FEATURE
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REVIEW
All fun and games? Exploring the positive effects educational video games can have on medical learners

NEWS AND LETTERS
Mixed reviews: critiques and compliments of physician-rating websites
Media has long been an integral part of how the medical community communicates with the public. Technological advances have made creating and consuming media content easier than ever before. In this issue, we explore how physicians can use digital media to make healthcare more accessible for the community as well as how media can change the way we study and practice medicine.

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Are medicine and media a compatible pair? Medicine, at its core, values privacy, confidentiality, and professionalism. On the other hand, most forms of media thrive on transparency, dissemination of knowledge, and—at times—informality, especially with the rise of social media. Despite (or perhaps due to) these differences, medicine has been a longstanding subject of interest in the media and the two work closely alongside each other. Newspapers and scientific journals report on the latest medical breakthroughs and rare disease case reports shared by healthcare professionals and researchers. Television and radio programs disseminate a variety of health-related messages, from advertisements of health products to public health campaigns such as Stop Overdose BC.¹ The internet contains a wealth of information that is just a click away.

The impact of media on medicine has been magnified in the last decade with the surge of social media. Platforms such as Facebook, Twitter, and YouTube that began as means for social networking and content sharing have now developed into ubiquitous media giants with billions of active monthly users,² including patients as well as current and future healthcare professionals. According to national surveys conducted in the United States and Canada, approximately 40% of practicing physicians reported using Facebook or other forms of online social media, with markedly higher usage rates of 79% and 93% among the younger cohorts of resident physicians and medical students, respectively.³⁴ The pervasiveness of social media makes it a convenient and powerful tool that can affect healthcare decisions made by patients, doctors, and policymakers. When used appropriately, social media can increase awareness and share knowledge among the lay and medical audience, as exemplified by the Movember initiative or Twitter hashtags used by researchers at major scientific meetings to garner peers’ attention for their work. However, the interaction between social media and medicine can blur the professional boundary of patient-physician relationships and raise concerns of patient privacy and confidentiality. The ease of accessibility to social media can also be abused to spread misinformation and propagate false beliefs, as seen by the anti-vaccination movement today. In this issue’s feature articles section, clinician investigator program fellow Dr. Gillian Goobie discusses the impact of social media on dissemination of information and patient-physician relationships in the context of specific illnesses.

Certain healthcare fields and their patients have embraced different forms of media to improve care and service accessibility. Patients living with chronic diseases, such as cystic fibrosis and chronic kidney disease, make use of social media groups to connect, find peer and medical support, and build advocacy programs for new treatments or patient engagement.⁵⁶ This topic is explored in a joint feature by Dr. Mark Gilbert, Dr. Gina Ogilvie, and their teams from BC Centre for Disease Control, which discusses the development of two digital health interventions aimed to improve access to sexual and reproductive health screening, as well as the realistic opportunities and challenges of incorporating such resources in today’s care. Lastly, this issue features a discussion of a text message-based prenatal education program developed by Dr. Patricia Janssen and her team at the UBC School of Population and Public Health. This mobile health program for expecting mothers again underscores the fact that multiple healthcare resources facilitated by media are currently being used to serve various populations in British Columbia.

Despite their seemingly conflicting values, medicine and media may be inseparable in this interconnected society. As you read this issue, we invite you to reflect on the impact of media in your life as a medical student, healthcare professional, researcher, or everyday consumer of information.

Conflict of interest
The authors have declared no conflict of interest.

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Using digital health interventions to improve access to sexual and reproductive health services in British Columbia.

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Citation: UBCMJ. 2020: 11.2 (4-5)

Sexual and reproductive health service barriers

Increasing rates of sexually transmitted and blood borne infections (STBBI) are of significant public health concern. Rates of chlamydia (317.6 per 100,000 population in 2016), gonorrhea (68.8 per 100,000 population in 2016) and syphilis (18.4 per 100,000 population in 2018) have increased in British Columbia (BC) over the last two decades.¹ These infections are often asymptomatic, but if detected early through screening, can be easily managed or treated. Another very common STBBI is human papillomavirus (HPV), which is the primary cause of cervical cancer. More than 75% of all sexually active adults will have had an HPV infection at some point in their lifetime.² Through cervical cancer screening, cell changes caused by HPV can usually be detected and treated early, preventing progression to cervical cancer. However, approximately 30% of the BC population is under-screened for cervical cancer—an enduring gap that standard practice has yet been unable to address.³ As a result, it comes as no surprise that those who face barriers or lack access to sexual and reproductive health (SRH) services and screening (Table 1) also experience a higher burden of STBBI and cervical cancer.³,⁴ This article discusses two internet-based testing services developed to improve access to SRH care in BC, and the opportunities for and challenges to implementation in a primary care context.

Table 1 | Access barriers to SRH services in BC, adapted from a multi-level framework for testing barriers and facilitators.⁶

<table>
<thead>
<tr>
<th>Barrier Level</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual-level</td>
<td>Lack of awareness of the need for screening</td>
</tr>
<tr>
<td>Provider-level</td>
<td>Not having a primary care provider, not wanting to discuss SRH with available healthcare provider for fear of judgement, or preference for another provider (e.g., a female provider, or one who specializes in sexual health)</td>
</tr>
<tr>
<td>Healthcare system</td>
<td>Inconvenient clinic hours or location</td>
</tr>
<tr>
<td>Social and structural</td>
<td>Stigma, embarrassment, cultural taboo, trauma, or mistrust of the healthcare system</td>
</tr>
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</table>

Digital health solutions in BC to improve access to services

There is increasing public interest in, access to, and use of health services online in Canada.⁷ The number of Canadians who accessed their medical records online in the last year doubled from 2016 to 2018, with lab testing being the most common type of health information accessed.³ Digital health interventions are appealing for their convenience and reduce the need for interactions with the healthcare setting or providers. Digital sexual health tools such as internet-based testing offer low-barrier approaches with the potential to improve access for priority populations, and increase efficiencies within primary care.⁸ In BC, partnerships within the Provincial Health Services Authority including the BC Centre for Disease Control (BCCDC), BC Cancer, and the BC Public Health Laboratory, along with regional health authorities, have led to the development of two digital health interventions, GetCheckedOnline and CervixCheck, to address barriers to SRH screening in BC.

GetCheckedOnline (GCO) is an internet-based testing service for STBBI developed by BCCDC that lets individuals test for chlamydia, gonorrhea, syphilis, HIV, and hepatitis C without needing to see a clinician in person.¹⁰ GCO users create their own laboratory requisitions on the website, visit a participating lab to provide specimens, and receive results online (if negative) or by phone (if positive). All users are offered gonorrhea and chlamydia urine testing, plus HIV and syphilis serology testing. Some are additionally offered gonorrhea and chlamydia throat and/or rectal swabs, or hepatitis C serology if indicated by the assessment. Clients can opt out of any of the recommended tests if they choose to. Testing through GCO is done centrally through the BC Public Health Laboratory, and treatment and follow up is managed by the Provincial STI Clinic at the BCCDC. To reduce barriers related to concerns about confidentiality of testing, clients do not need to use their real name and are not asked to provide their personal health number (PHN) when they register for GCO, with tests conducted using a unique alphanumeric code. GCO launched in Vancouver in September 2014, and in February 2016 expanded to Island Health (Victoria, Langford, Duncan) and Interior Health (Kamloops, Nelson), with over 800 test episodes per month since January 2018. Research has demonstrated that GCO reaches people at a higher risk of STBBI and helps to mitigate known barriers to accessing traditional clinic-based testing. Compared to STI clinic clients, people who used GCO were more likely to report that they previously delayed testing due to distance and wait times, felt discomfort discussing sexual health issues, and feared judgement from any healthcare provider.⁶ GCO also may facilitate a higher rate of repeat testing, which in individuals at ongoing risk of STBBI can facilitate earlier diagnosis and treatment.¹¹ A recent chart review found that 98.8% of GCO users completed treatment, which is comparable to the treatment uptake among BCCDC STI clinic clients.

CervixCheck is an online service for at-home cervical cancer screening for women who do not regularly attend screening. It was developed by BC Cancer and UBC researchers in partnership with the team that developed GCO, and builds on the GCO platform by being integrated within primary care (i.e., results are returned to primary care providers). CervixCheck uses HPV testing, which is an evidence-based, effective way to screen for cervical cancer. Compared to cervix screening with the Pap test, HPV testing allows the opportunity for

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self-sampling, where women can collect their own vaginal specimens. To use CervixCheck, participants must be registered with MSP and be a patient of a collaborating healthcare provider. The participants’ screening results are available online for the participant, in addition to being sent to a pre-identified primary healthcare provider to help ensure linkage to care in the event of an abnormal or positive result. CervixCheck launched in May 2019, and is being piloted as a research project in select communities with low screening rates in the Fraser and Northern Health regions, with plans for eventual scale up to other areas. CervixCheck will evaluate uptake of self-collected cervical cancer screening and acceptability of the service. Attendance among those that were recommended follow-up care will be a key outcome that will be measured to determine whether the CervixCheck model can support participants throughout the full continuum of care.

