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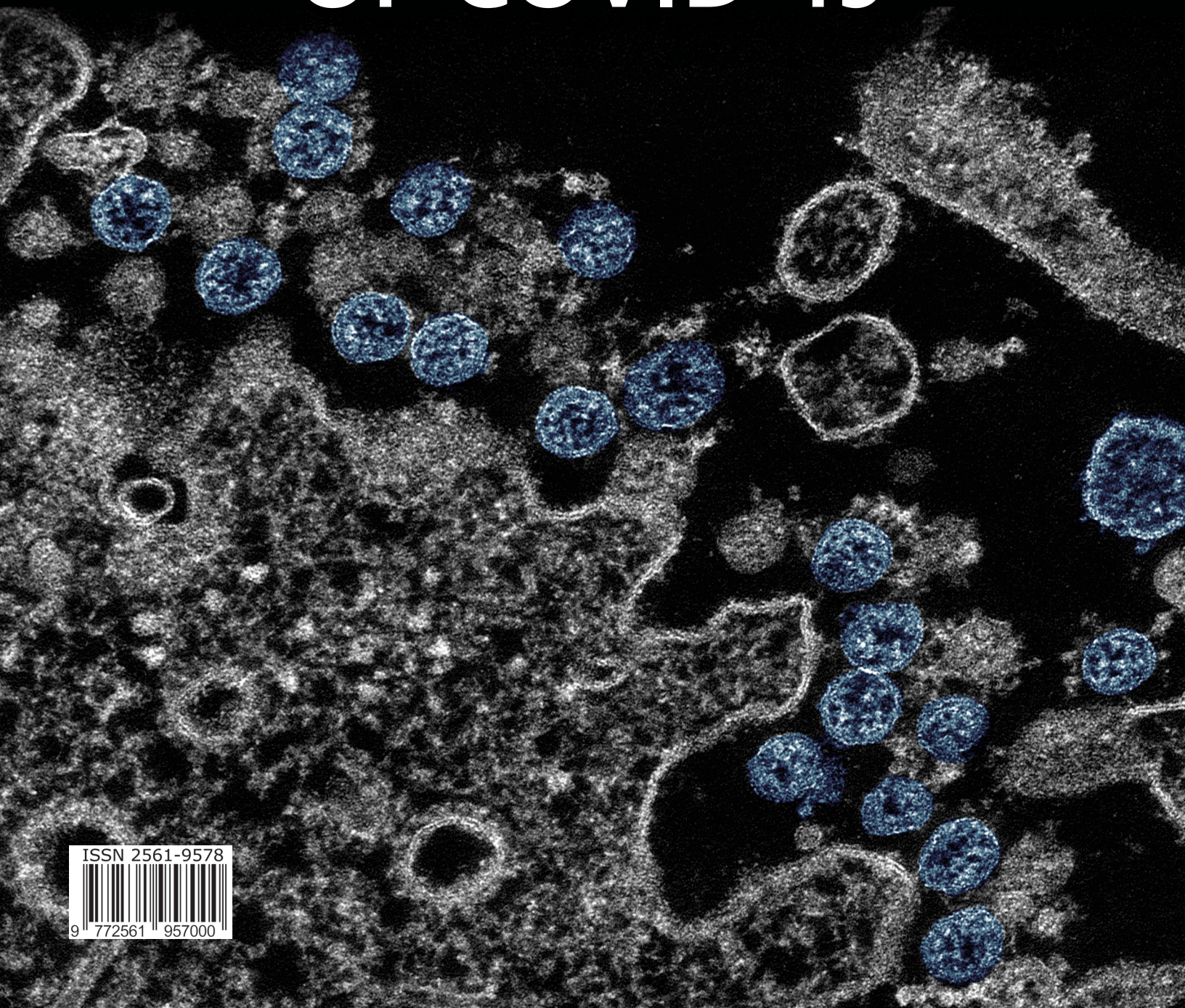
MEDICINE IN THE AGE OF COVID-19



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Awards

Outstanding Original Submissions for Volume 4 Issue 2 are awarded to Graham Casey and Alexei Berdnikov et al. Outstanding Letter to the Editor for Volume 4 Issue 2 is awarded to Anthony Wightman. Congratulations!

Learn more about how to submit your original writing at www.umjm.ca. The *UMJM* can also be found on Twitter @UMJMed We welcome submissions from students, residents, and faculty members from all colleges within the Rady Faculty of Health Sciences. Authors from institutions outside of the University of Manitoba are also welcome. We look forward to your submission!

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Letter from the Editors

Dear reader,

Thank you for joining us for Volume 4 Issue 2 of the *University of Manitoba Journal of Medicine (UMJM)*. The theme of this issue is "COVID-19". Our lives have been largely shaped by the pandemic for over a year now. Throughout its ups and downs, the response of healthcare workers and researchers has revealed the great strength that underlies our medical community. Together, we have battled the pandemic both on the frontlines and behind-the-scenes. Our efforts have paid dividends, and the largest vaccine supply operation ever conducted is well underway. It comes as no surprise that our authors had strong insight to offer for discussions around the pandemic.

Submissions to this issue describe a variety of perspectives around COVID-19. We begin on an interview with the principal investigator of the Novavax vaccine clinical trial. Adaptations made to the pandemic are also examined in pieces that describe its impact on anatomy lab education as well as the religious and ethnic barriers to accessible personal protective equipment. Principles of viral emergence are discussed by a commentary that compares SARS-CoV-2 among several other emerging viral zoonoses. In addition to COVID-19, our authors analyze issues in medicine such as the political history and theory of medicine as well as animal experimentation for biomedical research. In a first for the *UMJM*, a team of medical student, resident, and faculty authors publish together. They describe a retrospective analysis of urgent care centre complaints in Winnipeg since conversion from emergency departments.

This issue is only published due to the year-long hard work of 17 committed medical students that comprise the *UMJM* team. These students review, edit, and refine each piece in collaboration with our authors multiple times over. They also draft and design this final PDF you are reading, update and maintain our website, and engage with the medical community on Facebook and Twitter. As well, the *UMJM* is fully peer reviewed by our faculty reviewers. Without these generous donations of time and energy by faculty members at the University of Manitoba, the *UMJM* would not be possible. We would also like to extend our thanks to the inimitable Dr. William Libich, who has supervised the *UMJM* for all five of its publications, as well as the office of Dean Brian Postl for funding this project.

On a personal note, this is our last issue as editors for the *UMJM*. We have been with the team since September 2018. It has been an absolute pleasure to review our authors' manuscripts over the years. It has also been our privilege to collaborate with some of the brightest and hardest-working medical students here at the University of Manitoba. We have learned a great deal not just through the medical knowledge imparted to us by our authors, but also through the teamwork and support offered to us by our peers and faculty members alike. The *UMJM* is truly a community effort.

On behalf of the entire *UMJM* team, our authors, and reviewers, we hope that you enjoy this issue.

Sincerely,

Lindsay Bristow & Eagan Peters

Co-Editors-In-Chief

Letter to the editor in response to: "Research as a University of Manitoba medical student: a crash course"

Anthony Wightman BA (Hons), BSc[†]

Keywords: critical literacy; research; pre-clerkship; non-traditional

Conflict of Interest Statement: None to declare.

I enjoyed Lourens Jacobs' and Janessa Siemens' piece "Research as a University of Manitoba medical student: a crash course". It lists strong reasons for why and how students can get involved in research at the University of Manitoba. I think it is also important to discuss the issues that imperil research and make it less accessible. These relate to the goals of research, the ability to conduct research, and who conducts research.

"Research as a University of Manitoba medical student" concludes by stating that "involvement in research is likely quite beneficial to the general education of an undergraduate medical student," which is true.[1] It is also true that, as the Canadian Resident Matching Service (CaRMS) process becomes more competitive, many medical students pursue research due to its presumed necessity for matching success, especially in competitive fields with limited clinical exposure.[2,3] Increasing research engagement may intensify competition for spots, imperiling opportunities for students who are initially unsure about specialties, or who come from non-science backgrounds.

Jacobs and Siemens raise a strong point, that "it is important for medical students to be able to think critically," whether students conduct research for their own education or to increase their CaRMS competitiveness.[1] It is difficult to learn critical literacy in an accelerated environment with little experience. This is a subject that medical schools "hardly teach" and it decreases as students move through medical school.[4,5] When students who conduct research intend to gather data, write, present, and publish in two years, their ability to critically evaluate data is tested. This is compounded by the frequentist approach to statistical inference, in addition to publication bias, both of which can reduce studies' reproducibility.[4,6] To address this, pre-clerkship committees should assess the effectiveness and accessibility of current research literacy courses for medical students. The Department of Psychiatry's Research Summer School is an example of one such course at the University of Manitoba.

Differences in critical research skills may be compounded by changing pre-medical student demographics. Medical schools are becoming more accessible to non-science students and students from underrepresented backgrounds as seats are allotted and prerequisites are removed.[7] Jacobs and Siemens note that "the Scholarly Activities and Research Experience section of the Canadian Residency Matching System (CaRMS) residency application [considers] paid or unpaid work", and that students can raise questions with "physicians they already know."[1] However, many underrepresented students come from socioeconomically vulnerable backgrounds. It is therefore harder for them to gain unpaid research experience prior to medical school when they may not know many medical doctors and may have to financially support themselves.[8] It may also be more challenging for these students to conduct research in their medical school years due to financial and social constraints, such as supporting family members or working in addition to school.

Research is beneficial for medical students, whether for their own education or to increase competitiveness for residency. All students deserve this opportunity and should be encouraged to do research while being supported to develop their critical literacy. Students from non-science and underrepresented backgrounds should be intentionally supported so that they can take advantage of the opportunity that research provides.

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Perspectives and challenges in the race to develop a COVID-19 vaccine: An interview with Dr. R. Scott McClelland

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Abstract

Since the declaration of the COVID-19 pandemic, several vaccine candidates have entered development and received emergency authorizations. These include vaccines from companies such as Pfizer, Moderna, and AstraZeneca. Other promising vaccine candidates currently under investigation include Novavax and Sanofi. The rapid pace of vaccine development has provoked many questions concerning vaccine efficacy, logistics of distribution, and maintenance of safety standards. In the attempt to address these concerns, Dr. Scott McClelland, a principal investigator of the Novavax clinical trial, is interviewed. The resulting discussion explores his insight on the development of vaccines during the COVID-19 pandemic and their impact on future vaccine advances. Perspectives on vaccine distribution in low-income countries is also highlighted. The interview concludes by reviewing vaccine distribution strategies moving forward in the pandemic.

Keywords: COVID-19, vaccine development, global health

Conflict of Interest Statement: None to declare.

Introduction

Dr. R. Scott McClelland MD, MPH is Professor of Medicine (Allergy and Infectious Diseases), in the Department of Epidemiology and Global Health at the University of Washington. He is also the clinical attending physician of Internal Medicine and Infectious Diseases Consult services at Harborview Medical Center in Seattle. Dr. Scott's research and academic career spans over three decades. His expertise is in women's reproductive health, with a focus on vaginal infections, sexually ransmitted infections, and human immunodeficiency virus (HIV). Since 1998, he has conducted research in Kenya, leading multiple large-scale National Institutes of Health (NIH)-supported studies. These include six clinical trials as well as numerous epidemiological studies addressing risk factors for HIV acquisition and transmission in women. Dr. Scott has published over 200 peer-reviewed manuscripts and has contributed to in several book chapters on sexually transmitted infections and HIV. His expertise has seen him serve in the working group for the Centers for Disease Control and Prevention STIs Treatment Guidelines for trichomoniasis. Dr. Scott has also served as a member of several Divisions of AIDS/ National Institutes of Health collaborations. Currently, Dr. Scott is the principal investigator for the University of Washington Vaccine and Treatment Evaluation Unit site implementing the Novavax COVID-19 Phase III vaccine trial. This randomized, placebo-controlled trial will enroll approximately 30 000 participants at approximately 115 sites in the United States and Mexico. It will evaluate the safety and efficacy of NVX-CoV2373, a vaccine candidate developed by Novavax, Inc.

The following interview was conducted on January 15, 2021. It has been lightly edited for clarity and length.

In your research career, you have been involved in many clinical studies that relate to infectious diseases. During this pandemic you led the Novavax COVID-19 vaccine trial. Can you share with us about how this experience compares to your past work in infectious diseases?

"As you know, my career has largely been around infectious diseases as they relate to women's reproductive health, which includes HIV susceptibility, sexually transmitted infections, and preterm births. This is different content-wise since it is a respiratory virus prevention trial. I will say, for similarities, I have been involved in prevention research virtually my entire ca-

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reer – so that is familiar.

The speed of preparation for these trials and the of size of what we are trying to do are different from things that I have done in the past. I think, scientifically, these trials are not cutting corners. Instead, everybody is working 16 hours a day, seven days a week to make things go faster than they do normally. I think one of the major differences between vaccine development on a traditional time scale, which would be 10 or 15 years for most vaccine candidates, is that the steps are being overlapped so that phase I, phase II, and phase III trials are overlapping to the greatest extent that is allowable. The size of the trial is also driven by the need to get answers quickly. With more people, end points are accrued more rapidly, providing more rapid answers about whether these vaccines are safe and efficacious."

Given the great progress that has been accomplished in the development of vaccines against COVID-19, how do you think these advances will affect future development of vaccines and treatments for infectious diseases?

"I'm uncertain of the answer. One of the things I would say with greater certainty is that in the setting of another pandemic or epidemic, these efforts have set a new standard for being able to do exceptionally strong science to develop, test, and roll out vaccines on a pace that was not really considered to be possible prior to this [pandemic].

I don't know how that's going to impact other non-emergent vaccine or drug development efforts in the future. I think there are lot of added costs to doing things at this pace. You do it [vaccine development] fast and sort of spend what money you need to get it done quickly and done right. But that's sometimes more expensive than if we had a little bit more time to work with. Another huge thing to consider is that these vaccines initially seek emergency-use authorization in the United States and similar sorts of authorization in the European Union, United Kingdom, etc. And that makes sense in a pandemic. What an emergency-use authorization says, is that based on the available evidence, the benefits of using the vaccine appear to outweigh the risks. When you've got up to 4000 people in the United States dying of COVID-19 every day, that makes sense.

