medication compliance, vaccination administration, public health, prevention and wellness, chronic disease monitoring, and various minor treatments in the patient's own home. Pilot programs in the United Kingdom, Canada, the United States, and Australia have shown up to 50% decreases in emergency department admissions in targeted populations, such as the elderly and frail. Community paramedicine could become an adjunct to traditional primary care, alleviating the burden of care on family physicians and emergency departments in British Columbia's rural communities.

KEYWORDS: emergency medical services, allied health personnel, preventive medicine, primary health care

**F** or two decades, there have been calls for increased numbers of primary health care providers to meet the needs of British Columbia's rural communities.<sup>1</sup> However, a shortage of providers based in rural areas remains, despite coordinated provincial efforts to train and retain more doctors, including efforts such as the establishment of Canada's first truly distributed medical education program, regional training initiatives, a greater emphasis on rural family practice in medical school, and broad incentive strategies to attract new graduates to settle in smaller communities across the province.<sup>2</sup> Nevertheless, innovative solutions continue to arise, including telehealth, increased nurse practitioner training, and most recently the emerging field of community paramedicine.<sup>3</sup>

The British Columbia Ambulance Service provides Emergency Medical Services for the province of B.C. by maintaining and staffing all of the ambulance stations in the province. Many BC Ambulance Service stations are found in rural and remote communities with small populations and few local resources. In many instances, the closest medical clinic, doctor, or hospital is hours away. Transporting patients to the hospital can be a major challenge at many levels: financially, for the health care system; logistically, for the patient; and medically, for the community, leaving it without emergency response coverage while paramedics transfer the patient and return. Additionally, if the patient requires specialized or advance care, an air ambulance may be required to urgently transfer him or her to the appropriate care centre.

Paramedics are primarily trained to recognize and respond to life-threatening injuries and illnesses, as well as to stabilize and monitor patients during their transport to definitive care at a hospital. Paramedics cannot diagnose illnesses, refer patients to other health care services on an outpatient basis, or provide continuing care for chronic conditions. As such, community paramedicine is an emerging field in which paramedics operate in expanded healthcare roles to deliver healthcare to underserved populations.<sup>4</sup> Under a community paramedicine model, paramedics receive additional training in primary care, public health, chronic disease management, mental health, and prevention and wellness, among other skills. These additional skills allow paramedics to take on roles in the community that are left unfilled due to a lack of primary care providers. The model of community paramedicine was originally introduced in the landmark paper "Rural and frontier EMS agenda for the future: A service chief's guide to creating community support of excellence in EMS" by the U.S. Department of Health and Human Services.<sup>4</sup> This concept has been used in Canada,<sup>5</sup> the United States,<sup>4</sup> the United Kingdom,<sup>6</sup> and Australia,<sup>7</sup> and each pilot program has sought to emphasize the aspects of primary care most important to their specific community.

In the United Kingdom, the National Health Service had become overwhelmed with emergency medical admissions to hospitals. In an effort to "improve the care and assessment of patients" the University of Sheffield developed a "paramedic practitioner" program specifically aimed at treating elderly and frail patients, who make up 21 per cent of emergency department visits.<sup>6</sup> Paramedic practitioners were trained to perform home visits to assess, treat, and discharge older patients with minor acute conditions.<sup>6</sup> The trial evaluated over 3000 patients and found that patients attended by paramedic practitioners were 28 per cent less likely to attend an emergency department, 13 per cent less likely to require hospital admission within 28 days, and reported being highly satisfied with their experience, compared to standard care.<sup>8</sup> The evidence from Sheffield showed that paramedics with extended skills could provide a clinically effective alternative to standard ambulance transfer and treatment to prevent unnecessary admission of frail and elderly patients.

Canada's first community paramedicine pilot program was developed in Nova Scotia in two isolated island communities. The program provided 24/7 "community paramedic practitioner" coverage on the two islands as well as a part–time nurse practitioner, all supervised by an off–site physician.<sup>5</sup> The community paramedics administered flu shots, checked blood pressure and blood glucose levels, assessed medication compliance, performed wound care, administered antibiotics, performed phlebotomy for routine blood tests, and organized preventive education sessions, such as fall prevention for seniors.<sup>5</sup> Community paramedic services could be directly requested by residents of the community, or could be requested as continuing care after being seen by the nurse practitioner or physician.<sup>5</sup> If the community paramedics felt they were outside of their scope of practice, they could consult a physician on–

### Community paramedicine is an emerging field in which paramedics operate in expanded healthcare roles to deliver healthcare to underserved populations.

call or transport the patient to hospital for more advanced care. Over the course of three years, the program resulted in a 23% decrease in emergency department visits from island residents.<sup>5</sup>

The community paramedicine model is not only effective in rural health care settings. It has also been adopted by Toronto Emergency Medical Services with a focus on health promotion and injury prevention.<sup>9</sup> Through the Community Referrals by EMS (CREMS) program, any paramedic responding to a 9-1-1 call in the greater Toronto area is able to refer patients they feel require additional healthcare or support services.<sup>9</sup> These referrals are followed up by a central Community Access Care Centre to provide appropriate services to the patient.<sup>9</sup> Additionally, the Ontario government has recently announced a \$6 million expansion of the community paramedicine program specifically targeted at seniors, who utilize the emergency response system frequently.<sup>10</sup> The pilot program showed a 50 per cent reduction in 9-1-1 calls and a 65 per cent reduction in emergency department visits by targeted patients.<sup>10</sup>

The most evident barrier to implementing community paramedicine programs is cost, including whether the program will be cost–effective in the long term. While limited data from pilot programs suggest community paramedicine is a cost–effective model, sample sizes were small and program formats varied, so it is difficult to make any definite conclusions thus far.<sup>5,8</sup> Secondly, a large number of paramedics will need to be provided additional training in extended care roles, which could temporarily decrease the ability of those personnel to provide

services to their communities. The optimal type and scope of extended roles for paramedics has yet to be determined, as well as how these additional roles will be regulated. Lastly, the program may meet resistance to change, whether from other health–care providers, internally from paramedics, or from patients themselves.

The community paramedicine model could provide an adjunct to traditional primary care in B.C. in order to alleviate the burden of care on family physicians and emergency departments, specifically in rural areas where primary care is intermittent and difficult to access. This will be increasingly relevant given B.C.'s aging population, many of whom will have chronic diseases and multiple medications that require routine monitoring but may not require a physician visit. Given the shortage of rural primary care providers, these problems traditionally accumulate until the patient deteriorates or uses emergency services unnecessarily, resulting in enormous resource consumption. While community paramedicine programs have been shown to be effective in both urban and rural settings, benefits would be great in a geographically distributed health care system, such as in B.C., where there is a gap between primary care and the needs of regular patients in rural communities. Community paramedics could bridge this gap in rural primary care and provide preventive care, minor treatment, and disease maintenance services to the communities where they already reside and work, while continuing to also provide essential emergency care when necessary.  $\mathbf{V}$ 

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### The Future of Assisted Reproductive Technology: Insights from Dr. Hitkari

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KEYWORDS: assisted reproductive technology, in vitro fertilization, genetics, future, pregnancy, ethics

ssisted Reproductive Technology (ART) helps to achieve a pregnancy by overcoming the barriers of natural conception. It is often indicated in infertility, advanced reproductive age, or recurrent pregnancy loss. In particular, an in vitro fertilization (IVF) cycle is a three-week ART intervention that involves the extraction of follicles from hormonally-stimulated ovaries, the insemination of oocytes in a laboratory culture setting, and the implantation of the developing embryo into the patient's uterus.<sup>1</sup> Since the successful birth of the first IVF baby in 1978, approximately 5 million babies worldwide have been born using this technique.<sup>1</sup> In 2012, 14,953 IVF treatment cycles were undertaken in 30 of 33 Canadian IVF centers, and the clinical pregnancy rate was 32% per IVF cycle performed.<sup>2</sup> In response to the growing demand, this relatively young specialty has exploded with research and development in the past 30 years including: improved safety and efficacy of fertility medications, refinement of surgical techniques, and most impressively, optimization of laboratory culture environment and embryo handling techniques.<sup>1</sup> Collectively, these observations suggest that the prospect of assisted reproductive technology in helping patients obtain a much-desired pregnancy continues to be promising.

Over the years of training and experience in this area, Dr. Jason Hitkari has observed major technological advancements that are especially targeted to help patients who may be carriers of chromosomal abnormalities or genetic diseases:

There have been exciting changes even in the last year or two. Recurrent pregnancy loss can be devastating for couples, but now there is a tool to help them. *Comprehensive Chromosome Screening* is a technique where the extracted embryos are biopsied and screened for chromosomal abnormalities that may be associated with recurrent spontaneous pregnancy loss. This is very informative for us. It allows us to identify a chromosomally-normal embryo to replace back into the patient and dramatically reduce the risk of miscarriage. Occasionally, there are situations where all of a couple's embryos are non-viable and this allows us to explain why they have had repeated losses in the past and also allows the patient to move on to techniques such as egg or embryo donation which will change the outcome. Another incredible advancement is the *Pre-implantation Genetic Diagnosis* technique which can screen for singlegene disorders such as the classic example of Cystic Fibrosis.<sup>1</sup>

For patients who have struggled to start their own family, the journey of a healthy pregnancy enabled by ART is truly a miracle for the parents-to-be.

Dr. Hitkari believes that genetics will continue to play a pivotal role in determining the fittest embryos for a healthy, successful conception. Moreover, he envisions the field of ART to be completely revolutionized in a few decades:

I think that preserving frozen oocytes [until implantation at a later time] will be increasingly prevalent because this is an approach that eases women from the worries about a biological clock [within reason]. In the very long run, what would be terrific is the ability to create gametes such as oocytes and spermatocytes using stem cells from a patient. So, for that 30-year-old woman who is struggling with Premature Ovarian Insufficiency, we could recreate oocytes using her stem cells and help her have a baby that shares her genetics. Although really appealing as a concept, this is likely several decades away. That being said, researchers are working on this potential now.<sup>1</sup>

The scientific knowledge and application of ART may be outpaced by its complex ethical, medical, and socioeconomic issues that are quickly surfacing in discussions. There have been concerns about ART being used for purposes beyond its original intention, for example, using ART to help select for preferred gender and genes. In addition, it has been reasoned that if a single gene loci encoding for certain pathologies can be identified and manipulated, it is technically possible to build a "designer baby" with the perfect physical and intellectual traits.<sup>1</sup>

From a medical standpoint, the utilization of IVF is associated with an increased risk of multiple births and pre-term delivery compared to natural conception, and these consequences are further exacerbated by an increased maternal age.3-5 Moreover, there are uncertainties regarding the long-term health implications of the extension of reproduction into older age. From a socioeconomic point of view, the provision of ART services is becoming rapidly commercialized in the private sector.6 As a result, the accessibility to ART is highly limited by financial and geographical barriers as this medical intervention is expensive (costing a minimum of \$10,000 per intervention cycle in British Columbia) and the majority of the trained expertise and facilities are located in the urban centers.<sup>1</sup> Hence, patients from suburban and rural communities are the most affected as they must spend additional resources and time traveling to and from fertility clinics.<sup>1</sup> Evidently, these intricate issues are significant global topics that involve the government, society, and medical institutions. Yet, a paramount issue that is often overlooked is the impact of ART development on the personal interaction of the physician with the patients and their family.