Opportunities and challenges for integration with primary care

These innovative digital health solutions hold great potential for improving SRH, and there is even more potential for further adaptation to improve access (e.g., incorporating telemedicine services for prescribing HIV pre-exposure prophylaxis, and incorporating digital tools for notifying sexual partners to get tested). However, bringing these innovations to scale across BC has many challenges, not least of which is rising costs due to increasing utilization. In smaller cities and rural and remote communities, there may be limited or no access to laboratories for specimen collection. People may also have inconsistent or multiple healthcare providers, which can be a challenge for follow-up of lab results. There are also concerns that services like GCO and CervixCheck risk creating a parallel or siloed system of care that exacerbates health inequities by reaching people who are already engaged in existing in-person primary care health services. It is reassuring that early evidence suggests that this is likely not the case, and that these programs may instead connect people to the healthcare system who might otherwise not be engaged. For example, up to one in five GCO clients report never having previously tested for STBBI, a high proportion of whom live in suburban or rural areas.

With the BC government’s renewed prioritization and funding towards improving primary care, ensuring that digital health tools are integrated with primary care networks and useful to the practice of primary care physicians will be key to their successful scale-up. Both GCO and CervixCheck programs continue to consider how best to do this through iterative cycles of evaluation and adaptation. One approach currently planned for GCO that will facilitate this is adopting the CervixCheck model of giving users the option to use their PHN for testing and to identify their primary care provider for receipt of test results—an option valued by providers in early research and which does not pose a barrier for a majority of GCO clients surveyed. The team is also looking at ways to offer CervixCheck to under-screened women who do not have a primary healthcare provider, and offer access to clinics or clinicians who can support them through follow-up.

Indeed, the importance of digital technologies to accelerate primary and community care while empowering patients in their own care are core pillars of digital health strategies in BC. As digital health services for SRH continue to evolve in BC, it will be important to continue evaluating their impact to ensure that they are reaching individuals facing the greatest barriers to access.

Conflict of interest

The authors have declared no conflict of interest.

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Social media impacts on the dissemination of health-related information and patient-physician relationships

Gillian C. Goobie1,2
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Introduction

In our increasingly interconnected society, healthcare professionals should be aware of the impacts of social media on the health and wellness of their patients. Social media has a number of positive attributes for patients, including greater access to health information, increased support networks, and avenues for healthcare policy-related messaging.1 Similarly, social media can be used in medical education to engage learners, enhance professional development, and provide networking communities.2 Despite these advantages, concerns have been raised regarding the potential for dissemination of misinformation through these platforms. Healthcare professionals need to be cognizant of their role on social media and remain aware of professionalism issues that can arise across these domains.

While social media usage is often perceived to be limited to “Millennials” and younger generations, there has been a steady increase in its usage among all age groups in the U.S. since 2006 (Figure 1).3 Regarding health-relevant social media usage, a 2013 survey of obstetrics and gynecology patients found that 99% of respondents used one or more forms of social media, with 32% of these patients using social media for health-related reasons.4 This highlights the increasingly important role that social media plays in society and emphasizes the importance of evaluating the impact of these platforms on patient education and patient-physician relationships. This article seeks to summarize the major forms of social media used by patients, as well as explore the literature surrounding social media education and effective use of these platforms by healthcare professionals.

YouTube

YouTube is the second most frequented website on the internet, surpassed only by Google.5 A 2019 survey found that YouTube is used by 73% of U.S. adults, making it the most popular social media platform.3 YouTube has also been used in medical education, especially to promote procedural skill attainment.6 The accuracy and reliability of patient-directed health information on YouTube has been assessed for a variety of conditions. Many of these studies raise concerns about the propagation of misinformation, including the promotion of pro-anorexia and anti-vaccination perspectives.7–9

The accuracy and quality of medical information on YouTube may be affected by the source producing the videos.10,11 For idiopathic pulmonary fibrosis, information produced by foundations or medical organizations, news organizations, and independent medical professionals had higher accuracy and quality compared to videos produced by for profit organizations or independent non-medical users.11 Non-recommended or potentially harmful therapies were endorsed in 17% of all videos, with the potential for producers to directly profit from consumer investment. These videos had higher viewership and user interaction than videos that did not support non-recommended therapies, thereby increasing the propagation of inaccurate information to patient audiences.

Despite these concerns, YouTube has the potential to provide accurate and reliable health information to patient audiences. Health on the Net (HON) is an organization that evaluates the accessibility and trustworthiness of health information on the internet. The HON Code tool has been used to assess the quality of information available on the internet and YouTube for several medical conditions.10–12 The widespread implementation of this type of assessment tool for medically-relevant social media could help patients and healthcare providers identify informative resources for health-related content. Furthermore, the identification and professional endorsement of quality information could assist policy makers and investors in improving the accuracy of medical information on YouTube.

Facebook

After YouTube, Facebook is the second most popular form of social media,3 with numerous patient support groups available for many conditions.13–15 There is increasing public interest in using Facebook to engage with healthcare professionals and medical organizations.14,16 A 2016 study surveyed members of Facebook groups focused on congenital anomalies and found that 84% of respondents would like healthcare professionals to engage in their groups and 97% would like to join groups developed by their primary hospital.14 Healthcare professionals and medical organizations can harness this interest, along with the vast networks of Facebook, to engage patients in supportive and educational dialogues. One example of this approach is the Manchester Adult Cystic Fibrosis (CF) Centre Facebook page, which was created to improve healthcare communication and patient interactions in a large adult CF centre.17 This page has been successful

Figure 1 | The percentage of U.S. adults who use at least one social media site (2006-2019), by age group. Reproduced with permission from the Pew Research Center.

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in engaging patients in both supportive and educational dialogues about CF.

Although there are many useful and supportive pages on Facebook, there is also increasing concern about the content and quality of some health-related information on the site. A 2014 study evaluated the source and content of 522 Facebook pages pertaining to the top 20 health conditions searched on Google.23 The most frequently found pages focused on marketing and promotion (32%), followed by information and awareness (21%), with fewer pages focusing on patient support (9%). The high proportion of marketing-related pages indicates that patients may be susceptible to advertising of non-recommended therapies on pages that are run by industry or for-profit organizations. Despite advertising concerns, there is a demand for more professional-driven content on social media.14 This avenue should be further developed by the healthcare system to offset the proliferation of misinformation across these platforms.

Twitter

The majority of publications evaluating health-related information on Twitter have been descriptive in nature.18–20 A smaller body of literature supports Twitter as a beneficial platform for patient support and education.21,22 Participation in the Breast Cancer Social Media Twitter support community was found to be associated with reduced anxiety levels among patient respondents in a 2015 survey.23 Another evaluation of colorectal cancer-related tweets found that 85% of a subset of tweets contained credible information, and that a higher number of retweets was correlated with a greater likelihood of the tweet containing accurate medical information.22 This preliminary research indicates that health information disseminated on Twitter may be of higher quality than seen on other platforms like YouTube and Facebook.

One potential reason for the higher quality of information on Twitter is that it is the most frequently used platform to disseminate information about novel research.9 Twitter is frequently used by health professionals, especially at medical conferences and in residency education.9 However, Twitter is less frequently used across the wider population, with only 22% of U.S. adults surveyed in 2019 using this platform.23 Further study is required to verify the observed benefits of Twitter. These evidence-based conclusions may assist healthcare professionals in developing effective approaches of communicating health-related information using this platform.

Social media and the patient-physician relationship

Social media is a new and important element in the patient-physician relationship; however, the best methods of implementing social media training into medical curriculum remain unclear.24 Social media training in medical school has been shown to enhance and maintain empathy and professionalism in medical students, aid in career advancement and networking, and provide a novel platform for learner engagement.25 The University of British Columbia Faculty of Medicine Office of Professionalism and the College of Physicians and Surgeons of British Columbia teaches medical students about social media and professionalism, but formal social media training is not currently mandated by The Committee on the Accreditation of Canadian Medical Schools (CACMS).25 A 2012 study surveying psychiatry residents found that 96% had a Facebook account, but the majority reported a lack of social media conduct training during their medical education.26 A 2015 survey of family physicians and residents found that 15% of resident respondents and 56% of senior physician respondents had received friend requests from patients within the past year.16 Of these physicians, only 10% had received formal social media training. This highlights the possibility of professionalism and privacy issues that may arise for healthcare professionals using social media.

Patients who use social media for health-related purposes have reported that their primary motives are to increase knowledge, exchange advice, and obtain social support.27 In contrast, the motives of health professionals for using health-related social media are largely related to communication with colleagues, marketing, and to a lesser extent, patient-physician communication.8 It is important to consider these differing motives when navigating the challenging landscape of social media as a health professional.