However, emergency-use authorization is not the norm for development of most drugs. Full approval won't be granted for vaccines until they have at least two years of safety data. So, if you are developing a vaccine for gonorrhea or chlamydia, there would be no reason to push quite this fast. You would be more methodical, and you wouldn't seek an emergency-use authorization (EUA) to get a vaccine out for chlamydia. The food and drug administration would say, 'Let's wait for another two years of data and make sure we are comfortable with it.'

So just to recap: I think it has shown just what is possible in a pandemic and where things can be accelerated (some of which will make sense and others won't make sense for more traditional types of work). There are some barriers, like the fact that normal drugs or vaccine development would have to seek full approval rather than an EUA. This would mean you wouldn't see new drugs get turned out in less than a year. It will be much closer to the old timeline for most things."

This pandemic has disproportionately affected poor and vulnerable communities around the world. How do you go about making COVID-19 vaccines more affordable and accessible for these groups?

"I think the biggest global effort for this is called COVID-19 Vaccines Global Access (COVAX). This is a consortium of countries that signed onto a World Health Organization-led effort to help countries access [COVID-19] vaccines and make these vaccines available at the lowest prices possible. That is certainly one element of it. However, that alone doesn't create any vaccines. They still need to compete to get vaccines. I have heard calls for wealthy countries to make 10% of the vaccines that they produce available for use in low and middle-income countries. I don't know the details of how that would be done, which isn't to say that I don't think it can be done. I do think that, looking at the big picture, countries should recognize both from an equity and humanitarian perspective that this is an important thing to do and that we won't end the pandemic until it's ended globally. So, the idea that 10% of vaccines should go through either COVAX or bilateral partnerships directed to low and middle-income countries is a great idea.

Finally, I think the best evidence in the world right now for vaccine efficacy is that from Pfizer, Moderna, and possibly AstraZeneca. There is a need for more different vaccines that are shown to be safe and efficacious because it creates more pipelines to generate additional vaccines. I also think that, with the mRNA vaccines, there are going be concentric circles of increasing difficulties to reach out to remote and rural locations. Vaccines that can use the existing infrastructures and systems to reach out to people will be a real strength. The important point about adenovirus vector vaccines and the protein and adjuvant vaccines [like AstraZeneca, Janssen, Novavax, and Sanofi] is that they are stored at refrigerator temperature, which means we could use more traditional vaccine pipelines to get it out to people. Whereas, the mRNA vaccines need to be in ultra-cold temperatures most of the time."

One of the major strategies for vaccine distribution is the notion that public health could vaccinate as many people as possible with the first dose and then worry about the second dose as vaccine supplies re-fill. What are your thoughts about this strategy?

"Interestingly, Dr. Anna Wald, who is the co-principal investigator with me for our Vaccine and Treatment Evaluation Unit, published one of the pa-

pers suggesting that maybe we should give everyone one dose [of the vaccine]. I think that there are two different ways of looking at that question and it's important to keep them separate. One way is: do you rush out the first doses, not knowing exactly when the second dose is available, but with the intent of getting a second dose into people on the recommended timelines? (This would be four weeks later for the Moderna vaccine and three weeks later for the Pfizer vaccine). Or, do you just give everybody one dose of the vaccine and worry about the other vaccine dose later?

I fully favor getting the vaccine that we have out and trusting that the supply will come in to be able to give people a second dose of vaccine. I am uncomfortable with the idea of taking a huge evidence-based intervention like this, for which we generated good safety and efficacy data for two doses, and then using it in practice differently from the way it was tested. I worry in particular about the durability of protection. If we end up vaccinating people, but there is a short durability of protection, that's not going to do us a lot of good. We really don't know how long they [vaccine protection] last yet. So that's kind of where I come down while acknowledging there are people who do not completely agree."

Acknowledgements

Thank you to the organizers of the International Infectious Disease and Global Health training program at the University of Manitoba for providing us with the opportunity to learn from each other and from world-renowned scientists in the field of Global Health & Infectious Diseases.

Lessons for the next pandemic from COVID-19 and other emerging viral zoonoses

Graham Casey MSc[†]

Abstract

SARS-CoV-2 is a novel coronavirus that emerged rapidly and caused devastating effects worldwide. Understanding principles of virus emergence is necessary to adequately prepare for future pandemics. It is also important to understand and appreciate public health and human behavioural responses to outbreaks. Examining specific emerging zoonotic viruses can provide insight into general trends in viral emergence. In this narrative review, three emerging viruses and one potentially emerging human virus are discussed with comparisons to the ongoing SARS-CoV-2 pandemic. Their emergence is framed within a five-stage model for emerging infectious diseases described previously. Ebola virus, Nipah virus, monkeypox virus, and canine distemper virus are used as examples of emerging and potentially emerging viral zoonoses. These viruses are described in order to develop a better understanding of the breadth of existing emerging viruses, the means by which they emerge into human populations, and of how human behaviour shapes the course of their emergence.

Keywords: viral emergence, zoonoses, ebolavirus, henipaviruses, poxviruses

Conflict of Interest Statement: None to declare.

Introduction

The current COVID-19 pandemic shows what damage an emerging virus can cause. SARS-CoV-2 is currently hypothesized to have been introduced into humans from an animal source (likely bats) in late 2019. The first cases appeared to cluster in Wuhan, China but quickly spread worldwide.[1–3] Along with questions about the origins of SARS-CoV-2 come questions about what other viruses circulate in animals ready for the right conditions to spark the next pandemic.

There exists a five-stage model for emerging infectious diseases initially described by Wolfe et al.[4] with important modifications from Lloyd-Smith et al.[5] It describes the stages of emergence of a zoonotic pathogen from an exclusively animal pathogen (stage I) to an exclusively human pathogen (stage V), with diseases that are transmitted from animals to humans (referred to as zoonoses) representing stages II to IV (Table 1). In this narrative review, a selection of emerging viral pathogens will be discussed using the framework of this five-stage model. Discussion of these emerging viral pathogens will be used to illustrate factors that modulate the progression of a virus from causing an animal disease to a disease with pandemic potential. Connections will then be made to the story of SARS-CoV-2.

There are many emerging viruses with important aspects worth discussing, but only a few will be discussed in this review. Ebola virus is a stage IV pathogen that provides a strong example of the transition from causing an animal viral disease to a human viral disease. It also demonstrates how human behaviour, largely motivated by fear and distrust, shapes pandemics. The two strains of Nipah virus demonstrate the distinction between a stage II and stage III emerging virus. They also show how the context of the emergence of a virus is influenced by human-animal interfaces, politics, and cultural practices. Disease X is discussed to highlight that the next pandemic could be caused by a virus that is unexpected or undiscovered. The two viruses chosen to represent Disease X (monkeypox virus and canine distemper virus) were chosen for their relevance to the discussion of the "species barrier," consequences of viruses with broad host ranges, and difficulties predicting the cause of the next pandemic.

Ebola virus

Ebolavirus is a genus in the family *Filoviridae* containing several viruses including Ebola virus (EBOV, species *Zaire ebolavirus*), the causative agent of Ebola virus disease (EVD). EBOV was first discovered in the

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Democratic Republic of the Congo (DRC), formerly Zaire, in 1976.[6] To date, there have been 21 known outbreaks of EVD.[7–9] The largest outbreak was the 2013-2016 West Africa Ebola epidemic, with 28 646 suspected cases and 11 310 deaths.[6] The end of the epidemic in 2016 was not the end of EBOV. There have been seven more outbreaks of EVD since, including two EVD outbreaks in 2021 in the DRC and Guinea.[8]

EBOV is a zoonotic virus. Initially regarded as a hemorrhagic fever virus, this definition was reconsidered when the predominant manifestation of EVD in the West African EVD epidemic was severe gastroenteritis and multiorgan failure, with rare cases of bleeding described.[6] The animal reservoir is not definitively known but is suspected to be African fruit bats.[6] Historically, each outbreak appeared to involve contact with tissues or secretion of infected or dead wildlife.[6] EBOV is considered to be highly infectious, requiring small doses of virus to cause disease.[10,11] The human-to-human transmission occurs via direct contact with bodily fluids of infected individuals (including blood, vomitus, diarrhea, urine, saliva, breast milk, semen, and potentially sweat). Individuals in contact with infectious fluids can become infected if the virus contacts oral, conjunctival, or respiratory mucosa, or breaks in the skin.[10,11] Recently, more attention is being given to the long-term persistence of EBOV in the semen of EVD survivors and sexual transmission of EBOV.[12]

During the West African EVD epidemic, it became clear that EBOV should be considered a stage IV emerging pathogen. While it is suspected that the epidemic still started with an animal-to-human transmission event, EBOV was capable of sustained secondary transmission between humans.[13,14] Concerningly, the three most recent outbreaks (DRC 2020, Guinea 2021, and DRC 2021) are thought to have originated from long-term persistence of EBOV in EVD survivors from previous outbreaks rather than from contact with an animal source.[8,12,15] This indicates a potential mechanism by which EBOV could circulate in human populations without first being introduced by animals. Such a mechanism stands in contrast to previous EVD outbreaks wherein human-to-human transmission occurred but outbreaks were thought to originate from animal sources and secondary transmission was apparently self-limited (i.e. a stage III pathogen).[6]

In the West African EVD epidemic, significant EBOV transmission from the still-infectious bodies of EVD victims occurred during funerary and burial rites. When this was determined, the World Health Organization (WHO) made recommendations that heavily restricted traditional burial practices.[16] Rituals varied, but commonly involved washing and spending time with the body.[16,17] The WHO's recommendations were traumatizing to many cultures and were met with resistance due to the significant alteration to their core way of life and the distressing imposition by a foreign authority on traditional cultural practices.[16,17]

Public health responses to global threats must take care to be culturally sensitive. Otherwise, they may be met with significant resistance. This has been seen locally during the SARS-CoV-2 pandemic in the vocal opposition to pandemic restrictions on religious gatherings in Manitoba. For example, these restrictions were met with noncompliance in the form of the Steinbach protests.[18,19] The effects of culture on health behaviours in a pandemic can be seen on a broader scale in the differential adherence to public health policies according to political ideology[20] and in the differences in the policies themselves.[21,22]

The impositions on local culture in the West African EVD epidemic contributed to the already substantial fear permeating the outbreak. Descriptions of EVD were terrifying. The alien-like personal protective equipment, healthcare workers falling sick, and stories of loved ones disappearing into Ebola treatment units (ETUs) only to be returned dead all contributed to the spread of fear. This fear fueled the spread of EBOV.[17] People hid when sick or insisted on caring for loved ones at home. They fled from EVD-stricken areas, bringing virus with them. Contingents of healthcare workers stepped down from their roles in the face of EVD.[17]

In the Kivu 2018 outbreak, such fear and foreign imposition coalesced into violence. Wells et al.[23] describe "rumors about foreigners experimenting on locals, taking organs, and filling the bodies with concrete and Ebola being a fabrication" among locals in the Katwa health region that preceded a violent riot at a nearby ETU.[23] An important lesson from the EVD outbreak is the impact that fear can have on the evolution of an outbreak. Similar examples from the ongoing SARS-CoV-2 pandemic have been observed. These include the avoidance of necessary healthcare for fear of acquiring COVID-19[24] as well as the psychological toll on healthcare workers,[25] patients,[26] and public following isolation guidelines.[27]

Nipah virus

Nipah virus (NiV) is an emerging zoonotic paramyxovirus in the genus *Henipavirus* consisting of 2 strains: NiV-Malaysia (NiV-M) and NiV-Bangladesh (NiV-B). They are named after the locations where they first emerged. Both NiV-M and NiV-B cause a high-mortality severe encephalitis and respiratory syndrome in infected humans.[28,29] The reservoir host for both strains of NiV is fruit bat genus *Pteropus*.[30] NiV-M and NiV-B have been largely epidemiologically distinct, and so they will be discussed separately from each other.

Nipah-Malaysia

The first outbreak of NiV in 1998-1999 was the only outbreak of NiV-M. It resulted from the transmission of NiV-M from Pteropid bats to pigs, and then from infected pigs to the humans.[31] Unlike in humans, NiV-M was easily transmitted between pigs, had a low case-fatality rate, and often produced no or mild clinical signs.[31] Pigs functioned as excellent amplifying hosts for NiV-M, greatly expanding the interface for expo-

sure in humans. NiV-M was transmitted from infected pigs to humans mainly through close contact during routine pig farming procedures (such as piglet processing, assisting in birthing, or preparation for slaughter). This exposed people working with live pigs to aerosolized droplets from respiratory and oronasal secretions of the pigs.[32–35] In this outbreak, all human cases of the disease were traced to infected pigs. There was no definitive proof of human-to-human transmission, making NiV-M a stage II zoonosis.[36]

The emergence of NiV-M was a result of co-agricultural practices that kept mango orchards and pig herds on the same land with no barrier between them. NiV-M-carrying Pteropid bats fed from fruit trees overhanging pigsties. They occasionally dropped virus-contaminated fruit (with bat urine or saliva) into the sties for pigs to sniff, consume, and become infected.[37–40] Evidence suggests that the emergence of NiV-M into pigs had been ongoing for several years. The outbreak in 1998-1999 was made possible by the pattern of repeated bat-to-pig transmission over time.[38,41] Each NiV-M introduction into pigs caused mini-epidemics in pig herds that quickly spread through the population. Agricultural practices of keeping sows long-term while selling young pigs early prevented herds from developing total immunity to NiV-M infection by ensuring a rapid turnover of susceptible hosts. Paradoxically, the state of partial immunity to NiV-M allowed epidemics to burn for longer and spread more widely than in a wholly NiV-naïve population. This occurred until NiV-M ultimately exceeded a threshold in pig herds that resulted in spillover into humans.[38,41] Prevention of future similar outbreaks requires rigorous surveillance as well as rethinking how to avoid agricultural practices that increase the risk of exposure to, and adaptation of, novel viruses.