With rapidly evolving medical advancements in ART that may "de-humanize" the natural process of conception and pregnancy, the quality of care and genuine patient-physician interaction become even more crucial to sustaining the essence of reproductive health care in the future.<sup>6</sup> Conception, which has previously been a private decision between two individuals, may now involve clinicians, nurses, and laboratory technicians complicated with Petri dishes and embryo incubators. For patients who have struggled to start their own family, the journey of a healthy pregnancy enabled by ART is truly a miracle for the parents-to-be. However, ART can only increase the likelihood of a successful conception but does not guarantee it. In some cases, repeatedly failed IVF attempts may be discouraging and distressing for the patients and their family, and so this is a time in which they need specialized attention to their sensitive emotional needs. Currently, psychosocial support and counselling are offered as part of the management plan for patients who are experiencing infertility and undergoing the invasive procedures; however, the clinician continues to be the key communicator and caregiver in the face of these complex and sensitive issues. This is both a challenging and rewarding aspect of Dr. Hitkari's clinical work as a reproductive endocrinologist and infertility specialist:

Medicine is filled with privileges. One of the best things about this field is the ability to help couples achieve the dream of starting their own family when they are not able to do so. But the flipside of that success is the greatest challenge of my work, which is dealing with the patients' normal responses to grief [when treatment is unsuccessful], whether it be anger, withdrawal, or sadness.<sup>1</sup>



### ACKNOWLEDGEMENTS

I want to sincerely thank Dr. Jason Hitkari for sharing his insight and knowledge with us, and wish him all the best in his future endeavours.

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Dr. Hitkari is a Reproductive Endocrinology and Infertility specialist in the Department of Obstetrics and Gynecology at the University of British Columbia. He completed his MD Undergraduate program and residency in Obstetrics and Gynecology in Vancouver, and continued with a two-year fellowship program at Mt. Sinai Hospital in Toronto. Dr. Hitkari is currently the Medical Director of Olive Fertility Centre in Vancouver as well as a clinical assistant professor at UBC where he takes great pride in educating medical students as the Week Chair of the Year 2 Medicine Reproduction Block. Dr. Hitkari's dedication in his field of expertise and education has been recognized through the Humanitarian Award for Patient Care and he has twice received the Medical Undergraduate Class Educator of the Year Award. Spending the majority of his time providing patient care, Dr. Hitkari has shared much clinical expertise especially regarding the current impact and the future direction of assisted reproductive technology.

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# The Evolving Roles in Anesthesiology and the Team-based Model

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### ABSTRACT

Due to the growing need to improve access to Canadian healthcare and reduce spending, many specialties have had new roles emerge, changing their delivery of care. In delivering anesthetic care, the roles for certified registered nurse anesthetists and anesthesia assistants are increasing. This has led to the development of the Anesthesia Care Team in Ontario. The team increases access to care by decreasing time spent in hospital, and has also decreased costs to the health care system, and thus, may be the future of anesthesia care in Canada.

KEYWORDS: anesthesiology, team-based model, health care roles, anesthesia care team

The health care system is always evolving to meet the needs of Canadian society. With government reports stating that Canadians require improved access to health care, coupled with the need to find savings in our health care spending, many specialties are finding their roles and work environment changing dramatically.<sup>1</sup> Anesthesiology is no exception to this, and Canada is now beginning to see an increasing number of Anesthesia Assistants (AAs) across the country, as well as the introduction of Certified Registered Nurse Anesthetists (CRNAs) in British Columbia, which continue to change how anesthetic services are being delivered. By looking at a brief history of anesthesia, the roles of CRNAs and AAs, and understanding their contribution to new team-based models, we can better understand where the future of anesthesiology is headed.

Many date the advent of modern anesthesia back to the 18th century when Joseph Priestley created nitrous oxide, which, along with other gases like diethyl ether and chloroform, were found to have analgesic properties. By the mid-1800s, many used these gases as anesthetics for surgical procedures ranging from tooth extractions to leg amputations, and thus became the first anesthetists. The field grew exponentially with the development of intubation and laryngoscopes, and powerful machines that were able to administer gases and monitor vitals. With this complexity came the need to ensure that there were adequate safety measures in place, and as a result, anesthesiology self-regulating bodies were developed to train physicians in the delivery of perioperative care.<sup>2</sup>

While physicians were being trained to be anesthesiologists, the field of nursing also trained anesthetists and were actually the primary anesthesia providers before the American Medical The role of the Anesthesiologist may evolve into more of a perioperative medical director with responsibilities ranging from preoperative assessments through intraoperative management.

Association endorsed anesthesiology as a medical specialty in 1937.<sup>3</sup> The credential of CRNA was adopted in 1956 and today there are over 40,000 practicing in the United States. Their scope of practice varies by state but involves working under the direction or supervision of an anesthesiologist to provide anesthetic services to patients.<sup>4</sup> In terms of quality of care, a 2010 U.S. study looked at over 41,000 surgery reports and found that although there were no increases in adverse outcomes in cases performed by CRNAs alone (e.g. death in low mortality diagnoses, failure to rescue from a complication, iatrogenic pneumothorax), there was a statistically significant difference in the complexity of the surgeries that were performed when compared to anesthesiologists.5 While there are currently no CRNAs in Canada, the B.C. government has made plans to introduce them in an effort to reduce health care costs and address the shortage of anesthesiologists in the province.<sup>6</sup> This was prompted after a 2012 conflict between the B.C. Medical Association and the province's anesthesiologists when the anesthesiologists threatened to withhold non-emergency services due to concerns over remuneration and staffing issues.7 Dr. Jeff Rains, the head of the B.C. Anesthesiologists' Society at the time, stated that he was not opposed to CRNAs, but was not impressed that it was being used as a threat rather than an idea to improve patient care.8

While the B.C. Ministry of Health predicts it may take a few years before CRNAs become established in Canada, respiratory therapists (RTs) have been around since the 1960s and, starting in 2005, the Canadian Society of Respiratory Therapists allowed RTs and RNs to train to become anesthesia assistants.<sup>9</sup> There were an estimated 132 AAs who had graduated in Ontario by the end of 2011.<sup>10</sup> Like the CRNAs, their role varies by site but may include technical duties such as setting up anesthesia workstations, troubleshooting equipment, and stocking carts, as well as clinical duties such as preparing the patient, inserting IVs and arterial catheters, assisting with regional blocks, airway management, administering therapies as directed by the anesthesiologist, and assessing the patient intraand postoperatively.<sup>10</sup> A 2010 survey sent to 115 sites showed

What do anesthesiologists think about this? In a 2009 questionnaire, 86% of responders agreed they prefer working in a team and 91% agree the ACT model has enhanced OR safety. They also report greater job satisfaction and would like to see more AAs trained. With the increasing demand to cut health care costs, we may see the ACT be adopted in other provinces as more AAs continue to be trained.

that, of responders, 43% of departments used AAs and that this was distributed fairly evenly between academic and community settings (53% vs. 47%). The sites that were utilizing AAs were all in communities with a population of more than 10,000 people. The survey also described that 93% of responders agreed that AAs contributed to improved efficiency, productivity, patient safety, and job satisfaction.<sup>11</sup>

The future of anesthesia across Canada will likely see these health care professionals working in teams, already demonstrated with the development of the Anesthesia Care Team (ACT) in Ontario in 2005 to address the shortage of anesthesiologists and to improve access to care.11 The report that led to the development of the ACT team found that while the number of anesthesiologists grew, the shortage remained the same due to the increase in anesthesia services between 2003 and 2005.12 The ACT is an anesthesiologist-led model, which may include AAs, RNs, and RTs and soon, CRNAs. In this team, the team members report to the Chief of Anesthesia and work under the supervision of an anesthesiologist. The Chief of Anesthesia is responsible for determining the extent of activities for team members and may identify when it is appropriate for an anesthesiologist to provide concurrent care to more than one patient with the assistance of the other team members.<sup>13</sup> Potential benefits and savings were predicted as follows: an RN could

review patients in preoperative clinic and select only the more complex patients to discuss with the anesthesiologist, there could be one AA for two active operating rooms for both the technical and clinical duties of specific surgeries, and an RN could provide postoperative acute pain service.<sup>13</sup>

A safety audit stated that the ACT resulted in no increase in serious adverse events, and that it was associated with reduced time spent in the post-anesthesia care unit (PACU) and in hospital. An economical analysis claimed annual savings in cataracts surgeries of \$132,000 per OR and almost \$2,000 per hip or knee replacement.<sup>13</sup> While there were increased costs associated with the AA, the analysis found savings in time spent in the PACU as well as overall length of hospital stay. Further details into how safety was improved or how PACU and hospital length of time stay were reduced were not described, and it would be interesting to reassess what these outcomes have been over the past few years.

What do anesthesiologists think about this? In a 2009 questionnaire, 86% of responders agreed they prefer working in a team and 91% agree the ACT model has enhanced OR safety. They also report greater job satisfaction and would like to see more AAs trained.<sup>13</sup> With the increasing demand to cut health care costs, we may see the ACT be adopted in other provinces as more AAs continue to be trained. Some challenges may include standardizing this model across different provinces and determining the appropriate number of team members to employ per ACT to ensure that it remains cost-efficient while still providing strong patient care.

One of the concerns over the ACT was job security of anesthesiologists and AAs, and the report does not do much to ease these concerns with their statement "the extent to which any given role is retained will depend on the circumstances of each hospital and cannot be assured."13 So is this the end of anesthesiology? Not quite. While the Canadian Anesthesiologists' Society fully endorses AAs, they believe that the practice of anesthesia should remain physician-based to ensure patient safety and will continue to lobby to ensure that it remains this way.<sup>13</sup> Similarly, the American Society of Anesthesiologists believes that "CRNAs and AAs are not trained to make medical judgments, and that physicians are better able to handle more complicated cases and emergencies."14 Due to these changes, perhaps the role of the anesthesiologist may evolve into more of a perioperative medical director. Their responsibilities would still range from preoperative assessments to intraoperative management, with the ability to handle difficulties as they arise in the OR, through to postoperative patient care. In addition, they would supervise the delivery of this care by the AAs and CRNAs, and would effectively manage emergencies, complex disease processes, patients in intensive care units, and those with chronic pain appropriately as the need arose.

Thus, the field of anesthesiology has changed greatly since its beginning, with new health care delivery models and health care professionals being trained in new roles. As we move into an age with further cost-cutting measures and increasing wait times, it appears we are going to see an increase in advanced practice health care providers and team-based models in all areas of medicine.

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### Health Advocacy and Promotion in a Vancouver Inner-city Elementary School: Lessons From the HealthstART Program

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### ABSTRACT

HealthstART is an after-school education program developed to address the healthcare needs of vulnerable inner city elementary school children in Vancouver. Through creative art projects and positive mentorship, HealthstART demonstrated effective community-based promotion of healthy living and dealt with a broad range of health disparities facing this population. Further-more, we identified a lack of parental engagements and mental health education as pertinent issues that need to be addressed to enhance future program effectiveness and improved health outcomes in this inner-city community.

KEYWORDS: HealthstART, health advocacy, inner city, vulnerable children, after school, community

ccording to the BC Atlas of Child Development, two thirds of children in inner city Vancouver schools are developmentally vulnerable.<sup>1</sup> "Vulnerable children" are defined by Vancouver Coastal Health as "those with a greater-than-average risk of developing health problems by virtue of their marginalized socio-cultural status, their limited access to economic resources, or personal characteristics such as age and gender."<sup>2,3</sup> Such adverse health outcomes can manifest in the form of developmental delay and compromised physical and mental health.<sup>4</sup>

Inspired to lessen this disparity, we created HealthstART, an after-school program that promotes healthy living in innercity elementary school children, as part of a self-directed project in the "Doctor, Patient, and Society" course in the second year medical curriculum at UBC. Partnered with the Writers' Exchange, a Tides Canada Initiative, we planned and delivered seven weekly after-school sessions on relevant health topics with the aim of using art creation as a vehicle for communication and positive mentorship. Through this project, we aimed to become effective health advocates for a vulnerable community.