Conclusions

While there are numerous potential benefits from patients engaging in social media, there is also the possibility of harm from the dissemination of misinformation. Tools like the HON Code are being implemented in research to evaluate the quality of information on websites and YouTube, but these tools need to be more widely applied across various forms of social media. Wider application of these tools would help to ensure that medical information propagated across these platforms is accurate and not exploitative. Equally important is the recognition of how medical information received through these forums can impact the patient-physician relationship. The use of social media by both healthcare professionals and patients has the potential to blur professional lines and introduce privacy issues. Social media conduct training should be provided throughout continuing medical education, as this is a constantly evolving domain.

It is imperative that healthcare professionals and medical organizations recognize this new realm for communication of health information and counsel patients about the responsible use of social media. The possible benefits of social media in healthcare are vast, but harnessing this potential requires health professionals to engage social media investors and policymakers to achieve a common goal of providing accurate and accessible health information through these platforms.

Conflict of interest

The author has declared no conflict of interest.

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Health, or mobile health, leverages the use of cellular devices and digital media to achieve health-related goals. It encompasses the use of mobile communication and multimedia, and their integration in wireless health care delivery systems. There is much evidence from randomized controlled trials that mobile health (mHealth) can change health behaviour, including smoking cessation, weight loss, physical activity, and stress management.\textsuperscript{1-5} The Health Belief Model of Behavior Change theorizes that recipients change their beliefs and attitudes as a result of information received at the point of decision making. Messages serve as a cue to action, essentially providing “just-in-time” salient tips to help motivate behaviour choices.\textsuperscript{1}

Prenatal education is designed to teach women and their support persons about the physiological and psychological changes of pregnancy, what to expect during prenatal care, and how to prepare for labour, birth, and newborn care. Attendance at prenatal education classes has been associated with higher rates of attendance at prenatal care, compliance with prenatal screening, lower rates of preterm birth and low birthweight,\textsuperscript{2} and higher rates of vaginal births in Canadian\textsuperscript{3} and U.S.\textsuperscript{4} observational studies. In Canada, only 32% of pregnant women attend prenatal classes, and those in rural locations are even less likely to attend. Women are increasingly turning instead to the internet, especially smartphone pregnancy apps, to navigate the complexities and challenges of pregnancy and birth. However, there are concerns about the quality of this information. An overview of 370 apps found through the Google Play Store reported that only three apps documented having a scientific board.\textsuperscript{5} Furthermore, there are concerns about bias. A recent cross-sectional review reported that the most common sources of content for apps were either website portals for laypersons or commercial sites, rather than healthcare organizations.\textsuperscript{6} In Canada, the most popular pregnancy website is the Johnson & Johnson’s owned babycenter.ca. Sites driven by consumer-based advocacy organizations, such as mothersofchange.org, todayspan.com, or forums such as parentscanada.com do not reference sources for their content. In addition, information available from the internet is potentially overwhelming in its sheer volume, exacerbating the difficulty of identifying accurate, relevant, evidence-based, and unbiased information. Finally, there are concerns about the completeness and timeliness of information that is not organized to provide the right information to the right person at the right time. For example, a study examining the content of two frequently used free U.S. apps, Text4Baby and My Pregnancy Today, reported that neither delivered comprehensive prenatal information.\textsuperscript{7}

To address the need for accessible and reliable prenatal education, our research group (www.optimalbirthbc.ca) created “SmartMom,” Canada’s first prenatal education program delivered to cellphones by short message service (SMS) text messaging (Figure 1). Women enrolled in SmartMom receive three SMS text messages each

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week. These messages focus on accessing knowledge, undergoing assessment, and adopting behaviours to support healthy pregnancy and physiologic birth. They provide information and links to online sources of evidence-based topics such as discomforts of pregnancy, fetal development, exercise and activity in pregnancy, nutrition, labor and birth, mental health, prenatal screening, and vaccinations. Messages also suggest topics of conversation with healthcare providers (Figure 2).

The messages are consistent with current professional guidelines and peer reviewed prenatal education curricula, and have been endorsed by the Society of Obstetricians and Gynaecologists of Canada. They are brief (136 characters or fewer) and tested for health literacy (grade eight reading level). Messages contain embedded links to more detailed information online. Consistent with Social Cognitive Theory, our links also take women to interactive learning tools designed to enhance engagement and promote self-efficacy, critical elements in behaviour change.5,10 Our focus group findings and those of others have reported that women want a “personalized touch” in digital programs. SmartMom provides optional supplemental streams for women who wish to have additional messages addressing special topics such as: reducing use of tobacco, alcohol or illicit drugs; depression; obesity; maternal age over 35; violence in the home; and vaginal birth after a prior cesarean section.

The back-end software sending messages to subscribers was developed by MEMOTEXT, a Canadian company with extensive experience in mHealth. The message set is anchored to the woman’s due date so as to be relevant to each week of gestational age for individual participants. MEMOTEXT has developed an enrollment portal to allow women to quickly, anonymously, and securely enroll in the program by texting from a cell phone. The company is based in Toronto and encrypts and stores all data on Canadian servers. SmartMom has developed optional supplemental streams for women who wish to have additional messages addressing special topics such as: reducing use of tobacco, alcohol or illicit drugs; depression; obesity; maternal age over 35; violence in the home; and vaginal birth after a prior cesarean section.

Figure 2 | Sample SmartMom message.

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SmartMom has been successfully launched in the Northern, Fraser, and Interior Health Authorities in British Columbia, with Vancouver Coastal Health and the Northwest Territories joining in early 2020. SmartMom initially launched in 2017 as a pilot. Since then, over 5000 women have enrolled and 500 currently join each month.

To evaluate the program, women complete online surveys at enrollment and at completion of the program. Nearly all participants—99%—have indicated that the program was useful to them and that they would recommend it to a friend. They indicated that the reliability and comprehensiveness of the information were important factors in their satisfaction, as well as the fact that they did not have to search for information online. These reasons were closely followed by a desire to know about local resources and receive reminders related to their stage of pregnancy. Our evaluations to date have demonstrated significant improvements on knowledge tests and standardized measures of anxiety, depression, and fear of childbirth at completion of the program. We will be evaluating perinatal outcomes including rates of preterm birth, fetal growth restriction, and stillbirth, based on comparisons of enrolled versus non-enrolled women. Personal health numbers, provided by participants in a secure fashion to Memotext via the SmartMom website, will be sent to health authorities who will link them to health outcomes and then send de-identified data back to the investigators for outcome analysis. Our findings indicate that SmartMom is reaching our target audience of young (76% of participants), lower educational attainment (18% with high school education or less), Indigenous (9%), and visible minority populations (33%).

The future of health education is tied to advantages found in the use of digital media and mobile technology. SmartMom exemplifies use of mHealth to improve access to health education for underserved populations to effect improvements in knowledge and health outcomes.

Conflict of interest

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References

Gender/sex disparity in self-reported sleep quality among Canadian adults

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Abstract
Objective: This study investigated gender/sex differences in sleep quality among Canadian adults in a population-representative survey.
Methods: Data for this study was provided by the Canadian Community Health Survey (CCHS). For respondents who completed the 2011–12 CCHS sleep module, multinomial logistic regression was used to investigate the relationship between gender/sex and a composite sleep quality measure among adults ≥18 years old, adjusted for confounders.
Results: Among the sample (n = 39,700), gender/sex was evenly distributed (49.3% men, 50.7% women). In the adjusted logistic model, being a woman was independently associated with higher odds of poor sleep quality at all levels of poor sleep quality (from ‘a little of the time’ AOR = 1.47, 95% CI: 1.24, 1.73 to ‘all of the time’ AOR = 2.10, 95% CI: 1.74, 2.54). This sleep quality disparity was progressively greater the more frequent the poor sleep quality reported, for all but the highest poor sleep quality level.
Conclusions: This study provides population-level evidence of a sleep quality disparity between Canadian men and women. Using a mixed gender/sex population-based sample and a robust composite sleep quality measure, this study contributes to a growing understanding of poor sleep as a population health issue. Further research is needed to understand the mechanisms underlying the gender/sex-sleep relationship, as well as to investigate effective public health and policy interventions for addressing sleep-gender/sex population health disparities.