Many human social and political factors also influenced the course of the NiV-M outbreak. Malaysian pig farmers engaged in the practice of "fire sales", or panic selling in the face of a disease outbreak. This contributed to the spread of NiV-M infections throughout Malaysia and into Singapore.[38] The outbreak was at first mistaken for an outbreak of Japanese encephalitis virus (a vaccine-preventable, mosquito-borne virus). This resulted in the Malaysian government ineffectively responding with JEV vaccinations and anti-mosquito fogging.[42] Even short delays in the recognition of an emerging pathogen can have devastating consequences. Indeed, there are many accusations of various countries' slow, surprised response to SARS-CoV-2[43] and of poor information-sharing early in the outbreak.[44–48] The 1998-1999 NiV-M outbreak was eventually controlled by the culling of over a million pigs in Malaysia.[32] No confirmed human infections of NiV-M have been observed since.

Nipah-Bangladesh

All subsequent NiV outbreaks have involved NiV-B, occurred in Bangladesh or India, and have been initiated by direct transmission of the virus from Pteropid bats to people. This cross-species transmission of NiV-B has commonly been mediated by human consumption of raw date palm sap, which is harvested from open containers hanging in trees available to bats.[29,36] Multiple small outbreaks of NiV-B have occurred since 2001 in a similar pattern to the outbreaks of EBOV between its 1976 discovery and the 2013-2016 West Africa outbreak. This pattern is referred to as stuttering transmission, describing the outbreak pattern of an emerging virus that is capable of self-limited (i.e. not indefinite) human-to-human transmission. Stuttering transmission can represent an important phase in the adaptation of a virus into a new host.[49]

Like what was observed with EBOV, some cultural practices in Bangladesh contributed to NiV-B outbreaks. Boiling date palm sap before consumption could have prevented many index infections. However, consuming raw date palm sap is important to Bengali culture and the risk of infection is low overall. As such, this behaviour is difficult to modify.[50] Striking a balance between safe, long-term behaviour change versus disrupting culturally-important behaviours is a complicated task in global health. Discussion with affected communities is critical in order to develop effective interventions. For NiV-B, simply using bamboo skirts on date palm sap containers can effectively reduce bat contamination of sap while requiring little behaviour change or invasive demands.[51–53] For SARS-CoV-2, an analogy may be made to calls to shut down wet markets in China.[54–56] Although the calls appear as a promising pandemic prevention strategy, they oversimplify the complex issue of intersecting cultural traditions and socioeconomic forces. An approach to emerging infectious diseases must account for these complexities. Obtaining cooperation requires working with affected parties as opposed to dictating to them.[57,58]

NiV-B saw fewer instances of animal-to-human transmission than NiV-M. Unlike NiV-M, NiV-B outbreaks have involved multiple instances of human-to-human transmission. This makes NiV-B a stage III zoonosis.[36,59] Human-to-human NiV-B transmission risk factors include close contact (e.g. touching a patient or their secretions, or being near them when they cough) and aerosolizing procedures in the absence of proper personal protective equipment.[36]

A cultural norm in Bangladeshi healthcare is for family members to provide significant hands-on care and close physical comfort to the sick, especially near the time of death.[60] In severe illness, family members are described as cradling their loved one's head in their laps, attempting to spoon-feed them, or hugging and kissing them.[36,60] Family in Bangladesh perform much of the hands-on care in-hospital.[60] Cruelly, transmission of NiV-B in this cultural context of compassionate care results in infection of people who are at the same time loved ones and healthcare providers. These cultural practices also contributed to some superspreading events where a single infected individual transmits the disease to an unusually high number of people. In one

case, an important religious figure was ill with NiV-B and transmitted the virus to 22 devotees who had come to perform ceremonial rites for him in his illness.[36] Superspreading has also been described for SARS-CoV-2 and may inform public health responses by targeting them towards certain behaviours.[61] Similar to what was seen with the 2013–2016 West Africa Ebola outbreak, cases of NiV-B have also been attributed to burial practices.[36,62] Pandemics force societies to address what they can sacrifice, such as conceptions of good healthcare or a good death. For the purposes of the current pandemic, healthcare bodies must therefore consider the number of people who have and will die alone in hospitals to prevent the spread of COVID-19.[63]

Disease X

The WHO's list of priority pathogens for research and development in emergency contexts has included "Disease X" since 2016.[64–66] Disease X refers to a pathogen that is not yet known but could have large impacts on human health. SARS-CoV-2 is a strong example of this. Including Disease X on the list of priority pathogens is important because the viruses of which we do not know outnumber the ones that we do know. Therefore, the next pandemic virus could easily be drawn from the vast pool of undiscovered virus species.[67–69] It is difficult to study or review viral pathogens that are unknown. Consequently, there is significant interest in determining exactly what changes in a virus may allow it to cross the species barrier, increase its virulence, or increase transmissibility.

Monkeypox virus

Monkeypox virus (MPXV) is a zoonotic virus in the genus *Orthopoxvirus* that is related to the now-eradicated variola virus (VARV), the causative agent of smallpox. MPXV causes a disease similar to smallpox that is not as deadly. Most cases occur in the DRC[70,71]. MPXV has been a growing concern since the cessation of routine smallpox vaccination, which historically provided some cross-protection to all orthopoxviruses.[70] Transmission of MPXV between humans occurs with relatively low efficiency and usually by the respiratory route. MPXV can also infect through mucosal surfaces and breaches in the skin.[72,73] The low-efficiency transmission makes MPXV a stage III emerging virus as it cannot sustain human-to-human transmission indefinitely.[70] Similar to NiV-B and early EBOV, MPXV appears to be in the stuttering transmission phase of emergence. Its transmission efficiency may also be increasing.[71,74,75] Vaccines against MPXV are being developed for use in the DRC to specifically prevent MPXV infections.[76] However, with an existing animal reservoir, it is unlikely that MPXV could be eradicated.

Despite its name, MPXV's natural reservoir is suspected to be an ecologically complex group of small terrestrial mammals prevalent in forest margins and peridomestic zones near human habitations. Monkeys, like humans, are incidentally infected.[75] MPXV's broad host range indicates it might be more tolerant to interspecific host variations and thus amenable to adaptation in humans.[77] While it is not true that all viruses with broad host ranges are dangerous to humans, many emerging viruses (including NiV, EBOV, and SARS-CoV-2) have broad host ranges.[78–80] Additionally, MPXV can infect monkeys, which may give it an advantage to emergence into humans. This is because it already infects a species that is (relatively) genetically similar.[71] Genetic relatedness of animal reservoir species is not a foolproof method of identifying emerging virus threats, but it can help narrow the field of likely animal sources of emerging viruses. For example, a paper published in January 2020 suggested that snakes might be the source of SARS-CoV-2.[81] This has since been discounted, but even in the uncertainty of the early COVID-19 pandemic, the vast species differences between humans and reptiles were a plausible reason to consider this hypothesis unlikely.[82]

Canine distemper virus

Another example of a candidate "Disease X" is canine distemper virus (CDV). CDV is a virus in the genus *Morbillivirus*, family *Paramyxoviridae*, which also contains measles virus (MeV; a stage V pathogen, only infecting humans). CDV has a broad host range including canines (the primary host), large cats, ferrets, seals, and Macaca primates. Transmission of CDV between animal hosts is thought to be by production and inhalation of infectious aerosols.[83] It is highly contagious in many hosts and in some it is highly lethal (with case fatality rate as high as 90%).[84,85] Currently, CDV is a stage I pathogen with no reported human cases. However, evidence has been found that circulating strains of CDV could be as little as one amino acid change away from efficient infection of human cells.[86,87]

Fortunately, similar to MPXV before smallpox eradication, CDV emergence into humans may currently be prevented by cross-protective immunity from MeV vaccinations.[88] Even without pre-existing heterologous immunity from MeV vaccines, there are far more barriers to interspecies transmission than just viral entry. It may therefore be presumptuous to offer that a single amino acid change on the CDV receptor is sufficient for transmission to and between humans.[89]

Nevertheless, there are many reasons for concern about a virus such as CDV. The broad host range of CDV suggests that it could quickly adapt to human hosts.[77] Humans have a large interface with CDV-susceptible animals, particularly domestic dogs.[85] Outbreaks of zoonotic viruses do not bode well for the affected humans or animals. The discovery that SARS-CoV-2 could infect cats resulted in public health recommendations for protecting both household pets and pet owners,[90] but these did not stop people from abandoning or killing housecats.[80,91,92] Zoonotic viruses affecting agricultural animals are usually controlled by

large culls,[32,93,94] as was recently demonstrated with SARS-CoV-2 and mink farms in the Netherlands and Denmark.[95,96] Such control methods come at a significant cost to the relevant economies and the psychological wellbeing of the farmers and cullers involved.[97–99] A virus with a broad host range is a threat to more than just human health.

Of course, CDV may never cause a human case. However, the above concerns about CDV have all been realized in some way by SARS-CoV-2 and other emerging viruses. What are the chances that CDV is the only virus that is a few mutations away from infecting humans? In contrast to the lengthy stuttering transmission phases of NiV-B and EBOV, SARS-CoV-2 has demonstrated that an unknown virus can emerge into a worldwide pandemic within months.

It is at the boundary of the unknown viruses – Disease X – where predictions become difficult.[100] Similar arguments to CDV could be made for any number of pathogens.[88,101] By attempting to identify exact viral agents, researchers are forced to select from the known viruses and fall prey to publication bias and the availability heuristic. There are many unknown viruses.[67–69] How do we protect ourselves from so much unknown?

Conclusions

There exists an unnerving task: to prepare for future pandemics without knowing what will cause them. A multifaceted approach is required. Research should focus on strategies for pandemic prevention and preparedness that can be broadly effective for classes of viruses. Clear communication of rigorous research between scientists, governments, public health offices, healthcare providers, and citizens is imperative. Social and public health strategies should focus on basic infection prevention and control strategies that are easily deployed, such as barrier precautions, masks, and hand hygiene. The interfaces between human populations, domestic animals, and wildlife should be carefully observed so that signs of emerging threats or spillover can be addressed. Environmental stewardship, responsible agriculture, and ethical interactions with wildlife should be practiced.

Human behaviour drives pandemics. Past outbreaks and epidemics can help us to understand human behaviour in the COVID-19 pandemic and hopefully to understand the rationale behind public and global health responses. The emergence of SARS-CoV-2 has afforded us our reluctant opportunity to reflect on a situation that less than two years ago was science fiction. How have I acted in this pandemic? What should I be doing to prevent or survive the next one? What are we ready and able to sacrifice? Hopefully, with all that has been learned up to and throughout the COVID-19 pandemic, the world is a small step farther away from the next one.

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Gross anatomy laboratory education: The importance of cadaveric dissection in medical school during the COVID-19 pandemic

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Abstract

The role of cadaveric dissection for medical education has been subject to scrutiny in recent years. Questions around its effectiveness compared to other modalities for gross anatomy education were further potentiated by the COVID-19 pandemic. The objective of this commentary is to describe the ongoing importance of cadaveric dissection for medical education. A brief history of gross anatomy education is described as well as the contemporary approaches to anatomy education for medical learners. The current role of cadaveric dissection as a unique and effective resource for learning is examined in comparison to other modalities. Anatomical instruction at the University of Manitoba Max Rady College of Medicine is used as an example to discuss gross anatomy education before and after the onset of the COVID-19 pandemic. Adaptations made because of the pandemic, and considerations therein, are explored based on discussions with current anatomy laboratory instructors at the University of Manitoba. Overall, cadaveric dissection is demonstrated to be a valuable learning tool for early-years medical students and continues to be safely incorporated into coursework in the context of a pandemic. Expanding the availability of gross anatomy education for senior-years medical students, as well as postgraduate medical education, should be strongly considered.

Keywords: medical education, cadaver, dissection, COVID-19

Conflict of Interest Statement: None to declare.

Introduction

In December 2019, cases of an unknown viral pneumonia cases were in Wuhan, China.[1,2] This virus was later identified as a novel strain of coronavirus.[3] By March 11, 2020, the World Health Organization (WHO) declared the COVID-19 outbreak as a pandemic.[4] Given the circumstances, prevention strategies were, and still remain, a mainstay approach to manage the pathogen until mass immunization could be achieved.[5] Social distancing became one of the foremost prevention methods around the world.[6] On March 23, 2020, the province of Manitoba declared the closure of all universities and schools.[7] Similar closures of medical schools around the globe resulted in a massive shift in medical education, with significant impacts on teaching gross anatomy.[8,9]

Gross Anatomy at the University of Manitoba prior to the pandemic

Anatomy laboratories ("labs") in the University of Manitoba Max Rady College of Medicine Undergraduate Medical Education (UGME) program are predominantly a first-year endeavour taught in conjunction with lectures and adjunct note packages. In pre-pandemic times, labs and relevant lectures are held in-person. Students are separated into groups, and each group conducts dissections on a given body donor (a person who donated their body to medical science after they were deceased). Groups dissect body donors to completion by the end of the academic year in parallel with their modular coursework. Labs comprise of dissections, as well as a combination of prosection and electronic resources (such as relevant radiological imaging and note packages). During certain modules, groups rotate through multiple stations presenting a different aspect of anatomy under guided teaching by a preceptor, each with a separate body donor. Given the intensive nature of medical school training and faculty commitments respectively, guided time in labs can understandably be limited. However, access to labs is made available outside of class hours for students' independent learning. Unfortunately, the COVID-19 pandemic forced educators, both within and outside of medicine,[10] to adapt by cancelling in-person labs and/or restricting student access.[11] This resulted in the

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anatomy labs at the University of Manitoba, and many others across the world,[12] to focus on ways to adapt to the corresponding shift to online learning.

Gross Anatomy through the ages: Its history and importance

A thorough understanding of human anatomy is integral to medical education. Medicine is grounded in its physiological and pathological underpinnings, both of which are related to human anatomy. As such, anatomical education allows medical students to understand the link between function, structure, and the relation to disease process. Cadaveric dissection has long been a gold standard instructional method in medical school.[13] Indeed, centuries of history describing cadaveric dissection pedate even the United Kingdom's Anatomy Act of 1832 and the Murder Act of 1752, demonstrating that cadaveric recruitment and dissection are long-embedded within medical education.[14] Both of these acts legitimized the medical supply of human cadavers via legislature in one form or another. For example, the Murder Act stated that the bodies of criminals were to be given to the Surgeon's Hall in London for dissection and education. Nowadays, schools have instead developed ethically-rigorous standards for body donation that allow for the continued dissection of body donors for the purposes of medical learning.[15] Nevertheless, the development of this modern ethical framework is rooted even further back in time, stemming from a legendary professor, Galen of Pergamon, and a curious student, Andreas Vesalius.