The participants in this year's HealthstART program consisted of 10-15 children in Grades 4-7 from Queen Alexandra Elementary School, a population deemed vulnerable based on its high proportion of children in care (living outside the parental home) or receiving social assistance.<sup>5</sup> Each session began with a discussion on a topic of healthy living, complemented by a creative art project to help consolidate key concepts. In order to address the most pressing needs of this community, the lessons were designed based on a combination of literature research and surveying of school staff, Writers' Exchange volunteers, and the students themselves. Topics covered included nutrition, physical activity, hand-washing and infectious disease prevention, dental health, and mental health. Artwork created by students includes fridge-magnets of germs as reminders of proper hand hygiene, decorated cookbooks containing nutritious, low-cost recipes, and antibullying buttons in support of self-esteem and positive peer relationships.

Surveying of the students (before and after HealthstART), the volunteers, and parents (after HealthstART only) was done to assess the educational value, strengths and weaknesses, and general impression of the program. Overall, from the responses of 10 students, four volunteers, and two parents, HealthstART was perceived as fun and educational; and all respondents indicated that they would sign up with the program again. By comparing pre- and post-program surveys, we also found that students demonstrated increased knowledge of healthy practices by providing more detailed examples of the concepts surrounding exercise, a nutritious diet, dental health, and mental health. For example, instead of responding with "running" as the only form of exercise as they did in the pre-program survey, most students were able to name many sports and other activities in the post-program survey. In addition, all student respondents indicated that since the start of the program they had applied at least one of the practices learned to daily life, such as exercising a minimum of 60 minutes every day or flossing. Finally, feedback from

the parents and volunteers revealed their support for more programs like HealthstART, or other programs related to health, in elementary schools.

Among these successes, our experience with HealthstART allowed us to acquire key insight into the process of health advocacy. The first component of this perspective was the im-portance of connecting to our target population in health promotion initiatives. We were initially apprehensive about the participation rate of HealthstART as the volunteer coordinator at the school told us that "when kids hear 'health' or 'healthy', they turn and run the other way." The art component was likely instrumental in the successful delivery of the program because it attracted many students who would otherwise be disinterested in the topic of health. Three new students joined us in the middle of the semester because they had heard about how "fun" the class was from other students.

### The other component to health advocacy, as determined through our experiences with HealthstART, was the necessity of working with the community to identify their specific needs, and responding to these issues accordingly.

Noticing the appeal of art, we attempted to vary our activities to keep the students engaged during the hour and a half long sessions. In this way, we were reminded that health promotion seminars should be tailored to the target population.

The other component to health advocacy, as we found through our experiences with HealthstART, was the necessity of working with the community to identify their specific needs, and responding to these issues accordingly. That is, while our literature review and consultation with the program coordinators from the school and Writers' Exchange revealed an array of potential health concerns, we were unable to foresee which health care needs existed specifically among our unique population of students, and to what extent, until we immersed ourselves in the lessons, observed the children in the classroom, and built relationships with them. In our student community, one of these needs is the inclusion of parents in health promotion programs. Many studies show a positive relationship between parental involvement and healthy living behaviors, such as in the reinforcement of physical activity and providing balanced meals.<sup>6,7</sup> However, of the 10 surveys sent home with the students to evaluate HealthstART, only two were returned despite numerous reminders. Barriers to parental involvement in school programs include economic and time constraints, cultural and language differences, and negative attitudes towards school and vice versa.<sup>6</sup> As such, to increase parental engagement in future years, we plan to partake in brief, informal one-on-one meetings with parents.

By actively working with this community, we have also discovered that there is an alarming deficit in mental health

education in this population of elementary school children. Literature suggests that 1 in 7 Canadian children ages 4-17 suffer from clinical mental disorders, and the lifetime risk of mental illness for Canadians is 1 in 5.8,9 We were surprised that all 14 students wrote versions of "I don't know" when asked to explain what "mental well-being" means on the preprogram survey. Although programs such as the BC FRIENDS pro-gram, which is aimed at reducing anxiety and depression in children K-7, exist in BC to improve mental health education for children, these initiatives have not yet been translated effectively into the community.<sup>10</sup> Consequently, we plan to extend the HealthstART program to run throughout the school year in subsequent cycles to include more sessions on mental wellness education and promotion. These issues in parental engagement and mental health were revealed through direct and dynamic engagement with these children, which subsequently enabled us to reshape HealthstART to better reflect the community.

As per the CanMEDS competencies, we will soon be entrusted with the role of health advocates, not only for our patients, but also for our communities. Our experience with HealthstART encouraged us to view this process as a two-way street. By actively immersing ourselves in the community and learning from its members, we recognized art as an effective communication and mentoring technique for children, and identified pertinent needs of this inner-city community in the realms of parental engagement and mental health education. Given these insights, we hope that HealthstART will continue to adapt and grow as a community program, empowering vulnerable youths to take health matters into their own hands.

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### This Is the End: Our Post–Antibiotic World

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C ince the dawn of the antibiotic age, we knew that the end would come.

In the 1930s, the serendipitous discovery of penicillin provided clinicians with a powerful weapon to combat previously fatal illnesses. Antibiotics became household drugs. Yet our cavalier use of these key weapons is facilitating the development of antibiotic resistance. In medicine, some estimate that in the United States, 50 per cent of prescribed antibiotics are squandered on viral infections and other cases where they are not needed or are ineffective as prescribed.<sup>1</sup> Outside the clinics, over 75 per cent of antimicrobials in Canada are used in agricultural animals to stimulate their growth and prophylactically guard against infections.<sup>2</sup> This practice might help to breed drug–resistant strains that are infectious to humans and much harder to treat.

Antibiotic resistance is growing at an alarming rate, and the public health consequences are dire. Globally in 2011, 3.7 per cent of new cases and 20 per cent of previously-treated cases were estimated to have multi-drug-resistant tuberculosis (TB). Our "last line" antibiotic defenses—such as ciprofloxacin for *Shigella* or cephalosporins for *Neisseria gonorrhoeae*—are crumbling in the face of rapidly-developing resistance<sup>3</sup>. In 2013, the World Health Organization issued an urgent warning regarding Carbapenem-resistant *Enterobacteriaceae* (CRE), which are resistant to nearly all antibiotics available today.<sup>3</sup>

Adding fire to the flame, the antibiotic development pipeline has slowed to a trickle. To engineer novel classes of antibiotics that are unfamiliar to microbes, pharmaceutical companies need to rely on rational drug design, an endeavor with an estimated onebillion-dollar price tag.<sup>4</sup> Furthermore, antibiotics are simply not profitable. Because they cure the root of the disease, they are not suitable for long-term use. Once a new antibiotic hits the market, resistance might develop rapidly and render the drug ineffective in a brief time. Even a truly innovative class of antibiotics might not sell; health care professionals often save them as a last resort for multi-drug-resistant cases. This is a good practice for medicine, but not for business. In 1999, pharmaceutical companies Roche, Lilly, Abbott, and Bayer pulled out of antibiotic research. In 2004, only five new antibiotics were under development; however, in stark contrast, four new drugs were under development for erectile dysfunction.<sup>5</sup> As recently as 2011, Pfizer closed down its main antibiotic research division.6

Is the post-antibiotic era inevitable? The answer is, hopefully, "No," but this will not be the case without global cooperation and

an attitude–change towards our use of antibiotics. In this regard, Canada has been vigilant in government regulations of medical and agricultural antibiotic use. First established in 1994, the Canadian Nosocomial Surveillance Program (CNISP) surveys CPE and other infections from 54 sentinel hospitals spread across ten provinces. This provides a framework for developing national guidelines for sustainable antibiotic use in medicine. The Canadian Integrated Program for Antimicrobial Resistance Surveillance (CIPARS) compliments CNISP and monitors antimicrobial use and resistance across the food supply chain. These and other international efforts continue to provide useful information about emerging resistance and outbreaks, including their impact on public health,<sup>2</sup> and these efforts need to be sustained.

An alternative strategy to combat rising levels of resistance is to spur the development of novel antibiotics. The Generating Antibiotic Incentives Now (GAIN) Act in the United States was enacted in 2012 to incentivize and accelerate approval for antibiotics development. Last year, Roche invested up to US\$ 550 million to develop macrocyclic peptidomimetic antibiotics against *Pseudomonas aeruginosa*.<sup>6</sup> This January, AstraZeneca and Sanofi each partnered with biotechnology companies to identify and optimize novel, naturally–occurring antimicrobial compounds.<sup>6</sup> This is not a fast fix, as drug leads often require over a decade to go from concept to market.<sup>7</sup> In the meantime, perhaps the most important intervention is to educate both medical professionals and the general public in antibiotic use. It is time to treat them with respect.

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### **Choosing a Specialty: Resources to Consider**

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#### KEYWORDS: jobs, employment, unemployment, specialty, resources

s medical students, we often hear statements about the difficulty many newly trained specialists have in securing employment, but are they true? Physician employment trends are important to heed as we move forward and seek to meet the future demands on our medical system. Here we review key resources on which to keep an eye.

In October 2013, the CEO of the Royal College of Physicians and Surgeons, Dr. Andrew Padmos, released a message around the most recent 2013 Employment Report, "What's Really Behind Canada's Unemployed Specialists."<sup>1</sup> Namely, the report found there is a 16% unemployment rate among specialists and subspecialists compared to a 7.1% unemployment rate experienced by all Canadians.<sup>2</sup> Other notable findings of the report included the following:

- Between 2011 and 2012 there was 4% rise in unemployment issues for specialists.
- Employment issues are most pronounced in resourceintensive disciplines including, but not limited to, critical care, general surgery, neurosurgery, radiation oncology, urology, gastroenterology, and ophthalmology.
- Over half of new specialist respondents reported receiving no career counseling.

The report cited three reasons why these problems may worsen in the future. Firstly, a weakened economy has delayed retirement for physicians, making new-graduate entry challenging. Secondly, interprofessional healthcare is less reliant on physicians for treatment, which slows job growth. Thirdly, new factors for today's specialists, such as an older age of entry, lead to relocation and job-finding difficulties.<sup>2</sup> The 2013 National Physician Survey shows us here in BC, family practitioners report a 2.9% underemployment rate versus 6.3% in other specialites.<sup>3</sup>

The National Physician Employment Summit held in Ottawa in February 2014 brought together hundreds of medical associations to address these very problems. The delegation strongly supported creating a pan-Canadian strategy to better match physicians to population needs to address employment issues.<sup>4</sup> This was in addition to the Canadian Medical Association (CMA)'s existing 10-Point–Plan intended to address employment, education, and training.<sup>5</sup>

These sentiments were in agreement with a 2011 report from the Doctors of BC who recommended collaboration between the Health Authorities and the Ministry of Health to create a provincial Physician Workforce Planning Committee for BC, which would include the Faculty of Medicine and the Royal College of Physicians and Surgeons.<sup>6</sup> The 2011 Doctors of BC report, "Doctors Today and Tomorrow," explains the difficulties in projecting physician supply, and notes that currently in BC, resource planning occurs at the regional, and not provincial, level. Individual Health Authorities develop physician human resource plans, however the plans have shortcomings in comprehensiveness, methodologies, and levels of implementation. Additionally, there is limited availability of high-quality physician workforce data with which to plan. At present, provincial, regional, and national databases report different numbers of physicians, but no source is able to provide comprehensive information on the services physicians provide or their perceived workload.6

### So how do you navigate this changing landscape? As a student, book an appointment with the Career Planning Program of the Faculty of Medicine.