Introduction
Sleep is increasingly recognized as a determinant of health at both individual and population levels, as well as a symptom of other underlying conditions (i.e., poor sleep).1 The Public Health Agency of Canada recognizes “personal health practices and coping skills,” under which sleep arguably falls, as one of the twelve key determinants of health.2 Sufficient and high quality sleep is important for normal daily functioning, while poor sleep is associated with increased use of healthcare services and products, reduced workplace productivity, and high economic burden.3 Sleep problems have a range of health consequences including increased risk of occupational injury,4 motor vehicle accidents,5 short-term and chronic morbidities, and early cause-specific and all-cause mortality.6 While the epidemiology of sleep problems is not well described in the Canadian context, 40% of Canadian adults experience insomnia symptoms.7

Women disproportionately experience poor sleep quality. Gender/sex-based differences in sleep can be explained by underlying neurochemical processes and anatomical differences, including less nonrapid eye movement, decreased delta activity, and higher prevalence of sleep apnea in women.8 Gender/sex-based differences in sleep can be explained by psychosocial and environmental factors, and include, for women, greater sleepiness, longer sleep latency, shorter sleep duration for older women (20 minutes or less per night), and poorer sleep quality.8 Sleep disorders are also more prevalent among women—women experience higher rates of insomnia and twice the risk of restless leg syndrome.8 In the limited research using mixed gender/sex samples that is able to examine gender/sex differences in sleep-related morbidity and mortality, it has been shown that women have a greater likelihood of both depression and cardiovascular disease-related death than men.89 In gender/sex-specific research, poor sleep among women is associated with decreased neuroendocrine and metabolic function and increased risk of metabolic syndrome, including diabetes,89 higher body mass index, and incident obesity.11

Though there is growing evidence of gender-based sleep differences, gaps in the literature remain. For one, high rates of sleep disorders known to be more prevalent among men have resulted in the underrepresentation of women in clinical studies. This likely leaves women both undertreated and understudied. Furthermore, the literature on gender/sex and sleep largely consists of clinical studies and gender/sex-specific samples. Much of the existing literature has focused on insomnia, the most prevalent sleep disorder in Canada.7 In gender-specific research, much has focused on midlife or menopausal women. There is a need for the investigation of gender differences in sleep quality across age groups using population studies to inform public health strategies and focus resources. While some population health research has investigated the relationship between gender/sex and sleep, much of the literature is U.S.-based, where the healthcare system and sociopolitical environment differs substantially from Canada and may impact gender/sex disparities in health outcomes. The Canadian Community Health Survey (CCHS) provides a unique opportunity to address these gaps in the literature, providing representative population-level data on sleep quality among Canadian adults across all age ranges. The objective of this study was to investigate gender differences in sleep quality among Canadian adults. We hypothesized that there would be a gender disparity in sleep quality, with women experiencing poorer quality sleep.

Data and Methods
Study Design
Data for this study were obtained from the 2011–12 CCHS public use microdata file.12 The CCHS is an ongoing, national, cross-sectional survey of the health status, service utilization, and related health determinants of the Canadian population. Conducted by Statistics Canada in two-year cycles, the CCHS is designed to provide

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reliable estimates at the health region level. Interviewer-administered questionnaire data are obtained from respondents aged 12 years or older living in private homes across the 115 health regions in Canada based on a multistage, stratified cluster design, in person or via telephone, which is representative of 98% of the Canadian population aged 12 years or older. Ethical approval of the study was covered under the University of British Columbia Research Involving Human Participants Policy (#89, item 7.1), governing use of publicly available datasets.

**Study Sample**

The overall CCHS 2011–12 sample included 124,929 respondents. Of those, 46,172 respondents (37.0%) lived in provinces that opted to include the optional sleep content survey module for their residents (Nova Scotia, Quebec, Manitoba, Alberta, and Yukon). The 2011–12 cycle was the most recent, most geographically representative cycle to include the sleep module. The current study sample was restricted to respondents aged 218 years and without invalid responses (“Don’t Know”, Refusal, Not Stated) to any study variable. Figure 1 illustrates the selection process to achieve the final analytic sample (n = 39,700, 31.8% of the CCHS total sample and 93.8% of eligible respondents).

**Fig. 1** Selection of analytic sample to investigate the relationship between gender/sex and sleep quality, Canadian Community Health Survey, 2011–12.

**Measures**

The main outcome for the analysis was sleep quality. A composite sleep quality outcome variable was created based conceptually on the Pittsburgh Sleep Quality Index (PSQI), commonly used sleep quality measure. The outcome measure combined three CCHS items related to the PSQI components sleep latency, sleep disturbances, and daytime dysfunction, respectively: “How often do you have trouble going to sleep or staying asleep?”, “How often do you find sleep refreshing?”, and “How often do you find it difficult to stay awake when you want to?”. The CCHS used a five-level response for all three questions: “none of the time”, “a little of the time”, “some of the time”, “most of the time”, and “all of the time”. For this study, respondents were assigned to the highest level of poor sleep based on their highest level of response to any one of the three CCHS sleep variables. The primary explanatory variable was gender/sex (men/women). Informed by a review of the sleep-gender/sex literature, potential confounders were included in the model, based on evidence of association with both the outcome and primary explanatory variables. These included age (younger adults: 18–39 years, midlife adults: 40–59 years, older adults: ≥60 years), educational attainment (< secondary school, ≥ secondary school, ≥ post-secondary school), visible minority status (yes/no), self-reported current mood disorder diagnosis (e.g., self-reported depression, bipolar, mania, or dysthymia diagnosis) (yes/no), marital status (married, common-law, widowed/separated/divorced, single, never married), and presence of children five years old or under in the household (none, ≥1).

**Data Analysis**

Data analyses were conducted with SAS® University Edition statistical software (SAS Institute Inc., Cary NC). Accounting for the nonrandom CCHS survey sampling design and uneven probabilities of selection, CCHS survey weights were applied to all analyses to provide appropriate variance estimates and meaningful population representative estimates. Following descriptive statistics, a multinomial logistic regression model was built to examine the independent effect of gender/sex on sleep quality, adjusted for confounders. Potential confounders were assessed via addition to the unadjusted model one at a time using a 10% shift in the point estimate strategy. Despite no strong statistical evidence of confounding, all were retained in the final analysis based on an *a priori* conceptual model of potential confounders of the relationship between gender/sex and sleep quality.

**Results**

Descriptive statistics profiling the overall study sample demographics are presented in Table 1. The study sample (n = 39,700) was comprised of approximately equivalent proportions of men and women (49.32% and 50.78%, respectively). Almost half of all respondents were in the older age category (43.68% aged ≥60 years), 35.43% were midlife adults (40–59 years), and 20.89% were younger adults (18–39 years). Most of the sample had completed post-secondary education or higher (68.88%), 15.88% identified as visible minorities, 6.42% reported a current doctor-diagnosed mood disorder, almost half (45.23%) were married, and 13.83% reported children under five years old in their household.

Overall, women reported poorer sleep quality than men. Further, the difference in the proportion of women versus men reporting poor sleep quality increased with each level of poor sleep quality. Specifically, 52.24% of women reported poor sleep quality “some of the time” compared to 47.76% of men, 55.88% of women reported poor sleep quality “most of the time” compared to 44.12% of men, and 57.11% of women reported poor sleep quality “all of the time” compared to 42.89% of men.

In unadjusted bivariable analysis (Table 2), being a woman was associated with increased odds of poor sleep quality from lowest level (“a little of the time”), odds ratio (OR) = 1.40, 95% confidence interval (CI): 1.19, 1.64 to highest level (“all of the time”), OR = 2.23, 95% CI: 1.84, 2.70), compared to being a man. In the multivariable model adjusted for age, educational attainment, visible minority status, current doctor-diagnosed mood disorder, marital status, and children in the household (Table 2), the progressively disproportionate relationship between being a woman and poor sleep quality remained overall, though the adjusted odds of poor sleep were somewhat attenuated for the “all of the time” level (AOR = 2.10, 95% CI: 1.74, 2.54). The 95% confidence intervals for estimates of the association
between being a woman and poor sleep quality excluded “1” at all levels of sleep quality, indicating a statistically significant effect.

Discussion

This study makes important contributions to the Canadian and international sleep-gender/sex literature, including use of epidemiological data from a large, population representative Canadian sample. Strengths of the study include use of a mixed gender/sex sample of adults 18 years and older and employment of a robust composite sleep quality outcome measure, rather than reliance on a single sleep problem indicator, with potential for use in future research on sleep in the Canadian population.

Results demonstrated that being a woman was independently associated with higher odds of poor sleep quality overall. Furthermore, a progressively disproportionate effect was observed between being a woman and higher odds of poor sleep quality at each outcome level except the highest (sleep problems "all of the time"). The greatest effect was a more than two-fold (AOR = 2.16) increased odds of poor sleep quality “most of the time” for women versus men, in the adjusted multivariable model. The results of the current study are consistent with other research, including a U.S. based study of socioeconomic impacts on sleep quality that found women had 1.55 times the odds of poor sleep quality compared to men, and a clinic-based European sample of multiple sclerosis patients that found men had 0.10 the odds of poor sleep quality compared to women. A higher prevalence of poor sleep quality in women was also noted in a U.S. community-based sample of older adults (32.6% versus 16.3%) and a cross-sectional study of Korean young adults.