In the almost 1500-year gap between the time of Galen and Versalius respectively, the culture surrounding medicine changed immensely. While Galen was limited by access only to animal dissections for education, Vesalius was able to use human cadavers.[16] Though Galen is commonly hailed as the founder of physiology and one of the most celebrated anatomists in history, Vesalius is specifically said to be the "father of modern human anatomy".[17] The revolutionary progression of anatomical knowledge illustrated by their research established that, if limited to books and animal dissection, understanding of the human body was inaccurate.[18] The modern debate however is no longer between animal versus human dissection, but rather between human dissection versus none whatsoever. Whether or not body donation is needed in current medical education is a highly-debated subject.[19] In contrast to the times of Galen and Vesalius, modern-day medical schools have access to technology that can act as a substitute to deceased animals and body donors.

Although new equipment may increase the number of modalities through which to teach anatomy, some physicians still believe that cadaveric teaching is an important element of medical curricula.[20] However, many physicians contend that it is possible to practice their current specialty without learning human anatomy via adaveric dissection.[20] Assuming goal-directed learning towards evidence-based medicine, if the intervention (i.e. cadaveric learning) does not alter the outcome compared to non-cadaveric learning, the benefit it offers would therefore be up for question. The problem with this statement is the outcome being measured. Depending on how teaching methods and subsequent learning is evaluated, assessing whether cadaveric teaching is beneficial or not may be unclear due to imprecise measurement. Most medical students do not know what specialty they will end up practicing at the end of their undergraduate education.[21] Rather, their goal through anatomy labs is to develop professionally, emotionally, and technically as future medical professionals.[22] This development is reflected by more than what is deduced from the application of semantic knowledge during bell-ringer examinations or similar assessment methods.[23–26]

Comparisons to contemporary gross anatomy

Regarding pedagogy around anatomical teaching itself, it can be argued that little has changed in the present day compared to previous centuries. In the past, most anatomical instruction occurred in-person at anatomy theatres where groups of students would learn from a teacher who would describe the human anatomy of a cadaver on display.[27,28] In the present, didactic anatomy teaching still occurs in lecture theatres and laboratories where one or more preceptors presents anatomy via a cadaver to a group of students. However, learning now also occurs via online class tutorials, video lectures, hands-on dissection,[29] and new computer software.[30] To this end, the pandemic has highlighted the importance of anatomical education, placing the spotlight on its novel technological adjuncts.[31]

Resources such as assigned study packages or three-dimensional modelling are not equal substitutes for cadaveric dissection. Yet, referring to the resources created for the past academic year at the University of Manitoba UGME anatomy labs as adjuncts would undercut their value. Medical students who used these resources during the pandemic achieved a thorough understanding of gross anatomy. The use of such packages offers a significant positive impact to students' performance and are well-received by learners.[32] However, cadaveric learning is a unique teaching resource that not only offers education on gross anatomy, but also serves to improve students' surgical,[24] communicative, and collaborative skills.[33] In Manual of Anatomy, Jacobus Sylvius noted that learning anatomy is to "learn the manner of cutting by eye and touch than by reading and listening. For reading alone never taught anyone how to sail a ship, to lead an army, nor to compound a medicine, which is done more so by the use of one's own sight and the training of one's own hands"[34]. Cadavers thus present a unique visceral experience to students that is not to be replaced by other resources, but rather supported.

The role of cadaveric dissection

In addition to the advantage it offers for developing surgical skill, the introduction of cadaveric dissection early in medical school may act as a differentiating factor concerning a student's choice between surgery and medicine-based practice.[26] At an even deeper level though, the tangible experience of cadaveric dissection elicits a response from students that does more than just direct them toward or away from surgical specialties.[35] Students go through the experience with their cadavers as one of their first "patients". This promotes their respect and appreciation for the body donor, which instills greater compassion for future living patients.[36] The process of cadaveric dissection teaches not just anatomy and surgical skill, but a fundamental sense of professionalism and humanism.[22,31,37,38]. As students progress through anatomy lab education, their perspective of the body donor may also evolve from cadaver to patient. As the encounter progressively more patients in-person, so to do they come to understand that their body donor was given to them by a once-living person who had a name, family, and life history. Indeed, the University of Manitoba holds an annual burial ceremony for the families of those that elected to participate in the body donor program. It allows students to present at this ceremony and thank the families for the contribution of their loved ones. This allows for the early development of an emotional and empathic understanding for patients in medical students.

Gross dissection afforded by body donors also offers a unique visuospatial perspective to learning that students would otherwise not obtain. Simply put, the human body has more to offer than what is offered by the sagittal, transverse, and coronal planes. In-person observation of organs and systems gives students a greater understanding of the proportion, scale, and relationship between structures. While these relationships can be emulated in three-dimensional computer-generated models of the body, those models lack reality. The human body is not perfect, and too often learning materials present them as if they were. Real people get old, have had a cholecystectomy, have atherosclerosis, break bones, develop renal cysts, etc. This reality is not necessarily encapsulated by a computer-generated model, or even corresponding pages in a medical textbook with structure and function listed. Examining multiple body donors in-person fosters an appreciation not only for the variety within "normal" human anatomy, but also for a wider understanding of numerous pathologic processes that affect normal structure and function. No other opportunity allows a student to appreciate the very texture of human tissue in order to contrast normal against abnormal, young against aged, and healthy against pathological. Cadaveric learning offers a gestalt of anatomical education that is unmatched even by combinations of other modalities.[26,39] Despite this, after March 23, 2020, the University of Manitoba UGME anatomy labs were forced to adapt their in-person gross anatomy labs to the COVID-19 pandemic.

Gross anatomy at the University of Manitoba during the pandemic

Videos, e-book readings, cadaveric images, simulation applications, online learning tools and Zoom videoconferencing were some of the resources used by the University of Manitoba's UGME anatomy labs to adapt to the pandemic. Many of these were specifically developed to facilitate anatomical learning at a distance. The resources allowed students to progress in their medical education by completing their required anatomical learning in isolation without cadavers. Given that students were able to learn gross anatomy during the pandemic without cadaveric dissection, does this mean that cadaveric dissection is unnecessary? Not likely. There exist no resources or accessory technologies that can fully replace the enhanced learning that students experience with real cadavers. In his book, When Breath Becomes Air, neurosurgeon Paul Kalanithi states:

> "Cadaver dissection is a medical rite of passage and a trespass on the sacrosanct, engendering a legion of feelings: from revulsion, exhilaration, nausea, frustration, and awe to, as time passes, the mere tedium of academic exercise. Everything teeters between pathos and bathos: here you are, violating society's most fundamental taboos... Eventually, as you complete your assignments by dissecting the median nerve, sawing the pelvis in half, and slicing open the heart, the bathos supersedes: the sacred violation takes on the character of your average college class... Cadavers reverse the polarity. The mannequins you pretend are real; the cadavers you pretend are fake. But that first day, you just can't." [40]

By the beginning of the 2020-2021 academic year, gross anatomy labs in the UGME program were able to adapt in-person sessions to allow for socially distanced learning. Compared to past years, first-year medical students were divided into three rather than two groups. Justifiably, this was done in order to minimize the size of the "bubbles", optimize social distancing, and reduce class contacts. However, this also meant that each group was allotted less time because the overall number of hours given to lab instructors to teach the material was unchanged. Students were also unable to visit the anatomy laboratories outside of supervised time. Limitations on time with cadavers correspondingly restricts the utility of dissection.[41] In contrast, prosection and interactive didactic teaching are of greater value for learning when time is limited.[42] Although time-consuming, dissection is still a necessary resource within an ideal multi-modal approach to anatomical education in medicine.[26,43].

Beyond academic benefits, the practice of dissection also delivers social benefits. In the context of a "Code Red" critical pandemic response, medical stu-

dents could hardly see anyone outside of their household, let alone their classmates. As a result, anatomy classes became one of, if not their only, social engagements on a day-to-day, or even week-to-week basis. Here, the relative value of group learning increases: students may favourably associate anatomy labs due to their sociality in an environment that is otherwise typically conducive to burnout.[44] Certainly, the medical community constitutes a large portion of a physician's academic and non-academic life. With extracurricular events, club meetings, classes, and clinical skills sessions cancelled due to new weekly outbreaks, the anatomy lab may represent the single reliable social outing for medical students. Hence, the gross anatomy lab has the potential to become a new community-building environment for students.

While students need the laboratory for academic learning and non-academic social benefits, the lab requires body donors to serve this purpose. The concept of body donation has long been a subject to scrutiny,[19,45,46] and therefore merits ongoing discussion, especially considering the transmissibility of a pandemic pathogen. There is still much to learn about SARS-CoV-2 and its pathogenicity. Questions around whether the virus is transmissible from the deceased to the living are allotted lower global priority compared to questions around vaccine development, transmission via fomites, etc.[47,48] However, for those who instruct and learn in anatomy labs, and whose conventional recruitment methods have been impaired due to the pandemic, these questions are important for the continuity of gross anatomy education. Typically, at the University of Manitoba, body donors can be recruited from funeral homes and hospitals with the help of emergency physician residents. There was a significant decrease in body donors over the past academic year due to the pandemic, its corresponding restrictions, and apprehension over transmissibility. This obstacle is both social and scientific: the community cannot currently answer questions about body donors acting as vectors for SARS-CoV-2 with scientific confidence.[49–51] It can neither market the body donor program for the purposes of recruitment due to dubious nature of, and ethical quandaries raised by, soliciting body donations during a pandemic that has resulted in the deaths of thousands in Canada alone.

Conclusion

The practice of cadaveric dissection was thought by some to be impossible due to the COVID-19.[52] In spite of this, the gross anatomy labs at the University of Manitoba have survived the pandemic. Not only has the program continued with dissections, but there are discussions underway to expand gross anatomy teaching using focus groups of 2nd- and 3rd-year medical students over the summer months to prepare for the upcoming academic year.[53] Expanding 4th-year gross anatomy electives and postgraduate training with the use of clinical grade cadavers is also under consideration.[54] Throughout the pandemic, the University of Manitoba UGME program demonstrated the high value of cadaveric teaching in order to provide future doctors with the necessary foundation to succeed in medicine. Medical learners' future patients are real people. This means that learning anatomy with real people, just as students do with clinical skills, is crucial. Body donors are among the first patients of young medical students. Ultimately, there are lessons beyond technical basics of gross anatomy that only a silent teacher can instill in learners.

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Putting the "personal" back in personal protective equipment

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Abstract

The COVID-19 pandemic has resulted in widespread use of personal protective equipment (PPE) among healthcare workers. However, there are challenges to using standardized PPE, especially in the context of a diversifying society. This commentary discusses religious, racial, and ethnic barriers to comfortable and safe use of PPE. The objective is to raise awareness for these challenges that will prompt considerations for possible evidence-based solutions. Challenges around finding PPE that is effective but accommodates religious symbols such as hijabs, turbans, and facial hair are discussed. This commentary also describes the negative impacts of limited PPE suitable for diverse populations. Some of the available resources for healthcare workers are explored, as well as several solutions around PPE placement, sizing, and supply. Overall, more research is required, especially given that PPE is now commonplace outside of hospitals and widely used in the public.

Keywords: personal protective equipment, diversity, religious differences, individual fit

Conflict of Interest Statement: None to declare.

Introduction

The COVID-19 pandemic has brought about many changes, one of which is the increased use of personal protective equipment (PPE) inside and outside of hospitals. PPE was once only indicated for certain patient contact precautions, such as methicillin-resistant *S. aureus* and tuberculosis among others. It is now commonplace in family practices and on hospital wards as a precaution against COVID-19. PPE in its various forms has also become a symbol of the COVID-19 pandemic. Shared Health Manitoba has made available evidence-based guidelines for the proper use of PPE in healthcare settings.[1] These requirements help ensure that PPE will fit individuals snugly, whether on the head or on the face. However, manufacturing PPE in mass amounts is challenging. Hospitals carry several different sizes of PPE to accommodate differences in healthcare providers' size,[2] but this neglects other factors that differ between healthcare providers. These include cultural and religious differences that make it challenging for healthcare workers to wear PPE not specifically designed for them. Turbans, hijabs, and facial hair are all examples of common religious symbols in diverse communities which cannot always be accommodated by PPE currently available in our healthcare systems.

This commentary will highlight challenges that standardized PPE poses for increasing diverse healthcare workers. The paucity of discussion around challenges associated with PPE compels diverse healthcare workers to tolerate these challenges without support. As a result, it requires individuals to develop creative alternatives for themselves. In an era where proper fitting PPE has become a necessity for the safety of frontline healthcare workers, an examination of the suitability of PPE is warranted.

PPE in the operating room

While the COVID-19 pandemic highlights the importance of PPE to reduce viral transmission, it also highlights challenges that some individuals face in order to find the right PPE for themselves. Barriers around PPE existed even before the pandemic occurred. Surgical caps and hoods used in the hospital operating rooms represent one of these barriers. For Muslim women and Sikh men, religious head coverings including the hijab and the turban are not allowed in operating rooms without appropriate PPE to cover them. Removing these religious symbols in a public setting is not simple. In fact, it defies some of individuals' cultural beliefs. It can also be a source of internal conflict as it falls to these individuals to find a balance between their personal religious attire and hospital protocols for infection control and prevention. One available option is to wear surgical hoods, which provide more head covering than scrub caps. This is a viable alternative for some. How-

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ever, it nevertheless presents its own challenges. Availability is a concern as hospitals may carry limited sizes and styles of surgical hoods. Despite the availability of surgical hoods, those that are supplied may still not be large enough to fully cover the head of a Sikh man or the neck of a Hijabi woman. These are important considerations because they force individuals to make compromises with their religious or cultural identities. Furthermore, women who wear hijabs, and who wish to keep their arms covered, must also obtain access to a scrub jacket or alternative covering until they scrub in. This can be difficult if scrub jackets are not dispensed in the same place as scrubs or other forms of PPE. The resulting dilemma forces them to expose more of their arms than they may be comfortable with. We recommend a potential solution that could also have a profound impact on affected individuals: relocate scrub jackets to a centralized location alongside other PPE.