Dr. Cunningham, President of the BC Medical Association (BCMA) and the Doctors of BC, was able to provide a statement around the employment projections for physicians – "[both groups] expect in the near future that students and physicians will have access to a national resource plan." Current support from the BCMA includes a speed networking event in addition to their 2011 report<sup>7</sup>.

So how do you navigate this changing landscape? As a student, book an appointment with the Career Planning Program of the Faculty of Medicine. For basic information, be sure to check the websites of the National Physician Survey, the Royal College of Physicians and Surgeons, the CMA, and the Doctors of BC.

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### Nurse Practitioner's Role in Canadian Healthcare

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The current role of registered nurses (RPNs) is a physician's aide who ensures patient treatment is carried out according to physician orders.<sup>1</sup> However, the climate in Canada has necessitated a shift towards nurses having more responsibility in the medical setting. This has produced a specific role within nursing known as a nurse practitioner.

Nurses in very remote areas are often required to perform duties outside of their job description.<sup>2</sup> The recently certified profession of nurse practitioner (NPs) allows nurses to diagnose and treat illnesses, order tests, and prescribe medication. This change in the roles and responsibilities of nurses is a type of task–shifting—a tactic that has gained attention over the past ten years, particularly in low-resource settings.<sup>3</sup> The goal of task– shifting is efficient use of human resources in a healthcare setting to achieve optimal patient health. Studies report that in specific environments, NPs can effectively diagnose and treat particular diseases and perform surgery with outcomes comparable to those of trained physicians.<sup>2,4</sup>

In 2002, a Cochrane review was conducted to survey the literature and determine patient views of NPs and synthesize data regarding clinical outcomes. This review reported that patients were more satisfied with NP visits than physician visits, as the consultations were longer and more detailed. Furthermore, patient outcomes were comparable between the two groups.<sup>5</sup> Although the studies examined in the review provided sparse data and had a large degree of heterogeneity, research still suggests NPs are competent at performing basic physician tasks. However, a source of contention lies in where NP responsibilities end and clinician responsibilities begin.

It is generally accepted that there will be overlap depending on the healthcare setting and resources available. However, too much overlap will create a two-tiered system where a portion of patients will be treated by NPs and another portion treated by 'more qualified' clinicians. As usual in medicine, the answer does not lie on one extreme or the other.

Although NPs provide support in duties that can be shifted vertically, the major aspects of specialist duties remain with highly trained clinicians. The implication is that there will always be limits on the roles of NPs. On the spectrum of responsibility; nurse practitioners must lie between a nurse and a clinician, with a margin of flexibility.

There have been multiple NP clinics opening across the country, indicating the task-shifting mentality that is pervading the policy landscape. Until there is evidence to the contrary, current use of NPs in Canadian healthcare provides an efficient means of reducing physician workload and costs while improving health outcomes. Further context-specific pilot projects in low-resource settings will facilitate further appropriate use of nurse practitioners.

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### Assessing Early Childhood Nutritional Practices in Rural Uganda

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### ABSTRACT

### **OBJECTIVE:**

According to the 2011 Uganda Nutrition Action Plan, 40 per cent of children under the age of five are malnourished. As local healthcare leaders identify childhood malnutrition as an ongoing problem in the rural village of Nakaseke, Uganda, this study aimed to assess early childhood nutritional practices in Nakaseke, and to identify barriers to healthy nutritional practices in order to create sustainable interventions. METHODS:

Data was collected using seven focus groups with a total of 46 participants including community health workers, village health teams, and community members. The interviews were conducted in Luganda using a translator, and were audio recorded, transcribed, and analyzed for common themes.

#### **RESULTS:**

General poverty and lack of knowledge were identified as two major barriers to healthy nutritional practices in the community. Poverty left many homes unable to afford certain nutrition–rich foods, an issue compounded by the lack of family planning resulting in large families. A general lack of knowledge contributed to the inappropriate cessation of breastfeeding and the improper introduction of complementary foods, and was due in part to a lack of proper education.

CONCLUSION:

This study identified a continued need for education on nutrition within the community. With a better understanding of current practices and beliefs, we can now collaborate with the community to create sustainable interventions to address their specific needs while taking into account their financial restraints.

KEYWORDS: global health, nutrition, health, lliteracy, community-based education

### INTRODUCTION

In Uganda, early childhood malnutrition rates have been estimated at 40 per cent of children under five years of age,<sup>1</sup> and are attributed to high rates of malaria, improper infant feeding practices, food insecurity, and lack of access to health care.<sup>2</sup> Although previous studies have examined nutritional practices in Uganda as a whole, data specific to rural communities are limited.<sup>1</sup> The causes of malnutrition are known to be multifactorial, including a significant socioeconomic influence. Dietary imbalance is a common problem, with Ugandan diets consisting mainly of starches and an inadequate intake of micronutrients, fats, and proteins.<sup>3</sup> Additionally, food insecurity is an ongoing problem, affected by the history of civil war and ongoing civil unrest, as well as by high rates of poverty.<sup>3,4</sup> Finally, education has been shown to be of particular importance in improving nutritional practices.<sup>4</sup>

Over the past four years, the UBC Global Health Initiative (GHI) has been working with the African Community Center for

Social Sustainability (ACCESS) in Uganda. ACCESS is a locallybased organization in the small village of Nakaseke that runs a health clinic and community-based projects. In the Nakaseke district, 55 per cent of people live below the poverty line, roads are not maintained, and access to amenities such as electricity and medical care are poor.5 Strikingly, about 15 per cent of children in the Nakaseke district are orphaned.<sup>5</sup> ACCESS focuses on sustainably in supporting the local community by providing medical care and education, encouraging economic empowerment, and training Community Health Workers (CHWs).<sup>5</sup> CHWs roles include providing guidance when dealing with disease, and following up with vulnerable patients in conjunction with the medical center at ACCESS.<sup>5</sup> The community also has Village Health Teams (VHTs), who are government based liaisons between community members and the medical system.<sup>6</sup> Because there is a low doctor-to-patient ratio in rural Uganda, CHWs and VHTs are vital to the health care system.

Each summer, UBC GHI has sent a group of four students to assist with the program by providing education, performing research, and targeting areas for improvement. The 2012 GHI team identified a strong prevalence of early childhood malnutrition, particularly anemia and growth stunting.<sup>7</sup> The 2013 GHI team arrived with the goal of assessing early childhood nutritional practices in the Nakaseke community. This qualitative study aimed to identify the current practices and barriers facing families and children in Nakaseke District, with the goal of preparing more efficient interventions for early childhood nutrition.

### MATERIALS AND METHODS

### **Recruitment of participants**

Research ethics approval was obtained from the UBC Behavioral Research Ethics Board (H13-00534). Participants were contacted by the ACCESS medical officer from a list of current CHWs, VHTs, and nursing aide students in the community. Community members who had recently attended the ACCESS medical clinic were also asked to participate. Consent was explained orally to the participants and translated into Luganda. All participants were given consent forms to sign if they wished to participate in the focus groups. Participants were served lunch and invited to take part in a seminar on early childhood nutrition following the focus groups. Participants were allowed to leave at any time without consequence and were still invited to attend the nutrition seminar.

#### **Demographics of participants**

The focus groups included a total of 46 participants including mothers, fathers, and participants without children (Table 1). The majority of participants had children, ranging from no children up to fifteen children.

Table 1. Participant demographics			
Females (%)	78		
Males (%)	22		
Age range (years)	20 to 58		
Average age	37		
Participants with children (%)	89		

#### Focus groups

Seven focus groups were run in Nakaseke, with each focus group including between five and nine people. The focus groups were conducted over a period of three days in the teaching building at ACCESS Uganda's LifeCare Center. There were three cohorts of research participants: 1) CHWs and nursing aide students (henceforth referred to as CHWs) 2) VHTs and 3) community members. Each cohort was sampled individually, grouping those with similar training backgrounds together to avoid influencing the responses given. Within each cohort, participants were placed into focus groups based on arrival time. All sessions were audio recorded with each session lasting between 60 and 90 minutes. Questions and answers were translated orally between English and Luganda, phrase-by-phrase by a translator during the focus group sessions. Each focus group was run by two UBC medical students; one student guided with questions while the other student observed and recorded any non-verbal cues and behaviours. These UBC medical students had previously met the cohort of CHWs while holding health education seminars, but had not previously met the VHTs or community members. A list of standardized questions was adapted from the USAID Knowledge, Practices and Coverage Survey specific to childhood nutrition.8 Questions were chosen to determine whether the World Health Organization (WHO) guidelines for infant and young child feeding were being met by community members.9 These questions were used to guide the focus groups in a semi-structured format, with additional questions added by the student leading the session as required for clarification and expansion on the answers given. The questions focused on breastfeeding, complementary feeding, and barriers to proper early childhood nutritional practices. The community members were asked about their personal practices and beliefs, while CHWs and VHTs were asked about both their own practices and beliefs as well as those witnessed within their community. The notes recorded by the second student consisted of details such as age, observations such as the visible comfort level of participants, and written summaries of the discussion. All audio recordings were later transcribed word-forword by the researchers, with any unintelligible phrases entered as blanks and interpreted with the aid of written notes.

#### Data analysis

The organization of data and its thematic analysis was done by hand and was adapted from suggestions given by Onwuegbuzie et al. (2009).<sup>10</sup> The transcripts were divided based on whether the response was about current practices and knowledge, or barriers faced in the community. Within these sections, ideas were grouped into themes, and each focus group was analyzed for the frequency with which the themes appeared. From there, each transcript was highlighted to show the frequency of these themes, and smaller themes were discovered and compared between the transcripts. Major themes were those that were mentioned in all of the focus groups. Minor themes were mentioned by some of the focus groups.

### RESULTS

### Demographics of participants Current early childhood nutritional practices and beliefs

Most CHWs and VHTs interviewed had received prior training on nutrition from other organizations such as World Vision. They were generally well informed on WHO recommendations, which consisted of exclusive breastfeeding to six months of age followed by introduction of complementary foods.<sup>9</sup> Prior to having this knowledge, these participants had a wide range of practices, but adjusted their habits once they received education. Community members had some knowledge of recommended nutritional practices, but many were unsure if the knowledge they had was accurate:

You may find in the community only bananas, they only give their children bananas. They view that a child has to eat only bananas neglecting other food kinds so that they have to teach them how to balance the foods (CHWs)

All participants reported a wide range of personal nutritional practices, as well as practices they witnessed within the community. Complementary foods were introduced at a range of ages and the amounts and types of complementary foods also varied. Breastfeeding practices ranged from mothers not breastfeeding at all, to mothers breastfeeding exclusively for longer than the recommended duration of six months.[9] Early cessation of breastfeeding was identified as being multifactorial. It was reported that mothers who worked often had to leave their child at home. The fear of sagging breasts after breastfeeding was identified as a concern, particularly among young women in the community. The lack of breast milk experienced by some women was attributed to some women being less "gifted" (VHT) than others at producing breast milk. A common belief was that breastfeeding should be discontinued when a mother falls pregnant as it was believed to cause kwashiorkor in the child. With many families not using birth control methods, there are frequent pregnancies, and thus the discontinuation of breastfeeding in many children before the recommended age of two years.<sup>9</sup> Other beliefs included cessation of breastfeeding during illness or if a mother is HIV positive.