In this mixed age group study, younger and midlife women experienced poorer sleep quality compared to older women. Much of the sleep-gender/sex research has been conducted among age group-specific samples, with little prior evidence comparing age groups across the life span. While there is limited research utilizing mixed age group and mixed gender/sex adult samples, a community-based study of U.S. adolescents found a 2.75-fold increased risk of insomnia for girls at onset of menses compared to boys. The lack of gender/sex difference in insomnia risk prepuberty may point to a potential hormonal pathway for sleep disorders, and suggests maturational development may be related to the natural course of insomnia and the onset of other sleep problems for women and girls. Relatedly, there is evidence that menstrual cycle, pregnancy, and menopause can influence sleep in women. Gender/sex-based disparities in sleep quality and other sleep problems may be further explained by gender/sex inequities in leisure time, caregiving responsibilities, and household labour at different life stages, as has been demonstrated in a study of gender/sex and sleep duration in U.S. adults. This finding is consistent with confounding effects in this study, demonstrating poorer sleep for married women and those with children five years old or younger in the household. While much of the sleep literature has shown poor sleep for older adults, finding greater sleep problems for younger and midlife women in this study may be a function of age-differential underreporting. Specifically, older adults may underreport sleep problems due to cultural normalization of sleep issues in older age.

Finding elevated odds of poor sleep quality for women using population-based data adds to the evidence that poor quality sleep is a population health issue, intersecting with larger social disparities in health. Currently, intervention for sleep problems is dominated by individual-level clinical and behavioural remedies such as sleeping pill use and sleep hygiene training. While these options may improve sleep quality for individuals, they do not address population-level causes. Understanding sleep quality as a population health issue rather than an individual issue brings into focus the need for population-level interventions aimed at improving sleep quality, such as sleep-conducive employment schedules and incorporation of sleep optimization education into primary school curricula. While poor individual autonomy and the uneven distribution of socioeconomic resources have been theorized as potential underlying causes of poor quality sleep, further research is needed to investigate effective public health and social policy interventions for ameliorating root causes and ultimately addressing related population health disparities, including gender/sex-specific efforts.

Limitations

There are a number of limitations to this study. Firstly, use of cross-sectional self-report survey data restricts the ability to assess temporality and causality, limiting inferences to observation of association. Though the composite sleep quality outcome is based conceptually on the validated PSQI, it is not a validated measure itself nor as comprehensive a measure of sleep-related problems and thus may have introduced information bias in this study. As a result, study findings may be a conservative estimate of sleep problems among Canadian adults. Relatedly, as respondents were classified by the highest level of sleep problems reported for any of the three sleep quality items, the outcome effect may be dulled, though this is likely non-differential by gender/sex. Selection bias may have been introduced as it is possible that those who opted to respond to the sleep questions experienced more sleep problems. In this event, findings of poor sleep quality in this study may be an overestimation, though likely non-differential by gender/sex. However, the number of non-respondents to the sleep module was relatively low, at less than 2% of eligible respondents. Further, this study is limited by an inability to control for a variety of known confounders of the relationship between gender/sex and sleep in the CCHS (e.g., household division of labour), resulting in possible residual confounding.

Potential misclassification of gender/sex may also bias this study. Survey documentation instructs CCHS interviewers to input respondent sex and, if necessary, ask “is respondent male or female?” Though the term “sex” is used in the CCHS documentation, this variable is more accurately a gender/sex measure. The survey question does not collect sex assigned at birth and thus likely captures interviewer assessment of respondent gender/sex based on name, voice pitch, or other gendered signifiers. Though inconsistent with best practices in the literature regarding measurement of sex and gender, this item has been used to make both sex- and gender-related inferences in the CCHS. The binary male/female response options also constitute a methodological erasure of transgender respondents and/or those with non-binary identities—an important consideration both for future CCHS research and for Statistics Canada as the survey instrument evolves. Though the resulting potential for misclassification bias is an important limitation, this study used the best available CCHS gender/sex measure, and the number of any potentially misclassified respondents is likely small, as to have minimal impact on results. Despite oversimplification of gender/sex measurement, a meaningful gender/sex difference was detected in this study.
Table 1 | Descriptive statistics for the study sample to investigate the relationship between gender/sex and sleep quality, Canadian Community Health Survey, 2011–12 (n = 39,700).

<table>
<thead>
<tr>
<th>Overall Study Sample</th>
<th>Study Sample by Sleep Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None (%)</td>
</tr>
<tr>
<td>Sleep Quality</td>
<td>39,700 (100%)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>17,464 (49.32)</td>
</tr>
<tr>
<td>Women</td>
<td>22,236 (50.78)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>Older (≥60)</td>
<td>22,191 (43.68)</td>
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<tr>
<td>Midlife (40–59)</td>
<td>10,846 (35.43)</td>
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<tr>
<td>Younger (18–39)</td>
<td>6,663 (20.89)</td>
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<tr>
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<td>36,745 (93.58)</td>
</tr>
<tr>
<td>Yes</td>
<td>2,955 (6.42)</td>
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<td>1 or more</td>
<td>4,690 (13.83)</td>
</tr>
</tbody>
</table>

Conflict of interest
The authors have declared no conflict of interest.

References
9. Rod NH, Kumari M, Lange T, Kivimäki M, Shipley M, Ferrie J. The joint effect of sleep duration and disturbed sleep on cause-specific mortality: results from the
Table 2 | Multinomial logistic regression model of the relationship between gender/sex and sleep quality (reference = no poor sleep quality)* (n = 39,700).

<table>
<thead>
<tr>
<th>Gender</th>
<th>Unadjusted Odds Ratios (95% CIs)</th>
<th>Adjusted Odds Ratios (95% CIs)</th>
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<tbody>
<tr>
<td></td>
<td>A little of the time</td>
<td>Some of the time</td>
</tr>
<tr>
<td>Men</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Women</td>
<td>1.40</td>
<td>1.82</td>
</tr>
<tr>
<td></td>
<td>(1.19,1.64)</td>
<td>(1.56,2.14)</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Older (≥60)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Midlife (40–59)</td>
<td>1.42</td>
<td>1.37</td>
</tr>
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<td>(1.16,1.73)</td>
<td>(1.13,1.67)</td>
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<tr>
<td>Young (18–39)</td>
<td>1.98</td>
<td>1.87</td>
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<td>(1.60,2.45)</td>
<td>(1.51,2.31)</td>
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<td>(1.33,1.91)</td>
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<tr>
<td>No</td>
<td>1.00</td>
<td>1.00</td>
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<td></td>
<td>(1.05,2.35)</td>
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<td>1.00</td>
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<td>(0.85,1.35)</td>
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<td>0.77</td>
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<td>(0.61,0.99)</td>
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<td>(0.99,1.50)</td>
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<td></td>
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<td>None</td>
<td>1.00</td>
<td>1.00</td>
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<tr>
<td>1 or more</td>
<td>1.46</td>
<td>1.33</td>
</tr>
<tr>
<td></td>
<td>(1.12,1.89)</td>
<td>(1.03,1.72)</td>
</tr>
</tbody>
</table>


Climate change and human health

Zev Dayan¹, Raiya Suleman¹, Videsh Kapoor²
Citation: UBCMJ. 2020: 11.2 (17-19)

Introduction

Climate change poses a serious threat to human health, with recent simulations predicting an increase in mean global temperature by 1.5-5.8°C, as well as a 5-15% increase in mean global precipitation by the end of the century.¹ These environmental changes impact several social determinants of health by affecting air quality, food chains, forced migration, and the incidence of various infectious diseases.²,⁴ Within the global community, specific populations will be more vulnerable to these consequences than others.²,⁵ It is the role of healthcare professionals, through education, leadership, and advocacy, to recognize and account for these changes and adapt current practices. Healthcare professionals must not only be able to provide appropriate care to populations that are most vulnerable to climate change, but also minimize the environmental burden of the healthcare system. This will help mitigate the negative health effects of climate change, which are expected to surge in the coming years.

Infectious Diseases

Many infectious agents can be impacted by climate changes.⁵ The explanations as to how these affect vector-borne disease communication are varied. Considerations include lengthy transmission periods due to changing seasonality, increasing temperatures leading to increased reproduction rates, and climate-induced migration of vectors and human hosts.⁶ With varying climates globally, it is understood that the distribution of infectious diseases will be impacted, leading to some regions being unsuitable for certain diseases, while others becoming vulnerable. The lack of acquired immunity in these newly infected regions is concerning.⁷

Malaria and dengue fever are two vector-borne diseases that have been influenced by temperature changes.¹¹ An increase in temperatures since the 1970s in Africa has been correlated with increased malaria distribution at higher altitudes in the southern and eastern regions of the continent.¹¹ Increasing temperatures are believed to shorten the time it takes for mosquitoes to become infected with dengue fever, thus increasing transmission.⁶ Additionally, water-borne diseases are expected to be influenced as well. Specifically, the rate of cholera infection in developing countries is anticipated to increase with rising temperatures.¹² Challenges in food and water security will also force individuals to rely on unsafe food sources, therefore increasing susceptibility to food- and water-borne illness.² Of particular concern is the vicious cycle that involves food-borne illness compounding existing hunger, which increases an individual’s vulnerability to acquiring other infectious diseases.²

Food Chains and Water Security

Food security is achieved when “all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs.”¹³ Almost all qualitative assessments predict that climate change is going to have a negative impact on food security, particularly in developing countries.²