PPE outside of the operating room

Outside of the operating room, masks have become routine equipment for healthcare workers. The N-95 masks required for aerosol generating procedures require fit testing. A clean-shaven face is preferred because adequate respirator fit decreases significantly with increasing facial hair.[3] This creates an uncomfortable situation for individuals who cannot or do not wish to remove facial hair for cultural or religious reasons. For example, the practice of keeping one's naturally grown hair in Sikhism is considered an emblem of faith. It demonstrates respect for the way in which one was created.[4] Asking Sikh men to compromise their religious beliefs to fit an N-95 can precipitate moral injury.[5] Appropriate alternatives should be made available to ameliorate this challenge. For example, a Sikh transplant surgeon in Manchester pioneered the "Singh Thattha" technique which allows men with facial hair who cannot shave for religious reasons to achieve an appropriate mask-face seal.[6] This technique had a pass rate of 25/27 (92.6%) by qualitative and 5/5 (100%) by quantitative fit test in full-bearded individuals. It is important that alternatives such as this are explored and, more importantly, are made widely available.

Ear loop face masks are also a challenge for providers who wear head coverings, especially those who are unable to remove them for religious reasons such as turbans or hijabs. However, masks are not just an obstacle for those with "removable" religious headwear per se. They are also a barrier for those born with structural or anatomical features out of their control that preclude satisfactory fit testing. A nonrandomized study of 74 anesthesia providers at a single centre in the United States reported that 95% of men passed mask fit tests compared to 85% of women.[7] In a survey of over 6000 healthcare workers in Australia, "higher fit test pass rates were found in Caucasian (90%) compared to Asian (84%) healthcare workers."[8] Asian women in particular have been shown to have low initial fit-pass rates, with an average of 60%,[9,10] despite comprising a substantial proportion of the healthcare workforce.[11] This discrepancy shows that certain groups may require alternatives to an N-95 mask to obtain satisfactory airborne protection. Depending on the availability of alternative PPE, these populations may be systemically disadvantaged. Thus, hospitals should ensure adequate stock of various mask models and sizes that are appropriate for all facial structures.

Implications for future research

The challenges described herein should be a catalyst for discussion among healthcare workers about accessibility. Further research into manufacturing racially and religiously sensitive PPE that could be adapted to supply healthcare institutions globally is needed. Some online media presences have created instructional videos for Hijabi medical students to learn how to wear and remove their PPE in a method that is culturally sensitive and procedurally safe.[12] Such content would be more credible and useful if institutions developed their own instructional material or incorporated similar videos within their medical education curricula. Providing tie-back masks, such as those offered in surgical units, throughout all hospital units has been recommended by the CDC and can effectively accommodate religious headwear.[13] Hospital administration could also encourage conversations around suitable PPE among healthcare workers and between other institutions. PPE should be obtained from suppliers that ensure a variety of sizes and alternatives. Throughout, ongoing feedback from hospital staff will be paramount to ensure their needs are being adequately accommodated.

Conclusion

One of the many healthcare issues that the COVID-19 pandemic revealed are the challenges surrounding PPE. Wearing PPE for hours at a time is uncomfortable. This is further exacerbated for those who may need to remove religious attire to accommodate their PPE. It is also a problem for individuals whose PPE effectiveness is compromised due to unavailability of viable alternatives. Where diversity provides an essential perspective, it also brings unforeseen challenges. Medicine is no exception. The evolving medical workforce deserves careful consideration of challenges uniquely due to diversity. Healthcare workers should feel comfortable while working and feel acknowledged in the environment that they dedicate countless hours to. As the pandemic progresses, it is a realistic hope that small changes can be made in hospitals in order to accommodate unique PPE requirements of the diverse medical workforce.

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A retrospective cross-sectional analysis of Winnipeg's Urgent Care Centres: Have presenting patient complaints changed since converting from emergency departments?

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Abstract

Three emergency departments (EDs) in Winnipeg, Manitoba were recently converted to urgent care centres (UCCs). This study sought to understand the effects of conversion from a traditional ED to UCC on the types and severities of medical presentations to those health facilities. This study also sought to compare complaint presentations between all UCCs and EDs as well as compare each UCC to its associated ED. This was a retrospective chart review of presenting complaints at Seven Oaks General Hospital (SOGH), Concordia Hospital (COH), and Victoria General Hospital (VGH) three months prior to and three months following the transition to UCC. Pearson's chi-squared test and t-test were used to describe and compare changes in presenting complaints and their acuity. A significant decrease in CTAS score acuity was observed at SOGH (9 vs. 3 for CTAS 1 and 2 patients, $p = 0.045$). There was no significant change in CTAS scores at VGH and COH ($p > 0.05$). There was a significant increase in ear, nose, and throat complaints at VGH UCC compared to VGH ED (1% vs. 7.9%, $p = 0.0208$) and in skin-related complaints at SOGH UCC compared to SOGH ED (9.4% vs 26.8%, $p = 0.0093$). There was a decrease in gastrointestinal complaints at VGH UCC since converting from an ED (19.4% vs. 9.0%, $p = 0.0434$). There were no statistically significant changes in presenting complaints at COH UCC. This study could form the basis of a larger study to examine how patient complaints have changed at Winnipeg's three UCCs. Future research should focus on patient education, administrative considerations, and creating acuity goals for UCCs and EDs.

Keywords: emergency medicine; urgent care; medical systems

Conflict of Interest Statement: None to declare.

Introduction

Since the 1980s, urgent care centres (UCCs) have been used in North America in response to long emergency department (ED) wait times and overcrowding.[1] UCCs are distinct from EDs as they primarily address non-life-threatening health concerns. The level of patient acuity, and therefore degree of urgency, is often classified according to the Canadian Triage and Acuity Scale (CTAS) score. Developed in the 1990s, the CTAS system used in Canada among other countries. It consists of five levels, where 1, 2, 3, 4, and 5, indicate resuscitation, emergent, urgent, less urgent, and non-urgent respectively.[2] UCCs typically receive patients meeting CTAS 3–5 criteria. However, UCCs should also be equipped to manage life- or limb-threatening conditions because patients often choose these sites for their higher-acuity illness.[3,4]

The impact of UCCs on ED wait times is unclear.[5–7] One theory suggests that diverting less acute patients to UCCs frees up valuable ED beds and therefore decreases subsequent wait times.[5] Some also believe that ED overcrowding is a system-wide problem that cannot be easily addressed by focusing on EDs alone.[8] Regardless, there is consensus on the appropriate level of acuity, as designated by CTAS scores, for EDs compared to UCCs.[8,9]

In Manitoba, the impetus to convert three Winnipeg EDs to UCCs was due to Dr. David Peachey's report: *Clinical and Preventative Services Planning for Manitoba: Doing Things Differently and Better.*[10,11] It describes the allocation and delivery of healthcare services

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in Manitoba, stating "...the actual number of patients that require an acute level of medical care could be consolidated into three hospitals. The majority of patients in medical beds in the Winnipeg Regional Health Authority do not require this level of care, are in the convalescence period or simply waiting for a non-hospital option." Peachey et al. suggested that patients with CTAS scores of 4 and 5 would be better suited for community UCCs. They recommended that three community hospitals transition to UCCs. The intention was to concentrate resources in EDs that care for the sickest patients, whereas less acute patients would be treated in UCCs.

Although three EDs in Winnipeg were ultimately converted to UCCs, it is unclear how this affects acuity and presenting complaints in patients that self-present to these centers. A retrospective study of 1263 UCC visits in the USA suggests that 2–3% of all UCC visits are referred to an ED for further management.[12] In contrast, there is a paucity of research in Canada to evaluate UCC transfers to emergency departments or appropriateness of the complaints presenting to UCCs. A 2017 study from Manitoba described patient demographics of EDs in Winnipeg, although it did not provide a description of the types of presenting complaints. This study revealed that Winnipeg's six emergency departments in 2012/2013 saw a case distribution of approximately 1% CTAS 1, 16% CTAS 2, 38% CTAS 3, and 42% CTAS 4 or 5. Approximately 3% of cases had missing CTAS scores.[13] CTAS scores at Winnipeg's only UCC at the time, Misericordia UCC, were not described. An older study by Doupe et al. in 2008 described a case distribution at Misericordia UCC of 2.5% emergent (CTAS 2), 26% urgent (CTAS 3), 45.9% less-urgent (CTAS 4) and 7.0% non-urgent (CTAS 5). There were negligible resuscitation (CTAS 1) cases. This study further revealed that 2.2% of UCC visits were transferred for further management.[14] These results were consistent with another Canadian study that reported a 2–3% referral rate from UCCs to EDs.[12] To our knowledge, there are no uniformly agreed-upon case distribution goals per the Winnipeg Regional Health Authority for the three new UCCs.

The objectives of this study were therefore to (1) Determine whether the types of presenting complaints at three newly opened UCCs in Winnipeg have changed since converting from EDs, and (2) Determine whether those presentations differ in terms of severity.

Methods

Setting

This was a retrospective cohort study of the case-mix at three community UCCs in Winnipeg, Manitoba: Seven Oaks General Hospital (SOGH), Concordia Hospital (COH) and Victoria General Hospital (VGH). These centres were selected because they are former EDs that transitioned to UCCs following the Peachey report in February 2017.[11]

All adult patients 18 years or older who self-presented to a UCC during time periods from July 2017-October 2019 identified in Figure 1 were eligible for inclusion. All presenting illnesses were considered for inclusion. Patients were excluded if they were younger than 18 years of age, were brought to a UCC via emergency medical services, or were transferred from an inpatient ward. Patients from emergency medical services were excluded because these services follow their own criteria that dictates to which destination they are permitted to bring a patient. This exclusion criteria also allowed impacts of public education and acceptance of the changes to the healthcare system at the time to be examined.

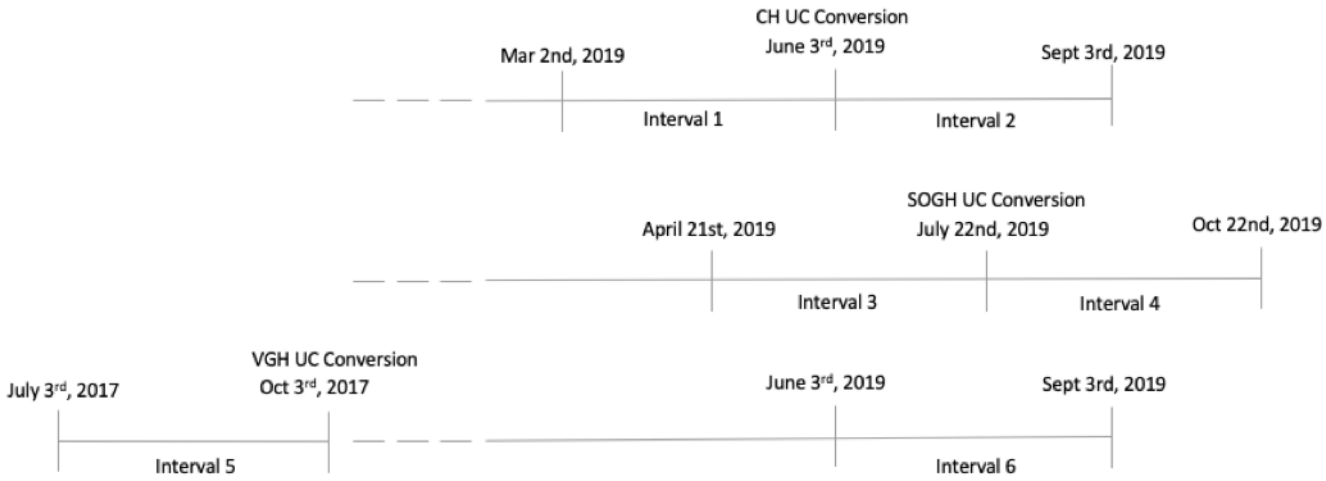
Population and data sources

Data from electronic personal records and paper charts from each UCC were accessed. A study period of three months prior and three months following transition to UCC was used. This was selected to allow time for sufficient transition to occur to reflect changes in CTAS scores/presentation complaints. Thus, six separate time intervals were examined (Figure 1). 50 charts were selected at random by a computerized number generator program from each of the six time intervals, totalling 300 charts. If the selected chart included multiple visits from either before or after the conversion, they were all included in the analysis.

The VGH UCC was designated a "mature site" because it opened approximately two years earlier than both SOGH and COH. This designation was applied to clarify how the types of complaints may change at both COH and SOGH over time relative to VGH.

Demographic and clinical variables at triage were collected, including age, sex, blood pressure, heart rate, oxygen saturation, temperature, and Glasgow Coma Scale. All presenting complaints were assigned to one of 17 categories outlined by the 2008 complaint-oriented triage method: substance misuse, mental health & psychosocial, neurologic, ophthalmology, combined nose/mouth/ears/throat/neck (ENT), respiratory, cardiovascular, gastrointestinal (GI), obstetrics and gynecology, genitourinary, orthopedic, trauma, environmental, skin, general, and minor.[2]

Figure 1. Pictorial representation of the timelines used to establish each of the six time intervals.



VGH UC = Victoria General Hospital Urgent Care; SOGH UC = Seven Oaks General Hospital Urgent Care; CH UC = Concordia Hospital Urgent Care.

Data analysis

Categorical data was represented as percentages within each site. Continuous data was represented as a mean with standard deviation. Pearson's chi-squared test was used to identify differences in the distribution of CTAS scores between EDs and UCCs. Differences in the proportion of presenting complaints, age, sex, blood pressure, heart rate, oxygen saturation or temperature between EDs and UC centres were detected using standard t-test. Significance level was set at ≤ 0.05. Variables were analyzed by comparing each ED site to its UCC counterpart, each ED other UCC sites, and each site to the "mature site" of VGH before and after the UCC transition. No adjustments were made for multiple comparisons. The primary outcome was the change in CTAS scores at new UCCs. The secondary outcome was the change in presenting complaints that could account for this change in acuity.