#### Barriers

Lack of finances and lack of education were the two major themes that emerged from the focus groups. The focus groups clearly indicated that there is a large variance in the understanding of recommended nutritional practices among community members. Some members follow current WHO recommendations while others practice traditional beliefs and customs.<sup>9</sup> There is some nutritional training given in hospitals during births, prenatal visits, and childhood immunizations. While this is a good step towards educating the community, it is not done consistently and not all mothers attend these sessions. Additionally, it is important to educate men in the community as well, because they are the primary decision makers and generally in control of the finances. Current programs do not target men, and any information sessions held at prenatal visits are not well attended by men. When health seminars are offered in the area, many community members are unable to attend due to transportation costs:

[T]here are many [community members who] know there is a seminar at Life Care [ACCESS]. They ask, "[are] there [reimbursements]?" If you say no, they hesitate. (CHW)

The need to work and care for their family prevents men from taking time away. As a result, a large part of the community remains uneducated.

Programs aimed at educating the community have suffered due to a lack of financial support. Programs involving the volunteer CHWs and VHTs have struggled due to financial and time constraints. The goal of these programs was to educate the CHWs and VHTs, allowing them to disseminate information in the community through seminars and house visits. Unfortunately, being volunteers, many CHWs and VHTs have to balance full-time work and personal responsibilities with health education. Lack of time and the cost associated with visiting families in the community have prevented these programs from reaching the entire community. Additionally, the level of training and knowledge varied between members of the health teams, was not standardized, and may have lead to the reinforcement of common misbeliefs.

It was reported that there are also some community members who lack the interest and motivation to receive education. The community members that do attend seminars are typically the same people each time, which means there is a large percentage of the community that is either unable or unwilling to attend the seminars. It was identified that some members of the community are "stubborn to change" their traditional ways. Many people who have multiple children see that their older child has grown up relatively problem free and believe that their methods are good. Meanwhile their children may have been suffering from malnutrition that the parent did not recognize:

...[The community members] have a tendency of saying "I don't have to bother with [changing nutritional practices], [this] older kid, he grew like that, he is in a good condition, why should I do that so don't tell me about it." (VHTs)

Even families that are well educated on recommended nutritional practices and are willing to change are not always able to carry out the recommendations. Inadequate finances was brought up in every focus group as a major barrier to healthy nutritional practices:

The family has all the required food that should be given to the baby, chicken because chicken lay eggs, they have milk, they have all kinds of stuff but because the family is so much focused on getting this money, instead of giving one egg to the kid, they give this egg to be sold to someone to get money. Instead of getting one cup of milk to the kid, someone sells this cup of milk to someone, then he gets money. (VHTs)

Meats, milk, fish, liver, and some vegetables are typically more expensive than starches such as matoke (a variety of starchy banana), maise flour, and cassava (yuca) (Table 2). Depending on the season, even staples such as matoke can become scarce and expensive. Additionally, a tradition of large families and a lack of family planning further stretches family resources.

### DISCUSSION

The barriers in our research included difficulties with translation that may have lead to the loss of subtlety in participant's answers and understanding, limited representation of community members (especially those not already connected with ACCESS), and possible participant discomfort in sharing personal information during focus groups. Nevertheless, a lack of finances and education emerged as major themes within all focus groups. Financial instability was a major factor limiting access to education and access to nutritional foods. Thus, because of the challenge that financial barriers pose, it is important to focus on how to more effectively use available resources by improving education. A study in Western Uganda showed that educated mothers were more likely than uneducated mothers to prepare complementary food specifically for their infants.<sup>4</sup> This points to the importance of education as a tool to improving nutritional practices in the community.

The current teaching methods that are being used for health education within the community follow the traditional classroom approach. This method appears to work well within secondary schools in the village of Nakaseke as it has been validated through research by previous UBC medical students; however, it is unknown if this is an effective method of education within the community as

Table 2. Current dietary practices of focus group participants					
	Proteins	Fats	Carbohydrates	Fruits	Vegetables
Foods commonly eaten	<ul> <li>Beans</li> <li>Crushed silver fish</li> <li>Minced meat</li> <li>Porridge</li> <li>Ground nuts</li> </ul>	• Eggs • Margarine • Avocado	<ul> <li>Sweet potatoes</li> <li>Flour</li> <li>Porridge</li> <li>Cassava</li> <li>Corn flour</li> <li>Rice</li> <li>Pumpkin</li> </ul>	<ul> <li>Bananas</li> <li>Guava</li> <li>Passion fruit</li> <li>Jackfruit</li> <li>Mangoes</li> <li>Papaya</li> <li>Pineapple</li> </ul>	• Greens • Tomatoes
Foods too expensive or unavailable	<ul> <li>Fish</li> <li>Soy bean</li> <li>Liver</li> <li>Meat</li> <li>Baby formula</li> <li>Tinned baby food</li> </ul>	<ul><li>Cow milk</li><li>Baby formula</li><li>Tinned baby food</li></ul>	<ul> <li>Rice</li> <li>Plantains</li> <li>Potatoes</li> <li>Baby formula</li> <li>Tinned baby food</li> </ul>		

well.<sup>7</sup> Traditionally, the community education sessions have been held in one central location and participants have been recruited from outlying areas. Long distances and a lack of viable transport makes it difficult for some individuals to attend. Members of the focus groups identified that only a small cohort of individuals regularly attend these educational seminars. Cultural barriers may also play a role in effectively disseminating knowledge, particularly into the more isolated regions of Nakaseke district. It is difficult to determine if the information is being relayed throughout the communities, and this is therefore an area for further investigation.

Future studies will address the need for early childhood nutritional education on a local level. In particular, we want to reach deeper into the community in order to target those community members who currently do not attend seminars, especially men. As suggested by focus group participants, traveling drummer groups could be used in order to present this information in a culturally appropriate way. These groups would present the information using story, song, and dance, incorporating local traditions as well as integrating culturally important beliefs. HIV and AIDS education was well received using this traditional style folk media in rural villages in Ghana.<sup>11</sup> Further modification of the presented nutritional seminar will help to better target identified issues and dispel common misbeliefs identified in the focus group sessions. It is important that these seminars promote the most affordable and accessible nutritional foods in order to help improve dietary imbalances. The modified nutrition seminar will continue to be taught to CHWs and VHTs in order to continue working towards sustainable education in the community. Our ACCESS partners are looking at ways to provide sustainable funding for these community-based education programs through future income-generating initiatives such as a planned nursing school.

In conclusion, the current nutritional practices in the village of Nakaseke are varied. The major barriers identified by the focus group participants were financial constraints and lack of education. Other minor barriers overlapped considerably with these two general themes. Future directions will target the current educational practices in Nakaseke. We will aim to reach this goal by improving the efficiency of education and reaching a larger part of the community. Sustainable funding generated through a new nursing school currently under construction will allow for continued outreach to the community for ongoing nutrition and health education. The overall aim of these initiatives would be to improve early childhood nutrition and general community health.

### ACKNOWLEDGEMENTS

We would like to thank ACCESS Uganda, Dr. Robert Kalyesubula, and James Sewanyana. This project was funded by the UBC Global Health Initiative (GHI) and the UBC Faculty of Medicine Summer Student Research Program (SSRP).

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### **Evaluating Behavioural Change Among Eighth–Grade Youth Following a Global Health Workshop**

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### ABSTRACT

**OBJECTIVE:** 

Youth growing up in today's globalized society will experience the impact of global issues more so than previous generations have. As such, educating students to be global citizens should be considered a priority in our society. METHODS:

This pilot study used the Theory of Planned Behaviour, a model previously shown effective in evaluating changes in behaviour and intention in youth. This model was employed to evaluate the efficacy of a one-hour workshop in changing youths' reading, talking, and watching behaviours when learning about global health.

### **RESULTS:**

Data showed that a one-hour workshop changed talking behaviours with an absolute mean difference of 0.50 (95% CI 0.28 -0.72, p-value of <0.001), and watching behaviours with an absolute mean difference of 0.33 (95% CI 0.05-0.60, *p-value* of 0.02) in a sample of female eighth–grade students from a Vancouver private school. Reading behaviours were unchanged. According to the Theory of Planned Behaviour, changes in behaviour can be attributed to changes in youths' subjective norm with a mean difference of 1.81 (95% CI 0.73-2.88, and a *p-value* of 0.001).

### CONCLUSION:

A one-hour interactive workshop changed youths' subjective norms when learning about global health issues that they care about. This may have led to behavioural changes, specifically watching and talking behaviours.

KEYWORDS: global health, youth, planned behaviour

### INTRODUCTION

In today's increasingly globalized world, the struggles of one nation can have far-reaching impact on individuals around the world.<sup>1</sup> It is therefore of great importance for the youth of today to grow up with an awareness of the world's interconnectedness, as they stand to be impacted directly by global problems in the future. Knowledge of the problems facing the global community is what will ultimately allow youth to have a positive and meaningful impact in the world. Even those who are seemingly far-removed from these issues by geographical location or by socio-economic status may in the future have a large role in combating issues that affect nations far from their own. For example, those who are well-educated and able to afford travel can work or volunteer overseas as young adults, helping people in these countries. Many important global problems fall under the category of global health, and the World Health Organization considers having access to the highest possible standard of health a fundamental human right.<sup>2</sup>

A key first step in understanding global health is to become aware of the notion and impact of health on populations and to become educated about its contributing factors. The term global health is used frequently in many settings; however, it is rarely defined.<sup>3</sup> For our purposes, global health is defined as "those health issues that transcend national boundaries and governments and call for actions on the global forces that determine the health of people."<sup>4</sup> Though some would ascertain that there remains some ambiguity in the limitations and ramifications of the term global health, it is well–understood and appreciated that increased knowledge of global health has led to a surge of interest, with many global health initiatives established.<sup>5</sup>

To educate youth about global health, a one-hour interactive workshop on the topic was delivered to groups of eighth-grade students. Different modes of delivery were used, including a lecture component, an audience question period, and small group

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activities. Students were encouraged to share their ideas with the rest of the class throughout the workshop. The goal of our workshop was to challenge students to think about specific global health issues and to inspire them to learn more about the issues that they care about.

While secondary schools are excellent venues to educate youth on various topics, it is unclear whether delivering a workshop on global health will encourage students to become more informed about it by pursuing further education or research in the area. As to our knowledge, there have been no previous studies in this area. We designed and conducted a pilot study to address two goals. The first goal was to determine if the workshop changed youth attitudes towards learning about the global health issues that they care about through watching, reading and/or talking about global health. The second goal was to evaluate if the Theory of Planned Behaviour (TPB) was an appropriate model for designing a presentation and detecting a change in youth behaviour. We hope that our study will provide some preliminary information on educating youth about global health and measuring changes in behaviour after an intervention such as the one we implemented. We believe that there is a gap in the literature on this topic and we hope that our study will act as a catalyst for more research in this area.

### MATERIALS AND METHODS

The workshop was one hour long, and it was presented to groups of grade eight female students at Crofton House secondary school in Vancouver, British Columbia. It was held during school hours. The workshop began with a lecture-style component that included asking the audience thought-provoking questions. The participants were encouraged to share their answers with the rest of their classmates. We introduced the concept of global health in general, focused on a few specific global health issues such as child mortality and clean drinking water, and presented the United Nations (UN) Millennium Development Goals (MDGs).<sup>6,9</sup> Also included in the workshop were small group activities. The students were split into groups of five to six, and each group was given a card that contained pictures from a particular country that represented various global health issues present in that nation. The groups were then asked to brainstorm what sort of global health issues the citizens of that country may face. They were then asked to present their ideas to the rest of the class and to provide possible solutions to the issues. At the end of the workshop, students were given a resource handout (see Appendix 3, available online) with information about various global health resources.