While climate change is predicted to lead to detrimental effects on crop yields, agriculture also accounts for 25% of greenhouse gas emissions.¹⁴ The impacts of climate change on agriculture are expected to be seen after 2020, especially with the demand for agricultural products increasing by about 50% by 2030.¹⁵ Temperature increases and changes in precipitation are expected to impact crop yields, specifically for crops grown at the extremes of temperature.¹⁸ The changes in crop yields will not only exacerbate existing hunger through direct means, but also through decreasing the net income of farmers.¹⁹ Increased CO₂ is actually predicted to positively impact crop yields, leading to a mixed picture when accounting for CO₂ changes that are expected with climate change.¹⁵,¹⁷,²⁰ However, foods grown at increased CO₂ environments have also been shown to have decreased iron, zinc, and protein content.²¹ Rising CO₂ emissions are expected to make 150–200 million people zinc deficient, and a similar number deficient in protein.³ The decrease of insect pollinators due to pollution and climate changes may lead to reduced intake of vitamin A and folate, as well as fruits, vegetables, seeds, and nuts.⁵ It is expected that the negative impacts on agriculture will be most pronounced in developing countries and coastal regions, with developed countries actually benefiting from climate changes.²,¹³,¹⁷,²²

The availability of freshwater has been threatened due to decreasing glaciers, ultimately leading to deprivation, displacement, and conflict.³,¹⁴ Additionally, various regions are turning to methods to extract water which require increased energy, ultimately resulting in increased CO₂ emissions.¹³ Ocean warming, acidification, deoxygenation, and overfishing have led to a decline in seafood availability, particularly in low-income countries.¹⁴ Approximately one billion people obtain over 20% of their daily intake from fish, making them particularly vulnerable to the decline in wild fish harvests.³,²¹ Furthermore, 22 of the 33 countries that are most vulnerable to climate change impacts on fisheries are classified as “Least Developed Countries.”³ It is, therefore, individuals from many of the world’s lowest-income countries that are most vulnerable to these changes, as they are over twice as reliant on fish than those from less vulnerable countries.⁷

Migration

Climate change also threatens human security through forced migration, which can lead to political conflict, physical and emotional trauma, and death.²⁴-²⁶ Forced displacement is known to have severe impacts on human health, and is associated with higher rates of malnutrition, infectious disease, and mental illness.²⁵,²⁷ It is often those living in low-resource settings that are subjected to forced migration, therefore compounding pre-existing vulnerability.²⁵,²⁶,²⁸ It is estimated that up to 700 million individuals may become displaced due to climate change by 2050.³ The causes of climate-based displacement are often

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categorized into two groups: sudden-onset and slow-onset events.\textsuperscript{24} Sudden-onset events, such as hurricanes, floods, and wildfires, can occur rapidly.\textsuperscript{24} Slow-onset events happen over time, such as land degradation and decreasing crop yields.\textsuperscript{24,29,30}

Climate change also exacerbates sociopolitical conflict. For example, millions were displaced due to the civil war in Syria, which was the result of political conflict and exacerbated by the region’s worst known three-year drought.\textsuperscript{3,25} Additionally, changes in land fertility have caused increased conflict over land possession.\textsuperscript{1} The unreliability of harvests, in combination with the increasing incidence of natural disasters, has led to displacement.\textsuperscript{3} Migration often occurs disproportionately from rural to urban settings, which can pose a serious problem, as many urban cities lack the capacity and infrastructure to host large waves of migrants.\textsuperscript{3,25,29}

It is also important to recognize that in precarious situations, it is often the young male of the family that is forced to relocate to find work, increasing the vulnerability of family members left behind.\textsuperscript{24,31} Children are also often sent to live with extended family to relieve resource demand within families.\textsuperscript{24} Studies indicate that individuals that migrate due to climate-based reasons prefer to stay in their place of origin; therefore, it is crucial that the mental health implications of these forced displacements are also explored and treated.\textsuperscript{24}

**Air Quality**

Climate and weather have significant influences on air quality, thus resulting in its sensitivity to climate changes. Air pollution results from a combination of emissions and untimely weather patterns.\textsuperscript{32} While there are various air pollutants, the two key players that influence health are particulate matter and surface ozone.\textsuperscript{32} Both of these pollutants have been associated with higher temperatures, however, the exact relationship between temperature and particulate matter is not clear in the literature.\textsuperscript{33,34} Ozone causes respiratory inflammation when inhaled, and studies have shown an increase in asthma-related hospital visits in regions with higher levels of these air pollutants.\textsuperscript{35}

Climate change is also influencing health through its impact on aeroallergens such as outdoor pollens. Several studies in Europe have shown that the pollen seasonal onset is advancing in alignment with warming trends.\textsuperscript{36} Further research has suggested that increases in CO$_2$ concentrations alone lead to greater pollen levels, through increased production and efficacy as an allergen.\textsuperscript{36}

Additional consequences of air quality on health include the effects of wildfires, with elevated temperatures along with extended droughts potentially leading to an increase in fires.\textsuperscript{37} The consequent smoke in surrounding communities has been shown to lead to an increase in hospital visits due to respiratory complaints.\textsuperscript{38} This was evident in a study looking at three weeks of wildfires in Kelowna, where physician billings for respiratory illnesses were largely increased from the same three-week period over each of the ten years prior.\textsuperscript{39}

**Discussion**

The connection between climate change and health is well established in the literature. Although many are susceptible to these effects, it is clear that certain populations are more vulnerable to the impacts on food chains, migration, infection transmission, and air quality. On a large scale, the infrastructure and robust healthcare systems of many industrialized countries can be expected to support their populations through these challenges. Unfortunately, this may not be feasible for many other regions globally, for example in coastal areas where infrastructure to combat rising sea levels is not affordable.\textsuperscript{38} For any region, government-level support is critical. For example, an enhanced infectious disease program could help relieve some of the sequelae of increased disease distribution and transmission. This would include public education, increased vaccination, and food and water safety measures.\textsuperscript{41}

Further populations at particular risk include the elderly, as they have a higher vulnerability in heat waves as well as in cold-related events.\textsuperscript{42} In regions with wildfires, individuals suffering from respiratory diseases, such as chronic obstructive pulmonary disease and asthma, have experienced additional exacerbations.\textsuperscript{39} Within Canada, Indigenous communities would be expected to have increased sensitivity to climate-related health outcomes, as well as a decreased adaptive capacity to climate changes, due to the lasting intergenerational trauma, lack of healthcare access, and poverty that has been disproportionality experienced.\textsuperscript{43} When considering the many consequences of climate change on health, it is inevitable that climate change will impact mental health. This could be through more severe adverse weather events, displacement, and added stress related to resource deficiencies, which can lead to anxiety-related responses and trauma, as well as the implications on physical health that are so closely related to an individual’s mental well-being.\textsuperscript{44}

To mitigate some of the challenges of climate change, it is essential that action is taken by the physician community. Recently, the global non-profit World Organization of Family Doctors (WONCA) issued a declaration calling on physicians to advocate and take action to prevent climate change.\textsuperscript{45} WONCA recognized the influence that physicians could have on making immediate and constructive change in local communities. The healthcare sector is a significant contributor to carbon emissions. In 2016, Eckelman \textit{et al.} reported that the United States healthcare sector reached nearly 10% of the national output of emissions in the United States in 2013.\textsuperscript{46} The same study showed yearly increases over a recent ten-year period, with a total increase of healthcare emissions of over 28% during that timeframe. Unfortunately, this is a trend in the wrong direction. The WONCA statement suggested that physicians can promote a sustainable workplace by reducing medical waste, encouraging active transit and plant-based diets, and educating themselves and their patients on climate and health. Evidently, this theme is important for medical students and physicians. One possible way to build understanding around this issue is by creating workshops for future physicians on the topic of climate change. To this end, the University of British Columbia’s Global Health Initiative, a student-led initiative, has recently introduced an annual climate health workshop. The session encourages thoughtful discussion on how climate can influence the health outcomes of varying communities. This also spurred ideas on how medical students felt action could be taken in their future careers. Furthermore, the UBC Faculty of Medicine plans to lead a teaching session on climate health as part of their new “Emerging Topics” initiative. The formal introduction of this issue to the curricula, as well as continued advocacy and efforts toward promoting sustainability within healthcare, is likely to create progress towards positive change.

**Conclusion**

Climate change is expected to have detrimental effects on several aspects of human health, specifically by affecting food chains, migration patterns, infectious disease distribution, and air quality. With recognition of the complex interplay of climate and health, it is imperative that the medical community takes action to mitigate the
negative effects that climate change has on the health of patients.

Conflict of interest

The authors have declared no conflict of interest.

References


All fun and games? Exploring the positive effects educational video games can have on medical learners

Ryan Chow¹, Matthew Cheung¹
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Abstract
Video games have transcended from being a simple pastime to a cultural phenomenon. With recent advances in computer processing and storage technology, this type of interactive media can provide a fun experience to children and adults alike. In the last decade, video games have found their way into medical education. Due to their intrinsic immersiveness, sensorimotor stimulation, and lifelike simulation capacities, medical-based games have become a popular medium for educational developers to create products that help elevate traditional pedagogical methods (i.e., didactic lecture-style learning). This commentary will discuss the positive aspects of medical video games and provide specific examples of how they have benefited medical education for both novice and expert learners.