Using a significance level of 0.05, it was calculated that a power $(1 - \beta)$ of 0.8 and a sample size of 190 patients (95 UCC and 95 ED) was required for each site analyzed. This calculation assumes a cohort study design estimates that the probably of CTAS score 1 and 2 in ED (unexposed group) would be 15% and the probability of CTAS score 1 and 2 in UCC (exposed group) would be 2.5%.[14] This calculation also assumes that the goal CTAS 1 and 2 score distribution for the new UCCs is the same as previously recorded for Misericordia UCC in 2008.[14] This assumption was made because there are currently no clear guidelines as to the goal CTAS score distribution for the new UCCs.

A further comparison of the CTAS scores was conducted using Pearson's chi-squared analysis. CTAS scores 1 and 2 were grouped as "high acuity" and scores 3–5 were grouped as "low acuity" for subsequent t-test analysis due to the small sample size. Presenting complaints at each of the UCCs and EDs were compared to one another using t-statistics and z-scores to assess change in the proportion of each presenting complaint. These complaints were represented as a proportion of all complaints at each of the sites. Significance was measured at p-value ≤ 0.05.

Ethics and dissemination

This study received approval from the University of Manitoba's Health Research Ethics Board, the Winnipeg Regional Health Authority, and each of the research review and impact committees at COH, VGH, and SOGH.

Results

No statistically significant changes were observed between each ED and UCC when comparing patient entrance characteristics including age, systolic BP, diastolic BP, respiratory rate, heart rate, oxygen saturation or temperature ($p < 0.05$).

Table 1 summarizes CTAS score distribution at each UCC. After grouping and analyzing CTAS scores (Table 2), SOGH was found to be the only site that demonstrated a decrease in acuity after converting to UCC (9 vs. 3 among CTAS 1 and 2 patients, $p = 0.045$). VGH UCC did not demonstrate statistically significant changes in acuity (17 vs. 8 among CTAS 1 and 2 patients, $p = 0.088$). COH UCC neither demonstrated significantly decreased acuity (8 vs. 12 among CTAS 1 and 2 patients, $p = 0.255$).

Table 1. Summary of CTAS score distributions with high acuity and low acuity groupings amongst patients presenting to one of three EDs converted to UCCs.

	CTAS 1	CTAS 2	CTAS 3	CTAS 4	CTAS 5	High Acuity (CTAS 1–2)	Low Acuity (CTAS 3–5)	Total Visits
VGH ED	0	17	47	9	25	17	81	98
VGH UC	0	8	42	15	25	8	82	90
COH ED	0	8	35	19	11	8	65	73
COH UC	0	12	23	24	9	12	56	68
SOGH ED	1	8	25	20	10	9	55	64
SOGH UC	0	3	23	28	17	3	68	71

VGH ED = Victoria General Hospital Emergency Department; VGH UC = Victoria General Hospital Urgent Care Centre; COH ED = Concordia Hospital Emergency Department; COH UC = Concordia Hospital Urgent Care Centre; SOGH ED = Seven Oaks General Hospital Emergency Department; SOGH UC = Seven Oaks General Hospital Urgent Care Centre.

Table 2. Pearson's chi-squared analysis of changes in CTAS scores between and amongst UCC and ED sites.

UCC & EDs Compared	*p*-value
VGH ED vs. VGH UC	0.088
COH ED vs. COH UC	0.255
SOGH ED vs. SOGH UC	**0.045**
VGH ED vs. COH ED	0.242
VGH ED vs. SOGH ED	0.578
VGH UC vs. COH UC	0.101
VGH UC vs. SOGH UC	0.244
COH UC vs. SOGH ED	0.582
COH UC vs. SOGH UC	**0.011**

VGH ED = Victoria General Hospital Emergency Department; VGH UC = Victoria General Hospital Urgent Care Centre; COH ED = Concordia Hospital Emergency Department; COH UC = Concordia Hospital Urgent Care Centre; SOGH ED = Seven Oaks General Hospital Emergency Department; SOGH UC = Seven Oaks General Hospital Urgent Care Centre.

Table 3. Proportion of entrance complaints at each site before and after conversion from ED to UCC.

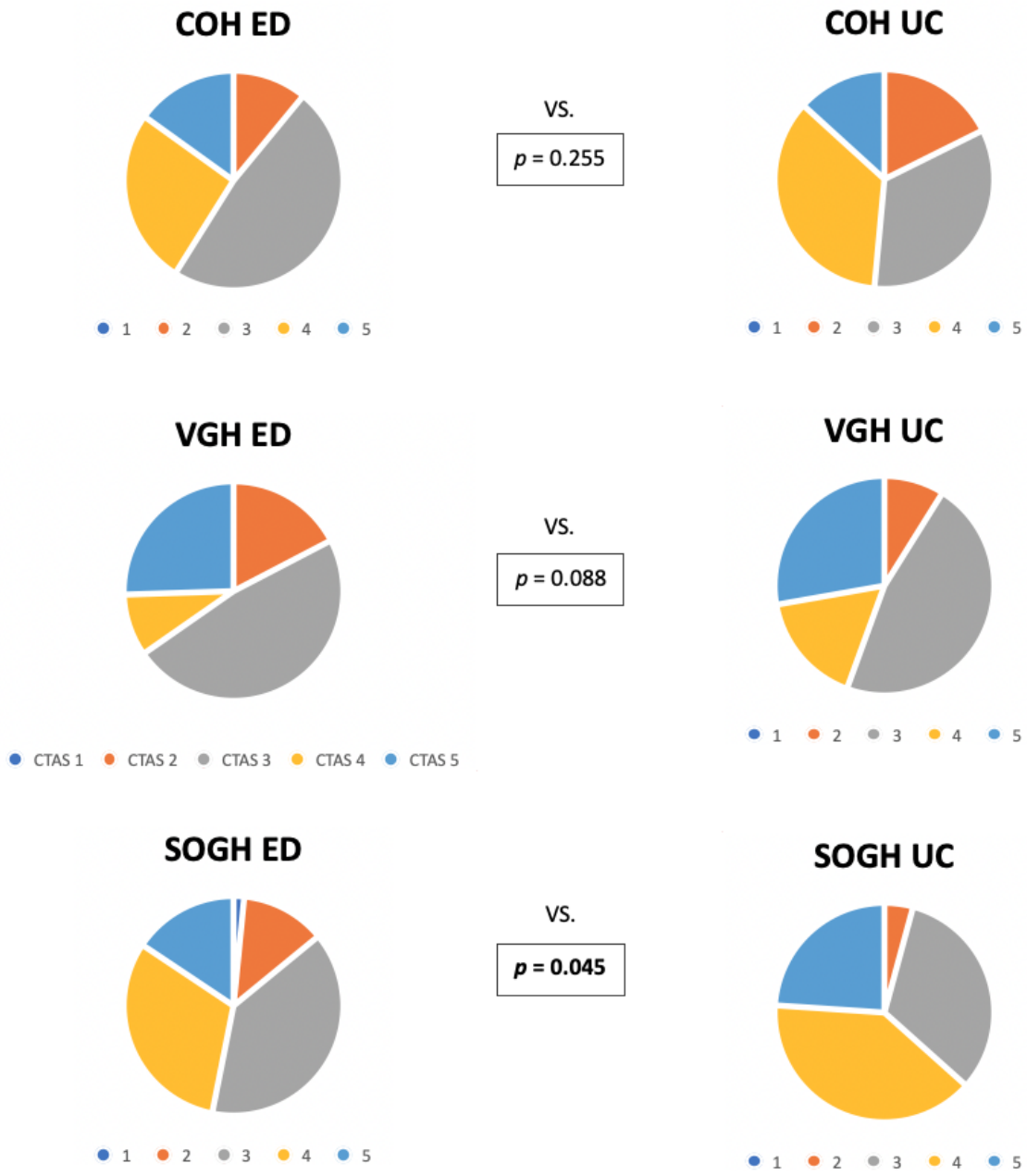
CTAS Complaint	Victoria General Hospital			Concordia General Hospital			Seven Oaks General Hospital		
	ED visits (%)	UC visits (%)	*p*-value	ED visits (%)	UC visits (%)	*p*-value	ED visits (%)	UC visits (%)	*p*-value
Genitourinary	2.7	7.4	0.2077	2.0	3.4	0.5755	4.7	2.8	0.5687
Cardiovascular	9.6	14.7	0.3524	9.2	13.5	0.3524	10.9	4.2	0.1362
GI	17.8	13.2	0.4533	19.4	9.0	**0.0434**	21.9	9.9	0.0549
Respiratory	8.2	8.8	0.8966	9.2	9.0	0.9601	6.3	8.5	0.6241
OB/GYN	4.1	0	0.091	3.1	0	0.0969	0	0	–
Orthopedic	21.9	19.1	0.6818	13.3	11.2	0.6745	12.5	14.1	0.7872
Skin	12.3	10.3	0.7039	13.3	16.9	0.4902	9.4	26.8	**0.0093**
ENT	5.5	5.9	0.9203	1.0	7.9	**0.0208**	10.9	8.5	0.6241
General	2.7	7.4	0.2077	15.3	18.0	0.6241	10.9	15.5	0.4354
Neurologic	13.7	10.3	0.5353	5.1	7.9	0.4413	6.3	5.6	0.8808
Substance use	1.4	0	0.332	6.1	1.1	0.0719	0	0	–
Trauma	0	0	–	2.0	2.2	0.9203	1.6	0	0.2891
Mental health	0	0	–	1.0	0	0.3371	4.7	2.8	0.5687
Opthalmology	0	2.9	0.1389	0	0	–	0	1.4	0.3421

ED = emergency department; UCC = urgent care centre; GI = gastrointestinal; OB/GYN = obstetrics and gynecology; ENT = combined nose/mouth/ears/throat/neck. P-values in bold are significant.

CTAS scores as a proportion are depicted in Figure 2. The "mature site" VGH saw no change in acuity as measured by CTAS scores in 2019 compared to 2017. There was no statistically significant difference in acuity when comparing SOGH UCC and COH UCC to VGH UCC.

Table 3 describes the proportion of entrance complaints at each ED and UCC before and after conversion. There was a statistically significant increase (1% vs. 7.9%, $p = 0.0208$) in "ENT" presentations at VGH UCC since converting from an ED. There was also a statistically significant decrease (19.4% vs 9.0%, $p = 0.0434$) in "GI" complaints at VGH UC since converting from an ED. Presenting complaints at SOGH UCC demonstrated a statistically significant increase in "Skin" complaints compared to SOGH ED (9.4% vs. 26.8%, $p = 0.0093$). No statistically significant changes ($p < 0.05$) in presenting complaints were identified at COH UCC.

Figure 2. Graphical representation of the proportion of CTAS scores for EDs and UCCs at each of the data collection sites.



VGH UC = Victoria General Hospital Urgent Care Centre; VGH UC = Victoria General Hospital Urgent Care Centre; CH ED = Concordia Hospital Emergency Department; CH UC = Concordia Hospital Urgent Care Centre; SOGH ED = Seven Oaks General Hospital Emergency Department; SOGH UC = Seven Oaks General Hospital Urgent Care Centre.

Discussion

To our knowledge, this is the first Canadian study to characterize how acuity and presenting complaints change in UCCs when converted from EDs. Although there are several documented cases of EDs converting to UCCs, literature examining how this transition has affected both acuity and presenting complaints at these centres has not been published to our knowledge.[15–17]

Most existing literature related to conversion of EDs to UCCs is based out of the United States and focuses on the economic cost of UCCs compared to EDs.[18–20] Additionally, much of the American literature focuses on conversion of "free-standing" EDs to UCCs. These departments differ from all the included EDs in our study as these departments are privately owned and are not hospital affiliated. Poon et al. in 2019 characterized changes of patient characteristics and common diagnoses in a Texas ED when converting from a UCC.[20] Although the conversion of this UCC to an ED was opposite to what we was observed in Winnipeg, some comparisons can be made. Similar to the results of our study, Poon et al. saw a decrease in GI complaints and an increase in ENT complaints in their UCC compared to its respective ED. Similarly, no changes were seen in the sex and age of patients.[20] This is consistent with the findings herein. Given that the results of our study were congruent to a similar intervention in a different country, it may lend credence to the notion that these results are true and not solely due to chance.

Changes in ENT and skin presentations

Each of the 175 distinct entrance complaints corresponds to a base CTAS score prior to added modifiers. "ENT" and "Skin" are the two categories in this system that are considered the least acute if no modifiers for pain or abnormal vital signs are used.[2] Some of the highest acuity categories prior to modifiers include cardiovascular, respiratory, environmental, and trauma.[2] The increase in "ENT" and "Skin" complaints observed at VGH and SOGH respectively highlights how the transition to the UCC system increased these types of complaints at these centres. This suggests the public is aware that these types of complaints are generally minor and can trust a UCC to adequately manage their minor health concern. These findings are again consistent with Poon et al. in 2019.[20] It would be useful to ascertain whether there exists a corresponding decrease in these complaints at other EDs in the city. It is possible that the increase in "Skin" and "ENT" complaints at UCCs is due to patients preferring to access 24-hour care available on short notice at UCCs instead of waiting to see their family doctors.

Minor vs. major complaints

Difficulty arises in complaints that are not obviously minor. A patient cannot be expected to diagnose their symptoms or to predict how much resources their complaint will require. It is especially true for GI complaints, which are difficult for patients and clinicians alike to classify as low or high risk. This is because many serious GI pathologies manifest as minor abdominal pain, diarrhea, or anorexia.[21] It is therefore difficult for a patient to decide if their GI symptoms warrant a visit to an ED or a UCC. Our study found that VGH had a decrease in the number of "GI" complaints but no difference in CTAS scores. This may suggest that patients fear their issue is too serious to be adequately addressed at a UCC. It could also be related to selection bias in our study design given our low sample size.