To evaluate the impact of the workshop on youth attitudes towards learning about global health, a pre– and post–workshop questionnaire was conducted. We used the TPB to ground our analysis.<sup>10-12</sup> The TPB has been used in many studies to predict a variety of behaviours, such as smoking, sexual behaviour, exercise, and food choices.<sup>13-15</sup> The TPB has been particularly useful in studies where the participants' intention to change a behaviour is unknown or may be low.<sup>14</sup> This feature is relevant to our study, as we have no preliminary data about youths' intention to learn about global health. To generate the questionnaire, constructs of the TPB were defined as detailed in Table 1 (see Appendix 1, available online). A minimum of three questions was devoted to evaluate each construct and a six–were point grading scale was offered for each question's response (e.g., strongly disagree, disagree, slightly disagree, slightly agree, agree, strongly agree). For each construct, questions asked about a talking, a reading, and a watching behaviour. For some constructs, additional questions related to youths' general interest in global health or details of the construct. All participant answers were confidential to reduce the bias of peer influence.

Table 1. Participant demographics			
Construct	Definition		
Behaviour	Youth have acquired new knowledge about global health through reading, talking, and/or watching.		
Behavioural Intention	Youth intend to acquire new information about global health through reading, talking, and/or watching.		
Attitude toward behaviour	Youth feel they have a responsibility to keep up with information in global health through reading, talking, and/or watching.		
Subjective norm	Youth believe their peers would approve of activities to stay informed about global health through reading, talking, and/or watching.		
Perceived behaviour control	Youth know resources where they can find information about global health through reading, talking, and/or watching.		

Usability of the questionnaire was evaluated via a group of six eighth–grade youth living in Vancouver who did not participate in the workshop. This volunteer group was recruited through community organizations, and subjects came from similar socioeconomic backgrounds to the full cohort. Results from the usability group demonstrated that participants were able to complete the questionnaire in ten minutes. Subjects also provided feedback on the clarity and appropriateness of the questions.

Inclusion criteria for the main study were any eighth–grade students who attended the global health workshop at Crofton House secondary school in Vancouver on February 21, 2013. While the workshop has been delivered to students in both public and private schools in Vancouver on multiple occasions, only students from Crofton House—a private school—were selected for this study. This school was chosen on the basis of a previously established relationship between the school and UBC medical students. While the study team recognizes this was not likely a representative sample of Vancouver youth (see discussion below), we felt that the opportunity to present to a large number of students (n=100) on single day would help to provide statistical power to our analysis and would control for temporal influences on study results.

Exclusion criteria were met if any student had previous exposure to the workshop (e.g., at a previous presentation at UBC or at another secondary school). Students were also excluded from the study if they did not agree to participate in the study or if their parent/legal guardian requested that they do not participate. Prior to subject recruitment, research ethics board approval for the study was obtained through the University of British Columbia. The pre–workshop questionnaire was conducted just prior to the delivery of the workshop, and the follow–up post–workshop questionnaire was conducted two weeks later. Participants were asked to write a unique code on each questionnaire so that the pre– and post–workshop questionnaires could be matched, and so that confidentiality could be maintained. The questionnaires, along with the workshop, were conducted during students' regular class time.

Responses for each subject (both pre– and post–workshop questionnaires) were entered into a Microsoft Excel spreadsheet (Microsoft Corp., Redmond WA). Initially, results were tabulated to create a cumulative score for each TPB construct. A paired t–test analysis was conducted to assess pre–/post–workshop changes for each construct, and p–value of <0.05 was set as the threshold for significance. Sub–analyses were also conducted to evaluate changes in the individual components of behaviour (i.e., reading, talking, watching) using paired t–tests.

Paired t-test analyses were completed using STATA version 12.1 (Statacorp, College Station, TX). All other calculations were conducted using Microsoft Excel 2011 (Microsoft Corp., Redmond WA).

### RESULTS

A total of 100 participants completed the pre–workshop questionnaire, and 83 participants completed both the pre– and post–workshop questionnaires. Results of the paired t–test analysis show a significant pre– and post–workshop difference in two TPB behavioural constructs: behaviour and subjective norm. [Table 2] For behaviour, the absolute mean difference (between pre- and post-) was 0.94 (95 % CI 0.42-1.46) with a *p*–value of <0.01. For subjective norm, the absolute mean difference was 1.81 (95 % CI 0.73-2.88), with a p–value of <0.01. No significant difference was noted in the other three TPB constructs as all *p*–values were >0.05.

Table 2. Paired t-test analysis of pre- and post-workshop questionnaires.				
TPB Construct	Pre–/Post– Mean Difference (95 % CI)	P-value		
Behaviour	0.94 (0.42-1.46)	0.0005		
Behavioural intention	0.08 (-0.51-0.66)	0.7909		
Attitude toward behaviour	0.75 (-0.21-1.72)	0.1247		
Subjective norm	1.81 (0.73-2.88)	0.0012		
Perceived behaviour control	0.34 (-1.08-1.76)	0.6375		

After the initial analysis, a sub–analysis was conducted to look at individual components of behaviour.[Table 3] The results showed significant differences after the workshop in talking behaviour (absolute mean difference of 0.50; 95 % CI 0.28-0.72; p–value of <0.01) and watching behaviour (absolute mean difference of 0.33; 95 % CI 0.05-0.60; p–value of 0.02). There was no significant difference seen reading behaviour, as the p– value was >0.05.

Table 3. Paired t-test analysis of pre- and post-workshop questionnaires.				
Behaviour Component	Pre–/Post– Mean Difference (95 % CI)	p–value		
Talking	0.50 (0.28-0.72)	< 0.0001		
Reading	0.15 (-0.11-0.40)	0.2550		
Watching	0.33 (0.05-0.60)	0.0192		

### DISCUSSION

The workshop was designed to change attitude, subjective norm, and perceived behavioural control of youth actively learning about the global health issues that they care about. As per the TPB, a youth's attitude, subjective norm, and perceived behavioural control all influence behavioural intention, which ultimately influences behaviour. The advantage of using the TPB in this study was that it allowed us to better understand the factors that can motivate changes in youths' behaviour.

### **Subjective Norm**

According to our analyses using the TPB model, the effects of the workshop on changing behaviour were attributed completely to changes in subjective norm. A similar study that evaluated the effectiveness of a youth intervention promoting safe sex used the TPB. They found that changes in subjective norms had the greatest influence on behavioural changes.<sup>16</sup> Another study using the TPB highlighted the importance of the intervention design and how interventions generally target a specific construct of the TPB rather than all the constructs.<sup>17</sup> In the workshop on global health, a dominating part of the workshop was discussion among peers, which was likely why youths' subjective norms were predominantly affected after the workshop. It is possible that focusing the global health workshop on one specific construct would have been more appropriate for the length of the workshop and would have been even more effective in changing that one construct.

### Attitude

In the current study, no significant change was observed in attitude towards learning about global health. This is similar to the results of a pre– and post–study evaluating a sexual health awareness program for Tanzanian youth, which found that while knowledge and behaviour were changed, attitudes were not.<sup>18</sup> The authors concluded that the 45–minute educational intervention was effective in improving knowledge, but they found that attitude was more difficult to change. Our findings further support this conclusion. Perhaps to see a change in youths' attitude, a longitudinal workshop series over several weeks would be more effective. For example, in a 6–week study evaluating the effectiveness of a 1 % milk campaign, researchers found that changes in attitude had the greatest influence on behavioural changes.<sup>17</sup>

### **Perceived Behavioural Control**

The influence of perceived behavioural control to affect changes in behaviours is quite varied.<sup>10</sup> In the present study, no changes were detected in the perceived behavioural control after the

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workshop. Blackwell hypothesized that the utility of changing perceived behavioural control increases when an intervention targets participants with more sociodemographic barriers.<sup>19</sup> The current study population came predominantly from wealthy Vancouver families, who may have not had barriers to learning about global health issues. Youth from other socioeconomic backgrounds may have faced more barriers. Previous studies have found that the home environment is an important predictor of perceived educational barriers—for example that parental education, financial difficulties, and ethnicity all influenced perceived educational barriers in youth.<sup>20</sup>

#### **Behaviour & Intention**

This study showed changes in youth behaviour after the workshop but no changes in their intention to learn about the global health issues they care about. While the questionnaire did have students list global health issues that they cared about, the workshop was not tailored to these issues. A meta-analysis of studies using the TPB found that in half of the studies, intention was affected, whereas in two-thirds of the studies, behaviour changed.<sup>21</sup> In the current study's questionnaire, the pre-workshop intention scores were higher than the pre-workshop behaviour scores. According to the TPB, behavioural intention is required before a change in behaviour can occur. This may suggest that the study population already had the intention to learn more about the global health issues that they cared about, and this may have enabled the workshop to influence a change in behaviour. Future studies may explore the effectiveness of the workshop's ability to influence intention in study populations where the baseline intention to learn about global health is low. Also, a future study might involve surveying students a few weeks prior to the workshop, and allowing time for the workshop to be tailored to the global health issues that the students found most interesting. This could potentially produce a change in intention and a greater change in behaviour by targeting students' interests.

In a meta–analysis about the effectiveness of health promotions campaigns, it was found that the baseline rates were important indicators in predicting change.<sup>22</sup> According to this analysis, it was easier to promote change in a population when the initial baseline rates were low. In our pre–workshop questionnaire scores, attitude and perceived control towards learning about global health issues both scored high while social norms scored lower. In congruence with the meta–analysis, social norm was the construct with the most change.

### **Evaluation of the Changes in Behaviour**

This study found a change in behaviour in youth actively acquiring information about global health issues that they care about through reading, talking and watching behaviours. Changes were found in talking, 0.50 (95% CI 0.28-0.7,) and in watching, 0.33 (95% CI 0.05-0.60), but not in reading (*p-value* was >0.05). The fact that reading behaviour was unchanged may be explained by a shift in youth behaviour shown by a longitudinal study done in Iceland from old media such as books, radios, and newspapers, to new media, including television, internet, and mobile phones<sup>2.3</sup> This is valuable, as it suggests that when trying to affect learning behaviours in youth, targeting

talking and watching behaviours may be of increased importance compared to reading behaviours, both in the context of global health and in a more general context.

A one-hour interactive workshop changed a cohort of eighth-grade girls' subjective norms towards learning about the global health issues that they care about. Using the TPB as a model to understand behavioural changes, the change in social norms may have led to behavioural changes in pursuing knowledge about the global health issues that concern them.

#### Limitations of the Study

There are several limitations to the study. Firstly, the results are not generalizable to all youth, as our study group consisted of only 83 eighth-grade girls attending a private school in a wealthy Vancouver neighbourhood. To be able to generalize the results, further studies need a larger sample size that includes both boys, as well as other socioeconomic groups. Also, while we did ask about whether or not students were born in Canada, we did not do an indepth racial or cultural profile for our study population. This could be of value in a future study, as these backgrounds may influence students' perceptions of global health issues. Secondly, there is volunteer bias among our study group. Students were all given the option to participate in the pre- and post-workshop questionnaire components of the workshop. The workshop was delivered to 100 students, of which 83 completed both the pre- and post-workshop questionnaire. Volunteers may have been more interested in learning about global health and therefore more likely to independently learn about global health issues after the workshop. Thirdly, the post-workshop questionnaire was conducted only two weeks after the workshop. These results reflect immediate changes rather than long-term changes in behaviour. Lastly, the questionnaire used has not been validated by previous studies, and it may not be an accurate reflection of the youths' actual intentions, attitudes, perceived behavioural control, social norms, or behaviour.