Introduction
On November 29th, 1972, the American home computer company Atari released the first commercially successful video game, Pong. Pong’s concept was simple: two players would each control a single white line to rebound a small pixelated ball back and forth on a two-dimensional plane, somewhat similar to the eponymous real-life sport of “ping-pong.” Since Pong’s international success, video games have transcended from once a frivolous pastime to now a cultural phenomenon. Much of the success of video games can be attributed to advancements in the portability of computer technology, which allowed the transition from stagnant arcade machines to more convenient devices such as Nintendo’s Gameboy or more recent Switch products. Furthermore, with the pervasiveness of cell phone use in North America, the ability to access these games has never been easier.

It is the consensus in developed countries that electronic device usage and access among healthcare professionals are high. It is estimated that at least 80% of American physicians use portable electronic devices, such as smartphones and laptop computers, while usage among Canadian medical students is estimated to be approximately 98%. While the topic of smartphone usage in actual medical practice is currently under debate, the potential utility that these portable devices carry as educational tools has been generally well approved. Educational video games are often stigmatized, especially by students, as being unappealing because of their inherent emphasis on education rather than being traditionally “fun.” However, as a result of technological and pedagogical innovation, some medically relevant video games have been shown to be appealing and clinically relevant to students and practicing physicians alike. This commentary will discuss the benefits of medical video game-based education tools and provide specific examples of successfully implemented medical video games.

Case-based immersion
A major reason why video games have become such a popular form of interactive media among creative developers is because of their ability to provide player immersion. This is especially true in role-playing games, where a player assumes the role of a fictional character and must make decisions that ultimately affect the progress of a narrative story. Similar to the rise of video games has been the popularization of case-based learning (CBL) in medical school curricula, which is based off the seminal problem-based learning method developed at McMaster University. CBL, analogous to role-playing video games, involves the immersion of medical students into the role of a practicing physician who must employ effective clinical decision-making to treat a patient and understand their underlying disease. Because of this immersion, CBL has proven to be an effective means of educating medical students and preparing them for the wards in their senior years. Several game developers have used the intrinsic similarities between CBL and role-playing games to create educational products that similarly immerse medical learners. Medical Joyworks, an e-learning company founded in 2010, has been particularly successful at creating a CBL-style mobile video game called Clinical Sense. With over one million downloads on the Google Play Store, Clinical Sense places the player in the perspective of a physician who must correctly choose the proper interaction with a virtual patient to progress the story. Other developers have created immersive narrative video games to teach learners how to utilize appropriate heuristics (cognitive pattern recognition processes). In collaboration with a company called Schell Games, researchers of a 2017 study found that a narrative video game called Night Shift (Figure 1) on Apple iPads proved to be a superior method of training emergency medicine physicians to rapidly identify moderate to severe patients requiring triage compared to traditional didactic lecturing. Following a gaming session lasting at least one hour, the video game-trained physicians were significantly less likely to under-triage, both immediately following and at six months after playing the game.

Sensorimotor development
Popular video games like League of Legends are fast-paced team games that require effective communication and a strong selective attention span. In fact, such games have been shown to train mental acuity and increase a player’s visual selective attention, reading accuracy, and cognitive flexibility. In addition to these cognitive benefits, video games have been shown to increase fine motor skills. Perhaps consequential to using rigorous handheld controls, which train hand-eye coordination and physical dexterity, video games confer an increase in sensorimotor learning, which enhances the ability to learn the dynamics of unfamiliar sensorimotor tasks.
Studies have shown that video games aid in the development of dexterous skills that are translatable to surgical operating rooms. In 2007, a study by Rosser et al. evaluated a group of surgical residents for their laparoscopic skills and suturing capabilities. The study found that participants who reported previous video game play exceeding 3 hours per week achieved a 27% faster completion time and did so with 37% fewer errors than their non-video game playing colleagues. They also found that those who were better at video games performed better in their laparoscopic and suturing demonstrations, concluding that there was a positive correlation between skillful video game play and increased manual dexterity. Further studies have confirmed this positive association and have attributed it to an increase in psychomotor skills, even going as far as to evaluate which video game consoles have the most skill translation. Practically, video game use has clinical significance as well. In 2018, an article published by the British Broadcasting Corporation interviewed a group of 33 surgeons and reported that video games have improved their quality of training and practice, strengthening factors such as concentration, reaction time, and hand-eye coordination, all of which would be important when focusing on a screen during laparoscopic surgeries.

High-quality simulation

Early video game home entertainment systems, such as the popular Super Nintendo Entertainment System in the early 1990s, had relatively low micro processing power resulting in graphically limited games that required around 0.23 megabytes to 4 megabytes of storage. Today, the average smartphone game on the Apple iOS store is 67.7 megabytes, and more graphically intensive games, like God of War on the PlayStation 4, require around 45 gigabytes. Because of these processing and storage achievements, medical educational video game developers have been able to create products that are so graphically powerful that they border on realistic medical simulation. One particular developer who has demonstrated great success in medical video game simulation is Sam Glassenberg, founder and CEO of Level Ex. Level Ex is a software development company that creates mobile video games and the first noticed the potential of using video games as an educational tool when he created a mobile video game for his grandfather, an anesthesiologist, who needed to teach residents how to perform a bronchoscopy. Since the success of its first game, Level Ex has produced multiple graphically intensive mobile video games that teach learners how to perform challenging real-life medical procedures. In March 2019, Level Ex released a game called Cardio Ex that teaches players how to perform difficult interventional cardiology procedures.
(Figure 2). Players have the ability to manipulate a fluoroscopy-based three-dimensional representation of the heart and are equipped with a host of tools like non-compliant/semi-compliant balloons, drug-eluting stents, polytetrafluoroethylene stents, aspiration catheters, and atherectomy drills. In the United States, the simulation and educational aspects of Cardio Ex are considered so powerful by the Accreditation Council for Continuing Medical Education that cardiologists who play the game are awarded Continuing Medical Education (CME) credits for reaching specific milestones. Currently, Level Ex has four games targeted towards cardiologists, pulmonologists, gastroenterologists, and anesthesiologists that can award CME credits, with more games currently in development.

**Conclusion**

As medical students who have played video games for nearly their whole lives, it is the authors’ belief that educational medical video games present a unique opportunity for learners. In addition to being fun and engaging, the underlying aspects of video games like interactive storytelling, graphical realism, and sensorimotor stimulation, warrant increased consideration from curriculum developers. These benefits are not exclusive to medical students, as evidenced by the provision of CME credits and increase in surgical performance when playing these games. Furthermore, as computer technology becomes more powerful and portable, the educational potential of video games will undoubtedly continue to improve. Whether you are a first-year medical student looking to develop your clinical decision-making skills or a seasoned cardiologist looking to expand your surgical horizons, there is likely a video game waiting for you to try.

**Conflict of interest**

The authors have declared no conflict of interest.

**References**

A review of wilderness patient transport: a British Columbian perspective

Andrew Stanley¹, Holly Buhler²
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Abstract
British Columbia is a mountainous province known for wilderness adventure. In British Columbia, transport of patients injured in the wilderness is conducted by a network of agencies including British Columbia Emergency Health Services (BCEHS), the Canadian Armed Forces, and 83 volunteer Search and Rescue teams. This narrative review examines select topics in order to provide allied health professionals with an understanding of resources in British Columbia and how they compare to jurisdictions elsewhere to identify areas for improvement.

The mode of transport is based on the patient’s condition and factors at the scene, making it important for both air and ground resources to work together smoothly to provide the greatest benefit to the patient. Often both ground and air resources are involved on a single rescue. Transport time is heavily dependent upon the distance from the site of dispatch to the patient, the environment, and the patient’s condition. Methods of helicopter rescue in British Columbia include landing, winch rescue (raising the patient to a hovering helicopter), and Helicopter External Transport Systems. The combination of these three methods in British Columbia is similar to the combination in the United Kingdom.

Qualification of transport personnel varies between resources, with some ground rescuers only required to hold first aid, while EHS helicopters in British Columbia are staffed by critical care paramedics who perform just as well as physicians on helicopters in other jurisdictions.

Overall, British Columbia’s system of wilderness transport is similar to that seen in other jurisdictions, but the field would benefit from a more robust body of research.

Introduction
British Columbia is a mountainous province that markets itself as a destination for wilderness adventure.¹ In British Columbia, patients injured in the wilderness are transported by a network of agencies working together. British Columbia Emergency Health Services (BCEHS) is formally responsible for prehospital care and transport throughout the province.² However, BCEHS may collaborate with other organizations that, for wilderness transport, include the Canadian Armed Forces (CAF) 442 Transport and Rescue Squadron,³ and the 83 volunteer Search and Rescue (SAR) teams throughout the province.⁴ Each organization in this network contributes unique abilities to the wilderness transport capacity in British Columbia. This narrative review examines select topics relevant to wilderness transport and relates them to current practice in British Columbia. We hope to provide allied health professionals with an understanding of the available resources and how they compare to jurisdictions elsewhere, and to identify areas for improvement.