Minimal change in CTAS scores

The minimal change in CTAS and entrance complaints may suggest that there was inadequate public education surrounding the capabilities of each type of centre. Patients chose UCCs when their complaint was obviously minor, which is consistent with the goal of the conversion. We would expect that the proportion of cardiac, neurologic, GI, and trauma complaints would decrease at UCCs since these types of complaints are more often life-threatening and demand more resources. One explanation for the lack of change is that patients choose the centre closest to them, especially when they fear the issue is serious and time sensitive. Additionally, they may have previous experience with a specific centre and choose to continue to go there even if they recognize that an ED might be more appropriate.

Another possible contributor to the minimal change found in acuity and entrance complaint is the public resistance and outcry surrounding the conversion of the EDs. A campaign to "Save our Emergency Room" was started for COH ED, with lawn signs and billboards present for months before and after the change.[22] From our collective experiences, patients at times expressed discomfort with presenting to a UCC, expecting inferior care in terms of skill or services, despite the staff remaining the same. This experience has been corroborated by studies in the United States and United Kingdom.[23,24]. Conversely, it is possible some patients with serious complaints intentionally went to UCCs to protest the loss of their local ED. Additionally, a $100 000 public education campaign was launched five days before the conversion of the COH ED, called "My Right Care".[25] A website and hotline were made available to assist members of the public determine if their complaint was more appropriate for a UCC or an ED.[4] Due to the short lead time between launching the campaign and the conversion of the COH ED, there was criticism that the message would not have time to spread, leaving people unaware of these resources.[25] As public acceptance and awareness of UCCs improves over time, it is likely that a greater difference in entrance complaints and decrease in CTAS scores will be seen.

In our analysis, grouping CTAS 1 and 2 into high acuity and 3–5 into low acuity impairs our ability to appreciate differences in acuity scores between sites. However, this was necessary to analyze the small sample

size. Only one site saw a significant decrease in average CTAS score. Given the weaknesses in the CTAS score, it is difficult to conclude that the CTAS scores were an accurate representation of the demands of the patient population at each site. Canadian Institute for Health Information data that characterizes the entire ED or UCC population based on percent admission and length of stay would help determine the change in acuity after the conversion. Unfortunately, this data was not available at the time of our analysis due to the COVID-19 pandemic.

Limitations

There are several additional limitations to this study. The analysis was underpowered by 270 patients (45 patients at each site). This was due to time constraints. A larger follow-up study would be required to confirm our findings and perhaps offer sufficient power to reveal associations otherwise nonsignificant in the current analysis. Given the small sample size, potential selection bias may have occurred. Larger sample sizes would allow for analysis of individual CTAS scores across sites. Moreover, the insignificant change in CTAS scores and the type of entrance complaints may be related to the temporal proximity between pre- and post-transition periods and the actual date of transition from ED to UCC. A longer follow-up period further away from the transition date may show a greater change as public acceptance of the change increased. The season of the year during which the transition occurred (and, therefore, the timeframe over which the data we abstracted was recorded) may play a role as well: two of the sites transitioned during the summer while one transitioned during the fall. The type of complaint at each site might differ seasonally.

The CTAS score also has some inherent weaknesses which may leave differences in patient populations unappreciated. For example, a patient triaged as "Chest Pain with Cardiac Features" is a CTAS 2, even if the patient's age and medical history make the pre-test probability of acute coronary syndrome unlikely. Similarly, any headache or abdominal pain where the patient reports 8/10 pain is a CTAS 2, even if vital signs, associated symptoms, general appearance, and medical history are reassuring. For this reason, one waiting room full of CTAS 2 patients can look extremely different from another, thus demanding different resources and level of attention.

Strengths

To the best of our knowledge, this is the first Canadian study to evaluate patient presenting complaints at UCCs since converting from EDs. This data may provide valuable insight into how patients utilize these relatively new services and whether more patient education is required around this new model. It also provides a basis for a larger study to examine these effects as UCCs become more established in the Canadian healthcare system.

Conclusion

Future research is needed to more accurately characterize how the acuity of presenting illnesses has changed at new UCCs. It should also be determined whether these changes have successfully reduced length of stay, wait times, and admission rates at UCCs. In future studies, it would also be important to include patients that present via emergency medical services to more accurately define how CTAS scores have changed overall and how to better allocate resources in the future. It may also be important to analyze whether there is a reduction of non-urgent complaints in Manitoba's two tertiary care centres: St. Boniface Hospital and Health Sciences Centre Winnipeg.

This study adds a useful perspective that describes how patient complaints have changed at Winnipeg's three UCCs. To the best of our knowledge, there are no other Canadian studies that examine the effects of converting an ED to UCC. We hope that this study stimulates administrative discussions in order to adjust operations that make these centers more efficient from both patient-flow and economic perspectives. Finally, this study can be used to help inform health authorities around the creation of a uniform CTAS score distribution goal for new UCCs. In doing so, more consistency can be achieved across all sites as there is substantial variation between sites currently. Ultimately, these research and interventions resulting from this study will allow for more accurate analysis of the effectiveness of the transition of EDs to UCCs.

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Personhood for nonhuman primates: Revisiting the moral justification for animal experimentation

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Abstract

Nearly every prescription medicine available today has been tested on animals. However, animal experimentation remains one of the most contentious aspects of biomedical research. While scientists strive to apply the replacement, reduction, and refinement principles, the use of animals in research has been increasing steadily due to a lack of universally accepted alternatives. Many animal rights groups argue that this shortage of alternatives is due to inadequate effort to create them. To many animal activists, the only morally permissible way forward is the total abolition of animal use in research. They see the legal personhood for nonhuman sentient animals, starting with nonhuman primates, as a means to an end. This commentary revisits the moral justification for animal experimentation from a contemporary philosophical viewpoint. It also discusses the concept of legal personhood for nonhuman animals and describes evolving alternatives that have the potential to replace animal experimentation.

Keywords: animal experimentation; nonhuman primates; moral patiency; legal personhood

Conflict of Interest Statement: None to declare.

Introduction: The example of Koko

"Koko" was the name given to the western lowland female gorilla that inaugurated scientific, philosophical, and moral debates on the concepts of individuality, animal sentience, and moral patiency. Koko was part of the "Great Ape language" project aimed at teaching nonhuman primates (NHPs) to communicate thoughts and feelings in sign language and lexigrams. It is often reported that Koko had a vocabulary of more than 1000 signs in addition to the ability to comprehend 2000 spoken English words.[1] Koko's life was fascinating to many scientists. However, the conditions in which she was kept during her life were highly unnatural, which impacted her ability to bond with members of her own species. Koko, the most visible member of her endangered species, died alone in her sleep in 2018 at the age of 46 years old. Her death marked the end of an experiment that lasted a lifetime.

The relationship between humans and NHPs

Intelligence is often defined as a multidimensional construct encompassing a wide array of cognitive functions. Classically, intelligence has been measured by the capacity for logic, self-awareness, learning, emotional knowledge, abstract thinking, language and flexibility in problem-solving.[2] While humans are known to prevail in all of these categories, NHPs also occupy varying levels of the intelligence spectrum. NHPs, such as gorillas and chimpanzees, have the mental capacity to organize social hierarchies, use facial cues to recognize kin and conspecifics (members of the same species), make tools and use them to acquire food, understand aspects of human language, and reciprocate emotions.[3] NHPs share a close phylogenetic relationship to humans across genetic, physiologic, immunologic, and behavioural levels. These similarities make them an ideal animal model for most aspects of biomedical research. Consequently, using NHPs in drug testing plays a central role in the development of many drugs that humans have come to depend on to treat diseases.[3] Preclinical trials on NHPs are often considered the final benchmark for establishing the effectiveness of experimental drugs or vaccines before transitioning to human clinical trials.[3] According to the Canadian Council on Animal Care, more than 4800 NHPs have been used to test drugs and products for human use in 2019 in Canada alone.[4]

NHPs are as amenable to pain and psychological afflictions as humans. While humans have the advantage of verbalizing descriptive phrases to refer to different pain intensity or severity levels, NHPs cannot articulate these feelings as effectively. As such, they

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are considered moral patients. In this context, humans are the moral agents who hold moral responsibility towards captive NHPs. This moral responsibility entails that humans do not intentionally harm NHPs. It also means that, if absolutely needed, humans must only conduct morally responsible animal research where the foreseen benefits must tremendously outweigh the projected harms. One pertinent example of morally permissible research is the development of COVID-19 vaccines to save millions of lives. In contrast, subjecting NHPs to harm and/or less-than-humane living conditions to test cosmetic agents is not morally justifiable. Indeed, many countries have already passed legislation to ban animal testing in the cosmetic industry.[5] A moral dilemma arises if one reflects on the use of NHPs (or other nonhuman animals) in research for scientific knowledge that may not yield any immediate benefit to humanity. This aspect of biomedical research is often viewed as morally grey. Furthermore, the grey area is inflated when researchers exaggerate the societal benefits of their work to acquire public funding,[6] or when they underreport animal procedures employed in study design.[7]

The biomedical community remains divided when identifying the pillars of morally responsible animal research. A recent attempt was published in the Cambridge Quarterly of Healthcare Ethics by Drs. David DeGrazia and Jeff Sebo, who laid down three conditions for morally permissible research:

> "Even if human beings have higher moral status than nonhuman animals, animal research is morally permissible only if it satisfies: (1) an expectation of sufficient net benefit, (2) a worthwhile-life condition, and (3) a no-unnecessary-harm/qualified-basic-needs condition. We then claim that, whether or not these necessary conditions are jointly sufficient for justified animal research, they are relatively demanding, with the consequence that many animal experiments may fail to satisfy them."[8]

DeGrazia and Sebo favour humans' interests to those of nonhuman animals while maintaining the moral obligation to consider the well-being of all animals. Although many researchers welcome their proposal, others remain hesitant to adopt it.[9] This is due to the resultant additional barriers the framework would create in order to pass institutional review and approve research proposals. Many researchers view the first condition in particular (an expectation of sufficient net benefit) to be excessively restrictive. Some recommended replacing it with "an expectation of knowledge production,"[9] which is already a prerequisite for biomedical research proposals.

The philosophical perspective: Deontology and consequentialism

The debate herein has deep philosophical roots. In contemporary moral philosophy, deontology refers to a normative ethical theory that uses rules to discern the morally acceptable course of action.[10] Deontology bases the morality of a given action on whether the action in and of itself is right or wrong under specific moral constraints (rather than based on the consequences of the action).[10] Immanuel Kant, an early proponent of deontology, argued that it would not be morally acceptable to lie even to a murderer at one's door.[11] Applying deontology to the topic at hand, one could suggest that it is not morally acceptable to cause intentional harm to any non-consenting pain-sensitive being (including humans, NHPs, rats, mice) even in pursuit of "good" ends (i.e., scientific knowledge). In contrast to deontology is consequentialism, which judges the morality of a given action based on the consequences brought forth by the action while considering intentions irrelevant.[12] Utilitarianism is a form of consequentialism that advocates for actions that maximize the good and happiness of all parties involved.[13] Applying utilitarianism, one could suggest that it is morally permissible to harm several animals to save many animals. It would also be permissible to generate scientific knowledge that could potentially save lives as long as researchers minimize the pain and maximize the happiness of the majority of people.

While both theories possess strengths and weaknesses, the biomedical community cannot fully adopt one theory and dismiss the other. Deontological ethics, while morally stringent, are intended for rational human beings who are capable of grasping moral imperatives. Hence, nonhuman animals are excluded from its scope. In doing so, one is not allowed to harm another human being under any circumstances. However, it is permissible, if needed, to harm nonhuman animals for one's or humanity's benefit. Conversely, utilitarianism cannot tackle many moral dilemmas that researchers encounter. For instance, measuring benefits can be subjective and open to political and societal interpretation. Additionally, if one assumes equal interests to all parties involved, utilitarianism benefits the majority at the expense of the minority in direct contradiction to individual's rights. Both theories' shortcomings lead many animal researchers to adopt an essentially flawed hybrid view, "Utilitarianism for animals, Kantianism for people."[14] This view assumes that humans are morally superior to every other animal species. As a result, humans' interests are weighed more heavily than other sentient animals' interests while maintaining an overall policy of harm reduction. This concept considers nonhuman animals as nonrational individuals that do not fall under deontological ethics protection. Therefore, nonhuman animals can be used in a utilitarian fashion.[14,15] While the "Utilitarianism for animals, Kantianism for people" view is speciest, it accurately reflects the general public's perspective of inferior animals' moral and legal status.[16] It also suits the biomedical research community to a large extent because it fosters relatively easy moral access to the use of NHPs in research.

A moral movement in the making

The purpose for the Nonhuman Rights Project, a key organization advocating for NHPs' rights, is to argue for equal fundamental rights of human and nonhuman animals.[17] In a perfect world, this objective would be a universal moral drive. Despite ongoing differences in the rights of humans and nonhuman animals, animal rights theorists continue to fight for the total abolition of NHPs use in research. This goal can only be achieved by instilling legal personhood status on NHPs, which would change the matter at hand from a moral issue to a legal issue. It would also likely criminalize NHPs use in research due to an impenetrable lack of consent. Consider this: if the law has already granted the personhood status to non-living entities such as corporations, why is it reluctant to grant the same protective status to living, high-functioning beings like NHPs?

The legal personhood movement lacks political presence, funding, and media coverage to realize its objective in the near future. However, it is slowly attracting attention to its cause, especially in younger, more progressive individuals. The repercussions of the legal personhood movement, however morally correct, could be devastating for biomedical researchers and pharmaceuticals companies who are reliant on NHP testing.[18,19] There is resistance to the legal personhood movement in the researcher community. For example, the Society for Neuroscience actively recruits members to "continue the collaboration to rebut legal arguments for the 'personhood' of animals."[20]

The legal personhood movement should not be taken lightly. It was just under 200 years ago that owning a human slave was an accepted social norm.[21] Barely 100 years ago, women did not have the right to vote.[22] 50 years ago, homosexuality was a crime punishable by imprisonment.[23] These historical facts are viewed with bewilderment and embarrassment at how contemporaries of the times neglected fundamental human rights. Will today's society be perceived in the same way given its treatment of sentient animals?