### **Further Applications**

These pilot study results can specifically guide the development of future presentations on global health for upper class eighth– grade girls. The results suggest that it is possible to change youths' behaviour towards learning about global health issues. The pilot study shows that further emphasis on influencing subjective norms in future presentations for this target audience would be the most effective means of influencing behaviour changes. Further, targeting talking and watching behaviours rather than reading behaviours would be more appropriate. Using the TPB, we were able understand the changes in behaviour. It would also be beneficial to conduct the same questionnaire in a broader range of schools to identify both similarities and differences in the driving factors in behaviour change among different groups of youth. These results would enable future presentations to be tailored to different audiences. Different presentation formats could target the specific constructs of the TPB that are most likely to influence a behavioural change in that population.

#### Conclusion

A one-hour interactive workshop changed a cohort of eighthgrade girls' subjective norms towards learning about the global health issues that they care about. Using the TPB as a model to understand behavioural changes, the change in social norms may have led to behavioural changes in pursuing knowledge about the global health issues that concern them. The workshop had no effect on the girls' attitudes, perceived behavioural control, or intentions towards learning about global health issues. Specifically, watching and talking behaviours were changed after the workshop, reflecting youths' usage of newer medias.

### ACKNOWLEDGEMENTS

We would like to thank the members of the Global Health Workshop Development Team, Matthew Kriese, Louise Masse, and Sue Mills for all of their efforts in developing this project.

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### **Tissue Engineering in Medicine**

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KEYWORDS: tissue engineering, regenerative medicine, biomaterials, reconstructive surgery, stem cells

### TRANSPLANTATION NEEDS

Transplantation of whole organs and complex tissues has progressed significantly over recent history.<sup>1</sup> Much of this progress has been due to technical advances in immunosuppression and organ and tissue preservation. Unfortunately, many of these advances have already reached their limit, while the disease burden of organ failure and tissue damage continues to grow.

Allogeneic transplantation from donors remains the definitive method; however, the need for organ viability and lack of donors results in a disproportionate demand. According to the Canadian Organ Replacement Register 2014 Annual Report,<sup>2</sup> this supply/demand discrepancy persists across all types of transplantation. Data for patients requiring organ transplants in 2012 is summarized in Table 1. These data demonstrate that despite the large number of transplants performed, many patients will end up on a waiting list and pass away while awaiting a donor. Moreover, patients who receive solid organ transplants must live with life-long immunosuppression and the risk of transplant rejection.

Furthermore, many other tissues are transplanted regularly and are subject to the same problems with shortages and immunosuppression. Additionally, there are no methods to restore function of deceased tissue such as after myocardial infarction. Taken together, these issues highlight the need for new methods of performing organ or complex tissue transplants and regeneration.

### **TISSUE ENGINEERING**

A subfield of regenerative medicine, tissue engineering is concerned with the use of cells, matrix scaffolds, and associated biochemical and biophysical factors to create organ or tissue substitutes.<sup>3</sup> Tissue engineering has the potential to address organ shortages for transplantation patients, as well as provide complex tissue substitutes for a wide array of medical issues. This review serves to introduce readers to the field of tissue engineering, its methods for tissue construction, and current experimental progress in the field. Readers will learn of technologies that show clinical promise as well as those that have already been surgically implanted in patients.

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Tissue engineering is multi-disciplinary field, drawing on aspects of cellular biology, biomaterials, chemical engineering, and surgery. Fundamentally, an organ or tissue consists of its component cells, the extracellular matrix, and surrounding biochemical factors. Tissue engineering uses these variables to induce differentiation of cells along a defined developmental pathway. An extracellular matrix scaffold is obtained either by manufacture or decellularization (removal of cells) of an allogeneic or xenogeneic organ or tissue. This scaffold is then recellularized with autogeneic cells or stem cells. Maturation of the developing tissue is completed in a bioreactor under finely tuned conditions. This approach has the hypothetical advantage of bypassing immunosuppression through the use of autologous cells. Interestingly, extracellular matrix molecules such as collagens and laminins are highly conserved among several species; xenograft scaffold transplantations do not result in severe immunogenic reactions.<sup>4</sup> A conceptual overview of the tissue engineering process is depicted in Figure 1.

Although the importance of the biochemical milieu has long been known to impact cellular differentiation and function, the importance of biophysical factors imparted by the extracellular matrix and tissue microarchitecture on gene expression and phenotype is a more recent development. These biophysical factors include such things as matrix rigidity<sup>5</sup> and diffusion dynamics of paracrine signals.<sup>6</sup> Scaffolds capturing some of these properties can be generated through manufacturing techniques like electrospinning, which is the use of an electric charge to design fine materials at the micrometer or nanometer scale.7 Nevertheless, extracellular matrix scaffolds are complex and manufacturing methods cannot yet replicate the 3D complexity of higher level organs such as the heart. For this reason, the use of decelluralized scaffolds has gained popularity.8 This technique involves obtaining a donor tissue and clearing it of cells and other molecules through the use of detergent. Manufacturing of scaffolds is constantly being improved, and patterning technologies such as micro-printing, 3D-printing, and soft lithography allow generation of artificial micro-architectures for the creation of "mini-tissues."9 Although not yet allowing full organ recreation, these technologies have resulted in tissue substitutes that have applications in fields such as toxicology testing.<sup>10</sup> In the future, generation of extracellular scaffolds may rely on a combination of decellularization and patterning technologies.

Examples of successful tissue engineering experiments

are provided below. Although this review is by no means comprehensive, studies highlighting major successes are described. Much of the clinical success using tissue-engineered structures has been accomplished using simpler structures, although work on whole organs is pending. Patients who have had surgical implantation of these technologies will require unique medical management and continuous monitoring. By understanding how these technologies are designed, and how they differ from traditional tissue grafts and organ transplants, clinicians will be better equipped to deal with them in practice.

A subfield of regenerative medicine, tissue engineering is concerned with the use of cells, matrix scaffolds, and associated biochemical and biophysical factors to create organ or tissue substitutes3. Tissue engineering has the potential to address organ shortages for transplantation patients, as well as provide complex tissue substitutes for a wide array of medical issues.

### EXAMPLES OF TISSUE ENGINEERED ORGANS AND TISSUES

#### **Cardiac Tissue**

An experiment using decellularized extracellular matrix to regrow rat hearts validated the use of an allograft scaffold for tissue engineering.<sup>8</sup> Coronary perfusion of detergent in hearts resulted in viable allograft scaffolds that were then repopulated with autologous cardiac or endothelial cells. Constructs were incubated in bioreactors simulating cardiac physiology, and eventually showed contractions that could generate two per cent of adult pumping function. The decellularization approach has also been extended to the study of heart valve regeneration.<sup>11</sup>

Engineered substrates also have the potential to restore function to infarcted cardiac tissue.<sup>14</sup> Other studies using smaller constructs such as cardiac cells embedded into microtemplated substrates and mesenchymal stem cell sheets have demonstrated successful integration of grafts in vivo, as well as partial restoration of function after infarction.<sup>12,13</sup> Clinically, the CArdiosphere-Derived aUtologous stem CElls to reverse ventricUlar dySfunction (CADUCEUS) trial demonstrated that cultured autologous stem cells can be successfully infused into patients after myocardial infarction.<sup>14</sup> Although this trial did not demonstrate improvement in left ventricular function after infarction, it showed that engineered cell therapy approaches are safe in patients and should be explored in further trials.

#### **Blood Vessels**

Tissue-engineered vessels using autologous cells have been

validated in a human adult arterial model.<sup>15</sup> The vessels, which displayed physiological biomechanical properties, were implanted in hemodialysis patients whose original arteriovenous shunts were failing. The authors showed that these vessels could withstand physiological pressures and remain viable 24 months after surgery. Additionally, an older clinical report demonstrated successful implantation of a tissue-engineered pulmonary artery.<sup>16</sup>

### Cornea

Nishida *et al.* demonstrated the use of autologous mucosal epithelial cells to create tissue-engineered sheets for corneal transplantation.<sup>17</sup> These sheets were used to reconstruct corneal surfaces in four patients with bilateral total stem cell deficiencies. There were no complications, grafts remained stable after 13 months, and vision improved in all patients. Bilateral disease prevents the harvest of autologous corneal stem cells for graft creation; this new approach bypasses this problem through the use of mucosal cells.

### Urethra

Raya-Rivera *et al.* demonstrated the results of implantation of tissue-engineered urethras in five boys who required urethral reconstruction.<sup>18</sup> Tissue biopsies taken from each patient provided the source cells, which were then seeded onto tubularized polyglycolic acid:poly (lactide-co-glycolide acid) scaffolds. Patients underwent reconstructive surgery and were followed with a median follow-up time of 71 months. All five boys were continent at their last follow-up. Urethral biopsies showed that the engineered grafts developed an architecture that appeared normal by three months after surgery. Adequate outflow was maintained for up to six years.

#### Bladder

Cystoplasty for end-stage bladder disease uses gastrointestinal segments, although these may be associated with complications. Atala *et al.* demonstrated the use of autologous engineered bladders in seven patients (aged 4-19 years) with myelomeningocele with high pressure or poorly compliant bladders.<sup>19</sup> Urothelial and muscle cells obtained from biopsy were grown on collagen or collagen/polyglycolic acid scaffolds. After transplantation, patients were followed up for a mean of 46 months. Patients did not demonstrate metabolic consequences or urinary calculi, and renal function was preserved. Bladder capacity of patients was less than what it was prior to surgery; mean bladder leak point pressure was decreased. Although the bladder is structurally relatively simple compared to other organs, this study demonstrates the feasibility and clinical possibility of whole organ autologous engineering.

#### Kidney

The kidney is a complex organ; thus, no tissue-engineered substitute has yet been developed for clinical use. However, basic research efforts in kidney engineering are plentiful. Of particular note, decellularization techniques to obtain rat, porcine, and human kidney scaffolds have been successful.<sup>20</sup> Recellularization and incubation of the rat scaffolds yielded bioartificial kidneys with very basic urinary generation function *in vitro*. When

orthotopically transplanted in rat, grafts became perfused through recipient circulation and produced urine *in vivo*.

#### Lung

Work from the same laboratory that generated the bioartifical kidney used the same approach to generate a bioartificial lung.<sup>21</sup> After decellularization of rat lungs, scaffolds were seeded with epithelial and endothelial cells. Incubation in a bioreactor simulating the environment of a developing lung yielded constructs that could gas exchange in vitro at levels comparable to native lungs. Orthotopic transplantation yielded *in vivo* gas exchange for up to six hours after extubation. Similar to kidneys, no tissue engineered lung constructs have yet been transplanted into humans.

#### Trachea

Tissue engineering of trachea has yielded clinical successes. Macchiarini *et al.* demonstrated that transplantation of a tissueengineered trachea into a 30-year-old woman suffering from end stage bronchomalacia immediately restored respiratory function and improved her quality of life.<sup>22</sup> A human donor trachea was decellularized and seeded with autologous epithelial and mesenchymal stem cell derived chondrocytes. It was then used to replace the patient's left main bronchus. A five-year follow-up of the patient showed that the engineered trachea had remained open, well vascularized, completely and appropriately cellularized, and had normal ciliary and mucus clearance functions.<sup>23</sup>

Another study demonstrated the transplantation of a bone marrow mesenchymal stem cell seeded graft into a 12-yearold boy with long segment congenital tracheal stenosis and a pulmonary sling.<sup>24</sup> Prior to surgery, the patient's airway had been maintained by metal stents. The graft was vascularized within one week of surgery, but restoration of epithelium was not evident until one year later. Additionally, the graft did not have sufficient biomechanical strength until 18 months. However, at two years follow up, the patient had a functional airway and required no further interventions.

### CONCLUSION

This article provided a brief introduction to current concepts in tissue engineering, as well as some examples of successful experimental and clinical proof of concepts. Fuelled by advances in stem cell biology, biomaterials, and manufacturing technologies, tissue engineering and regenerative medicine will lead to novel methods of restoring tissue function for a spectrum of medical conditions. Although the field is in its infancy, the clinical successes thus far have been impressive. Nevertheless, all relevant advances should be validated through rigorous clinical trials. In the future, physicians in many fields will need to be made aware of these technologies as they become prominent in health care delivery.

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improved patient outcomes.<sup>4</sup> Including Canada's, there

are 71 registries in the

world, allowing transplant

through 22 million potential

stem cell donors from across

the world to find a genetic

highlights the special need

for Canadian Aboriginal

donors. Patients are more

likely to match to a donor

in their own ethnic group,<sup>5</sup>

and Canadian Aboriginals

have a genetic makeup that

match for their patients.

Drayson's

to

search

story

coordinators

### Top of the World Stem Cell Drive: A Case Study in Rural Stem Cell Donor Recruitment

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### ABSTRACT

Many patients with blood diseases require a stem cell or bone marrow transplant as part of their treatment, and they need a donor who is a genetic match for a transplant. Canadians aged 17-35 can register as potential stem cell donors at stem cell drives, where they swab their cheeks to provide a tissue sample. Patients are more likely to match to a donor in their own ethnic group, and there is currently a special need for Canadian Aboriginal donors, as this demographic is underrepresented on Canada's stem cell donor database. At the University of British Columbia, third–year medical students are required to complete an elective in a rural community in British Columbia or in the territories of Canada. This presents an ideal opportunity to engage rural Canadians, including Canadian Aboriginals, to participate in the stem cell donor database. This dispatch outlines a pilot rural stem cell drive, and discusses general strategies for the implementation of rural stem cell drives.

KEYWORDS: donor recruitment, stem cell drive, aboriginal; health advocacy, rural engagement

### INTRODUCTION

**F** or Drayson, a six-year-old Aboriginal boy from Manitoba with a rare blood disease, finding a genetic match for a stem cell transplant will be an uphill battle. Drayson has been diagnosed with Fanconi anemia, a rare, inherited bone marrow failure syndrome that is usually associated with congenital anomalies.<sup>1</sup> It often progresses to pancytopenia and predisposes the patient to cancers including leukemia, myelodysplastic syndrome, and liver tumours.<sup>1</sup> He is just one of over twenty Canadian Aboriginals who are actively searching for a stem cell donor and cannot find a match anywhere in the world.<sup>2</sup>

Many patients with blood diseases require a stem cell transplant as part of their treatment. This process usually requires destruction of the patient's immune system with radiation or chemotherapy followed by transplantation of new blood machinery in the form of hematopoietic stem cells. These stem cells can be obtained from either bone marrow or from blood, and they must closely match the human leukocyte antigen (HLA) markers of the patient. Over 70 per cent of the time, patients cannot find a genetic match within their family, and they must rely on unrelated donors.<sup>3</sup>

Canada's stem cell donor database is used to match potential donors to patients in need, and it includes over 340 thousand Canadians willing to consider donating their stem cells. Individuals aged 17-35 can register to join this database online or at stem cell drives, where they provide consent and swab their cheeks to provide a tissue sample. Young male donors are preferred, as the selection of donors with these characteristics is associated with



Figure 1. Inuvik, Northwest Territories.

is unique to Canada. These factors make it unlikely for patients from this demographic to find a genetic match outside of Canada, despite the large number of donors worldwide. Moreover, Aboriginals currently represent less than 1% of Canada's stem cell donor database, with younger males—the most needed donors—only making up about 25% of this limited registrant pool.<sup>2</sup>

### PILOTING A RURAL STEM CELL DRIVE

At the University of British Columbia, third-year medical students complete a rural medicine elective in a community in British Columbia or in the territories of Canada. This past summer, I was placed in Inuvik, Northwest Territories (Figure 1), and I set out to



Figure 2. Rural Stem Cell Drive Setup: featuring posters, information pamphlets, swab kits, consent forms, and required office supplies. Photo was taken during rural stem cell drive pilot in Inuvik, Northwest Territories, August 2013, at NorthMART Community Store.

engage the community of Inuvik with the stem cell network by hosting a stem cell drive.

As founder of the UBC Medicine Stem Cell Club, I already had a number of tools available to facilitate this drive. Our club equips members with training to run stem cell drives independently, and it is accredited, supported, and equipped by OneMatch Stem Cell and Marrow Network to operate stem cell drives.

I first submitted a proposal to a Quality and Risk Management Administrator at the Beaufort-Delta Health and Social Services, the health authority servicing Beaufort Delta Region in the Northwest Territories. I was given permission, with the caveat that my drive needed insurance coverage. OneMatch arranged to provide the insurance.

My next task was to secure a location—a high traffic, easily accessible area—where I could get permission to set up a table and could invite people walking past to consider registering as potential stem cell donors. I approached several venues, and I was allowed to set up a table in the NorthMART Community Store, near the food court (an ideal venue to reach out to 17-35-year-old males) (Figure 2).

I used social media to advertise for the drive, by posting on Inuvik's events page on Facebook. Inuvik has a remarkable online presence, which is something that I did not initially expect, given its small size. My marketing campaign highlighted Drayson's story, and targeted young, male, and Aboriginal residents of Inuvik (Figure 3).

### **RESULTS AND DISCUSSION**

The pilot rural stem cell drive took place over approximately 20 hours during the final week of the rural elective. It successfully recruited 44 individuals under age 35 to be potential stem cell donors, including 26 Aboriginal males.

There were a number of challenges which needed to be overcome when coordinating rural drives. First, supplies, including OneMatch swab kits, needed to be transported to the site of the drive. Arranging shipment of supplies to rural locations

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An important facet of medical student training in Canada is to become a health advocate. This includes identifying opportunities for health promotion and disease prevention in the communities served and responding appropriately. Through coordinating rural stem cell drives, medical students can improve their health advocacy skill set and ultimately become better physicians.

can take time and requires planning in advance. Second, rural electives at UBC are just one month long. This does not provide much time to obtain permission from the local health authority and from OneMatch, to arrange supply shipment, and to run the drive itself. During my pilot drive in Inuvik, it took two weeks to secure the approval and supplies needed to run a drive, highlighting the need to plan ahead.

Finally, to achieve informed consent, it is necessary to impart registrants with basic knowledge about the stem cell donation process, including potential risks. In any public setting, it is particularly important to present information clearly and accessibly see that participants will have a clear understanding of what they are being asked to do and why this is significant.

### CONCLUSION

In all, this pilot demonstrated that combining stem cell drives with medical student rural electives is feasible and can facilitate rural community participation in Canada's stem cell donor database. Rural stem cell drives provide an opportunity to engage individuals from key ethnic groups to become potential stem cell donors, including Inuit, First Nations, and Metis Aboriginals of Canada.

The principles of coordinating a rural stem cell drive (Appendix 1), as piloted this past summer in Inuvik, can be extrapolated to any rural community. An important facet of medical student training in Canada is to become a health advocate. This includes identifying opportunities for health promotion and disease prevention in the communities served and responding appropriately.<sup>6</sup> Through coordinating rural stem cell drives, medical students can improve their health advocacy skill set and ultimately become better physicians.

### ACKNOWLEDGEMENTS

The author would like to acknowledge OneMatch Stem Cell and Marrow Network for their partnership, training, supplies, and support; Inuvik Regional Hospital Staff and Administration for their support; NorthMART Community Store for providing space free of charge; and The UBC Stem Cell Club Executive Team.

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### **APPENDIX 1**

#### Checklist: For Use When Planning to Coordinate a Rural Stem Cell Drive

- 1. In Advance of the Rural Experience
  - a. Contact OneMatch (and/or the UBC Medicine Stem Cell Club) about your interest.
  - b. Request permission from Local Health Authority. Note that this step is not mandatory, but that it is good practice, particularly when acting as a representative or affiliate of the medical school.
- 2. Soon After Arrival
  - a. Find and secure location for drive: community centre, event/festival, high school (grade 12 class), or any high traffic area where you can interact with the most needed demographics: young, healthy, and ethnically diverse males.
  - b. Connect with OneMatch (and/or the UBC Medicine Stem Cell Club) to arrange shipping of needed supplies and to secure insurance for the event.
  - c. Advertise! Most small towns have social media. Some have local radio stations. Inuvik had a television channel exclusively for local advertising.
- 3. Coordinating a Rural Stem Cell Drive
  - a. Run the swab drive (see references<sup>6</sup> for a list of swab drive procedures and requirements).
  - b. Arrange for the shipment of completed swab kits to OneMatch headquarters, with their guidance.



Figure 3. Sample Advertising Campaign Resources for a Rural Stem Cell Drive. Left: Social Media Campaign. Right: Printed Poster Targeting Aboriginal Demographic



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Abstracts are not required for News and Letters submissions. There are two main types of submissions:

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- 2. Letters to the Editor are meant for readers to express their opinion in response to any articles published in past issues of the *UBCMJ*.

For submitting a news lead or for writing assignments, please contact **news@ubcmj.com** for more information.

### **Commentaries**

The aim of this section is to provide a platform for intellectual dialogue on topics relevant to the study and practice of medicine. Articles submitted to this section should correspond to one of the following descriptions. An abstract is required.

- 1. Subjective pieces relevant to medical studies, life as a future physician, or the current social context of medicine.
- 2. An article that highlights the significance of an interesting research study or area from a clinical perspective.
- 3. Book Reports are brief reports that feature a non-fiction or fiction work and explain its significance and context in the practice and study of medicine.

Please contact commentaries@ubcmj.com for more information.

### Careers

Career pieces discuss issues of interest to medical students related to professional development. Pieces can present a biographical look at the life of a prominent physician through interview, discuss the residency application process and specialty selection, or other related topics of interest.

### **Case and Elective Reports**

Case Reports describe notable clinical encounters with patients in a public health setting. The case should provide a relevant teaching point for medical students.

### Patient consent

Submissions must include consent from the patient in order to be considered for publication. A copy of the written consent obtained from the patient must accompany the submission.

### SOAP note

In addition to the standard submission criteria, case reports are strongly encouraged to include a brief inset summarizing the findings in the form of a standard medical history SOAP note (Subjective, Objective, Assessment, Plan).

Elective Reports aim to increase student exposure to a variety of medical specialties and training opportunities both locally and internationally. Reports give a specific description of the scope of a practice in a medical specialty and/or training program and recall a student's impressions and reflections during and upon completion of the elective. They should highlight the student's clinical experiences and the unique features offered by the program. Examples of Elective Reports can be found at the Lancet Student (http://www.thelancetstudent.com/category/electives/).

Please contact reports@ubcmj.com for more information.



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The UBCMJ could not have been possible without the support and guidance of the following: Linda Herbert, Dr. Richard Matthias, Linda Yang, Brian Kladko, Dr. Janette McMillan, and Brian Geary. We would like to thank Xerox Canada Ltd. for their generous support.

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