In search of alternatives

No experimental model to date can fully substitute the structural complexity or functional integration of organ systems as those found in laboratory animals. However, this may be slowly changing. Recent advances in biological microelectromechanical systems have made it possible to build multi-channel three-dimensional microfluidic culture devices that emulate the microarchitecture and mechanics of living human organs.[24] This revolutionary system is known as "Human Organs-on-Chips". While still in its infancy, it aims to replace animal testing altogether.[25] Human Organs-on-Chips are an example of humanity's ingenuity and our collective effort to replace animal testing with reliable and reproducible alternatives. Perhaps the most commonly used in vitro alternative is the animal cell culture that has effectively reduced, but not replaced, the use of living animals in research.[26,27] Cell cultures are slowly evolving into three-dimensional and four-dimensional systems by using guiding scaffolds or three-dimensional printers to stack cultured cells into designed structures. This help researchers better understand cellular behaviour under physiological and pathological conditions.[28] Another alternative is computational modelling, where advanced algorithms are used to simulate human physiology. Such *in silico* (computational) models have already been used to predict the clinical risk of experimental drugs with greater accuracy than animal models.[29]

Conclusion

Experimentation on NHPs remains controversial. This commentary offers an evidence-based exploration into the moral status of NHPs in biomedical research in the context of the corresponding legal personhood argument. While some may disagree with the perspectives presented herein, the moral justification for animal experimentation should be revisited at a systematic and institutional level. Legality is not necessarily equivalent to morality.

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Why we are where we are: Considering medicine's political history and theory

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Abstract

Medical advocacy is a core component of undergraduate medical education. The importance of advocacy has been highlighted by the SARS-CoV-2 pandemic, which made social determinants of health a core part of political discourse. The relevance of medical advocacy requires an understanding of the history and political theory of medicine. This can inform future advocates, ensuring that medicine's role in politics is effective. The goal of this commentary was to review research around medicine's political history and theory, and the current state of medical advocacy. A literature search was conducted on PubMed, using terms including "advocacy", "history", "politics", and "theory". 39 journal articles, position statements and letters to editors discussing medical advocacy, politics, and history were reviewed. Many were specific to sub-specialty advocacy or niche historical examples of medical advocacy. 22 articles contributed to a narrative understanding of medical advocacy by establishing a historical trajectory, describing a set of normative values, or contemplating the current state of advocacy. Tracing the historic trajectory for medical politics demonstrates that medicine has not always inhabited the political role it does today. Before the form of advocacy practiced currently, medicine was governed by a responsibility to the state, not a responsibility to patients. There is contention nowadays regarding the extent that advocacy should dictate medical practice and inform physician responsibilities. Further discussion and education around the profession on the physician's role as advocate is necessary for advocacy to be effective. This requires advocacy training with goals decided by various community members, along with an understanding of the boundaries of medial advocacy.

Keywords: advocacy; medical education; history; politics; social determinants of health

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Introduction

Medicine's role in politics, commonly manifesting as advocacy, is complex and ever-changing. Physicians and medical institutions wield influence and power. This is evident today as the SARS-CoV-2 pandemic has thrust physicians into the spotlight. They are in the headlines, advising policymakers, and communicating to the public. Some are now involved with partisan politics, public policy, and decision-making around conditions within communities. Many medical students are aware that medicine is political, but not why it is political or how this has changed. Students across Canada can recall the CanMEDS "Health Advocate" competency.[1] Some are given formal instruction on medicine's role in colonialism. Here in Manitoba, medical students even lobby members of the Legislative Assembly of Manitoba on an annual basis. However, the roots of medicine's role in politics should be elucidated to navigate its future. This commentary traces the development and philosophy of Western medicine's political history, and how its norms and goals have changed over time. It will also consider the current state of medical advocacy and politics in medical education, as well as the future of medical advocacy.

Medicine in political thought, politics in medical thought

The term "medicine" is used here to describe the institution of medicine, including physicians, medical schools, and regulatory bodies. "Medicine's role in politics" describes medicine's overarching goals within the state, such as alleviating physical and societal ills. An example of this is the CanMEDS "Health Advocate" competency, which asks physicians to "understand [patient and population] needs... and support the mobilization of resources to effect change."[1] "Medicine's role in politics" also describes how medical concepts influence political theory. This survey of medicine's role in

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politics will first focus on medicine's influence on political theory, and then medicine's institutional goals within the state. Later, the term "advocacy" will be interchanged with "medicine's role in politics."

Medical ideas have influenced political thought at a macro, theoretical level as far back as Plato's *The Republic* (375 BC). In *The Republic*, Plato seeks to describe the ideal political society and the individual's role in it. This society is a city-state called a "polis." [2] Plato compares stable and unstable states using the terms "healthy ... and [describing] the more complex polis as feverish." [3] At the theoretical level, a medical understanding of function and stability informed Plato's evaluation of the state. Foundational political thought "posited the nation as an object for medico-political mastery" even in the far reaches of Western political history. [3] Thomas Hobbes constructed another landmark in political thought with *Leviathan* in 1651. [4] *Leviathan* professes that when humans are ungoverned, they exist in a "state of nature" and that life is "nasty, brutish and short." [4] This state of nature can only be avoided with a strong government. Hobbes conceives of this state or "body politic" as "an artificial man, though of greater stature and strength than the naturall [*sic*] ... every joynt [*sic*] and member is moved to performe [*sic*] his duty." Magistrates are described as joints with reward and punishment as nerves. Riches are described as musculature and strength. [4] They are necessary for the "body politic ... itself an articifiall [*sic*] man ... [to] ... promote both political power and political health." [3] Medical thought has influenced some of the most important Western political texts. In turn, these texts have influenced the course of Western political thought.

This influence can be demonstrated throughout history. Many assessments of medicine's political history center on Rudolf Virchow, the father of germ theory. [5–7] He declared that "physicians are the natural attorneys of the poor, and social problems fall to a large extent within their jurisdiction." [7] Virchow's germ theory is influenced by politics. His description of "the body as a social organization ... of mutually dependent individual existences ... indicates that the organic view of the nation had by then become second nature." [3] The medico-political thoughts of Plato and Hobbes informed medical conceptions of the state, and Virchow's understanding of our own cellular composition.

The political responsibilities of doctors

Medicine and politics are historically intertwined. While medical concepts informed the growth of political theory, they did not always influence political decision-making. Instead of serving patients due to a purely moral obligation, physicians served as agents of the state, and were tasked with policing the health of the growing populace. As states grew and entered the Industrial Revolution, they asked more of the medical profession, including the development of "water purification, sewage disposal, sanitary food storage and handling, extermination of disease vectors, and the like". [3] Per Plato and Hobbes' sentiments, a state is as healthy as the sum of its parts.

Physicians were once more politically and ethically responsible to the state than the patient. An example of this can be found during the Black Death in Italy, which waxed and waned for 300 years after 1348. Doctors did not establish their own standards for treatment and care, but were dispatched by "health boards, comprised mainly of merchants ... including physicians as consultants" and "were regulated by contracts that differed in substance but not in form from the commercial instruments ... used to regulate ... the most affluent economies." [8] Medicine's ethical responsibility was a "less effective ... motive for action than economic interest, or more broadly, fear of loss of status." [8] This system was repeated in England, and later the United States. During an outbreak of Yellow Fever in Philadelphia in 1793, "civic authority and a negotiated contract with a physician who saw a personal opportunity in the epidemic determined the organization of medical care." [8] Physicians were not advocating for patients, or dictating social priorities. Instead, they were well-compensated agents of the state who addressed public health, as governments sought greater regulation and control.

The growth of advocacy

The foundations of Western political theory are informed by a "medical" understanding of the state. In turn, medicine was practiced for the good of the state because it was well remunerated and necessary. This is not mutually exclusive with advocacy, and an ethical responsibility to patients and their communities. It is necessary to consider when advocacy became a key part of medicine's role in politics.

Physicians today are held in high social esteem in return for their work. This is one end of a social contract: power and responsibility are given to physicians, and much is expected in return. Many schools of thought posit that "the social contract between society and the medical profession, which gives the latter autonomy and self-regulation in return for fostering the health of society ... can include political advocacy." [5] Advocacy can be described as "action by a physician to promote those social, economic, educational, and political changes that ameliorate the suffering and threats to human health and well-being that he or she identifies." [9]

Physician advocacy inhabited various forms as it developed. Examples include blanket organizations like the American Medical Association or the Canadian Medical Association, or smaller sub-specialty groups. These groups have traditionally advocated for physician interest, more so than patient interests. When Medicare and Medicaid were introduced in the United States, they were "met with great resistance from the American Medical Association, which was one of the first examples of a large medical group getting involved in the political process through advocacy." [6] The focus

of physician involvement in politics has recently turned to more issue-specific advocacy. Larger organizations are taking notice of social issues that influence determinants of health. An example of this is the withdrawal of the United Kingdom from the European Union. Dr. Neena Modi, President of the Royal College of Pediatrics and Child Health at the time, stated, "Brexit is placing at risk [European Union] policies that focus on the wider determinants of health by giving us clean air, good food, and healthy living... with a damaging effect on health." [10]

What drove this shift in medicine's political role? Over the past decades, the ideological leaning of medicine has changed. Using political donations as an indicator of political beliefs, the "political alignment of physicians in the United States changed dramatically" between 1991 and 2012. [11] It is possible that the same changes occurred in Canada. Additionally, there is an increasingly progressive makeup of physicians in lower-earning specialties. [11] This political shift may be due to partisanship following economic interests, or "it is also possible that physicians in training have characteristics that result in their being both partisan ... and entering higher paying specialties." [11]

As the physician population has changed, more physicians expect that they may be called to serve not just as professionals, but as private citizens. This is bolstered by the "overwhelming experience of those who engage in policy and advocacy ... [that] career satisfaction improves with involvement, the likelihood of burnout decreases, and it helps develop strong physician leadership skills." [12] Physician advocates are exhorted "as private citizens, to work as agents of social change with the nongovernmental advocacy organizations of their choice ... [to] effectively overcome the profound effects of the social determinants of health." [13]

Interpretations of advocacy

There are two key questions that frame the theoretical exploration of physician advocacy: (1) How far should advocacy be carried out beyond the immediate medical responsibilities of the physician? (2) Is advocacy a private or a professional matter? Some who are concerned about the boundaries of physician advocacy argue that "physicians must limit their advocacy to matters clearly related to promoting the health and well-being of their patients and communities." [9] This is anchored in the concern that "the medical profession has no special authority or insight into what is demanded by justice or how far societal resources should support communal health rather than other priorities." [14] A counterargument to this is that "medicine, inexorably linked as it is to money and power, is an inherently political vocation ... the choice to remain out of the political debate ... is still a choice." [5] This argument relates to the professional–private citizen dilemma: "proponents of mandatory physician advocacy need to explain why physicians may not legitimately prefer whatever activities they please to politics." [14] Conversely, some proponents of modern physician advocacy seek to fuse the private and the professional, and "reimagine virtuous professional behavior as an emergent property of care, faculty, and collective citizenship teams" rather than "individuals playing discrete roles entailing competing moral obligations." [15]

Moving forward

It is evident that advocacy has deep roots in medicine, but its extent and essentiality are not agreed upon. Two principles need to be developed for advocacy to be effective for populations and physicians.

First, medical education specific to advocacy should be developed. Medical students need to understand the history of their profession, and how it came to inhabit its political niche. Medical students may also benefit from a practical education in advocacy. The Accreditation Council for Graduate Medical Education emphasizes advocacy education focused on the social determinants of health, which reflects changes in legislation and society that shape curriculums. [16] One review notes that "an interested minority of medical students develop advocacy skills either on an ad hoc basis or through optional training experiences". [7] Barriers to advocacy education include a lack of detailed research on outcomes and implementation, scarce published criteria guiding educators on how students should apply advocacy concepts to individual patients, and conflicts with time demands for clinical responsibilities. [16 17 18]

Greater practice complexity and health system pressures have demonstrated a need and highlighted opportunities for broader advocacy training. [7] These opportunities are emerging primarily in pediatrics and family medicine residencies. They are accomplished by establishing partnerships with community organizations, engaging in community-partnered advocacy projects, and supporting legislative advocacy. [18] Successful training at a residency, clerkship, and pre-clerkship level will require implementation, measures of outcomes, and assessments of impact, as well as increased curricular flexibility and instructional capcity. [16] Longitudinal curricula and active learning appear to be superior for teaching medical advocacy compared to short, discrete units. [19]

A second principle that requires development is the establishment of boundaries for advocacy. Many societal issues can be addressed under the "Health Advocate" competency. It is rooted in beneficence, which can be exercised through engaging in legislation, effective administration, clerical best practices, and managing ethical conflicts. [16] Medicine risks losing public legitimacy if physicians "participate in partisan political activism unrelated to the practice of medicine; it is critical that the physician engage in such activity as 'a concerned citizen' only and not in their professional capacity clearly identified as physicians." [20] A systematic review assessing advocacy instruction, grounded in the CanMEDS "Health Advocate" competency, identified 'a number of publications willing to name the

elephant in the room – our collective discomfort with 'activism.'" [19] This is clearly a difficult boundary to prescribe. It needs to be effectively developed through consultation with physicians, healthcare team members, community stakeholders, and those most affected by medical decisions and resource distribution, such as Indigenous peoples in Canada. This boundary may also be established as a result of training program effectiveness: "frameworks that prioritize reliability, defensibility and standardization may be incompatible with the intended goals of meso and macro-level advocacy." [19] The Canadian Medical Protective Association has established guidelines for advocacy, which are situationally dependent: physicians should "consider the appropriateness of the campaign ... [and] whether it is necessary or appropriate to discuss the planned activity with parties who may be affected." This appears to acknowledge that what constitutes "appropriate" advocacy may be ambiguous. The best way to navigate this is to "act professionally, provide an informed perspective, and offer constructive input", while operating within the provincial regulatory frameworks established by various colleges. [21]

Conclusion

Medicine is political insofar as it relates to life and death, and money and power. Medical activism cannot be understood without considering the society in which medicine is situated. Medicine's political role has changed over the centuries, as societies have developed. Currently, Canadian medicine is situated in a political order that favors austerity, with many provinces levying "cuts to families and individuals, a move away from government responsibility." [22] If physicians are "expanding conversations about wanting a better, healthier world" they need to understand the roots of their advocacy, the limits of their advocacy, and how to make it effectively interact with the political system that they operate in. [22]

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