Mode of Transport
The International Commission for Alpine Rescue (ICAR) guidelines specify three general indications for choosing helicopter over ground transport: the patient’s medical condition, conditions at the scene (terrain, weather, etc.), and moving bulk equipment.⁵ Accordingly, a study of 309 helicopter transports from Swiss Alpine Club huts found that medical severity accounted for about one-third of missions, and remote location was responsible for the rest.⁶ In a review of rescues from Banff National Parks, helicopters were used in 64% of transfers due to the remote wilderness locations and the technical nature of the terrain.⁷

The rate of helicopter use seen in 1088 rescues recorded by the Alpine Club of Canada was 37.4%, whereas ground transport was involved in 87.1% and was the exclusive method in 49.7%.⁸ Notable here is that even when the initial response is by helicopter, ground crews may still be required to assist in the rescue and the patient may still be transported by ground, reinforcing the importance of British Columbia’s volunteer SAR teams and their ground rescue capabilities.⁹,¹⁰

While studies have demonstrated a survival benefit to transporting non-wilderness trauma patients by helicopter rather than ground ambulance, few studies have examined the benefit during wilderness transport, where the distances are often long and resources limited.¹¹ A retrospective analysis of 1018 skiers and snowboarders who suffered a traumatic brain injury compared the effect of helicopter versus ground transport on survival: transport via helicopter conferred a survival benefit that the authors attributed to the ability to quickly travel the large distances from remote ski areas to receiving facilities.¹² Here in British Columbia, where neurosurgical resources are concentrated in the southern one-sixth of the province geographically, this speed-over-distance benefit has the potential to be particularly valuable.¹³ However, this must be balanced against the risks inherent to helicopters. For instance, helicopter accidents that occur during wilderness transport have twice the fatality rate of accidents during general civilian flight.¹⁴

Transport Time
ICAR guidelines and others highlight the impact that delays in transport from wilderness locations can have on patients.¹⁵ With long distances and a sparsely distributed population, the most relevant benchmark for helicopter response times in British Columbia may come from a Norwegian study that recorded average dispatch-to-take-off (activation) times of nine minutes and total response times averaging 47 minutes.¹⁶,¹⁷ In Central and Western Europe, total response time was found to be more closely correlated with flight time than with activation time, suggesting the location of resources is

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the more important factor.\textsuperscript{18}

The complexity of a patient’s injuries, together with terrain and environment, can also increase the time to hospital, as illustrated in a study from Austria showing that 18\% of major trauma patients took more than two hours to reach a hospital from wilderness environments.\textsuperscript{19} A Swiss study further supported patient severity as a cause of delay, with crews averaging 54 minutes on the scene with severely injured patients compared to 37 minutes with moderately injured patients.\textsuperscript{19}

While no published information about wilderness response times in British Columbia was identified during this review, most dedicated Emergency Health Service (EHS) helicopters are based in the south of the province, suggesting increased response times should be expected in the vast northern wilderness.\textsuperscript{20} Increased data in this area would be helpful for drawing comparisons to other jurisdictions and identifying areas for improvement, as suggested by ICAR.\textsuperscript{21}

Methods of Helicopter Rescue

There are three primary helicopter rescue techniques: landing, winch rescue, and Helicopter External Transport Systems (HETS).

Landing the helicopter to embark a patient is the simplest approach, requiring the least specialized equipment, least training, and least risk; however, its disadvantage is requiring a landing site, which may be some distance from the patient.\textsuperscript{22,23} The time taken to transport the patient by ground to the landing site will therefore detract from the helicopter’s benefit.

Winch rescue involves the helicopter hovering above the patient, using a winch to lower a rescuer, and then raising both the patient and the rescuer to the helicopter cabin for transport.\textsuperscript{9} The capacity for winch rescue is encouraged by ICAR to facilitate rapid rescue from challenging environments; however, it comes with the greatest cost, training demand, risk of malfunction, and helicopter weight requirement.\textsuperscript{19,21} Additionally, because winching is technically challenging, even winch-equipped helicopters land when possible, with two Swiss studies showing that winch rescue was required in just 8.4–9.3\% of responses.\textsuperscript{19,24} In the United States, a review of 214 winch rescues identified perceived danger associated with ground rescue as its primary indication, though time, distance, and the need for technical rescue are identified elsewhere.\textsuperscript{9,23}

HETS involves landing away from the patient, securing a rescuer beneath the helicopter via a fixed line, flying to the patient with the rescuer suspended below, securing the patient together with the rescuer, and then returning them to the landing site for embarking onto ground transport or the helicopter cabin.\textsuperscript{21} HETS has the same ability as winching to extract patients from challenging environments using smaller, more economical helicopters and less complex equipment. The drawback is that HETS requires additional landings, which takes extra time. Still, HETS has been shown to save at least 30 minutes versus ground transport in the most time-critical patients, and ICAR considers HETS to be an acceptable alternative to winch rescue where resources are limited.\textsuperscript{17,21}

In British Columbia, BCEHS requires landing zones to embark patients onto its helicopters, winch rescue is conducted by the CAF, and HETS is provided by helicopters contracted through volunteer SAR teams.\textsuperscript{20,23,26} This arrangement is similar to that in the United Kingdom, where only SAR helicopters have winch and HETS abilities while EHS helicopters must land to embark patients.\textsuperscript{25} In Victoria, Australia, however, the state’s five EHS helicopters are all equipped with winches, allowing one service to carry out the full spectrum of helicopter wilderness transport.\textsuperscript{27} As this approach offers the advantage of pairing the greatest rescue capabilities with the greatest medical skillset in a single rescue resource, it may be beneficial to explore the inclusion of winch rescue capabilities on EHS helicopters in British Columbia.

Qualification of Transport Personnel

The skill of wilderness transport personnel has been identified as a critical factor in patient outcomes.\textsuperscript{28} For ground transport, B.C. government guidelines mandate all SAR personnel remain current in a seven-hour first aid course and suggest each field rescue group have one member with a 16-hour first aid course.\textsuperscript{29} When transport times exceed 20 minutes, at least one member must have 70 hours of first aid training or more. The make-up of SAR teams in British Columbia is heterogeneous, and many teams have paramedic or physician members.\textsuperscript{21} These requirements and general team makeup are consistent with observations in a survey of SAR teams in the intermountain west region of the United States, where 66\% were trained to a first aid/CPR level, 17\% as Emergency Medical Responders (EMR), and 17\% above EMR.\textsuperscript{30} In the extreme wilderness environment of Denali National Park in Alaska, however, physicians, mid-level providers, paramedics, emergency medical technicians, and nurses care for 90\% of all patients seen by the National Parks Service, whereas only 10\% are cared for exclusively by a lower level provider.\textsuperscript{31} No published sources were identified that described a similar targeting of high-level resources to extreme environments in British Columbia, and this may represent an opportunity to improve care for those at the greatest risk of injury.

In North America, rescue helicopters are typically staffed by paramedics, whereas elsewhere, it is common to include a physician.\textsuperscript{32} In Australia, the Greater Sydney Area Helicopter Emergency Medical Services (GSAHEMS) utilizes a physician-paramedic team. A study of 120 missions by GSAHEMS found physician-only interventions were carried out on 40\% of patients, an outcome they felt justified the provision of physicians on helicopters.\textsuperscript{33} However, the only observed physician-only interventions outside the scope of practice of Critical Care Paramedics (CCPs) in British Columbia were a fascia iliaca block and a tube thoracostomy, with B.C. CCPs limited to needle thoracostomies.\textsuperscript{34} Two other studies from Austria and Switzerland have also examined the procedures carried out by physicians on helicopters. Similarly, tube thoracostomy and peripheral nerve blocks were the only interventions performed in these studies, which were outside the scope of practice of B.C. CCPs.\textsuperscript{10,24,34} In Victoria, Australia, Intensive Care Flight Paramedics have a scope of practice similar to B.C. CCPs. In a study of 125 helicopter winch rescues carried out by Intensive Care Flight Paramedics, the most common procedures were analgesia, vascular access, and antiemetic administration. The only advanced procedures required were two thoracostomies. These findings suggest that the scope of practice for CCPs is sufficient.\textsuperscript{27} When the performance of physicians and paramedics were directly compared, no difference in survival was found between patients attended to by a physician and those attended to by a paramedic during rural Australian helicopter transport.\textsuperscript{35} Thus, the current practice of staffing EHS helicopters in British Columbia with paramedics rather than physicians seems to be supported by the literature.
Conclusion
Transporting patients injured in the wilderness is an essential part of pre-hospital care in British Columbia, a province known for its abundant outdoor activities. For those likely to care for patients transported from wilderness locations, this review draws attention to the variation in transport times depending on the resources involved and the location of the event, which should be considered when planning resuscitation. It also highlights the diversity of qualifications amongst wilderness rescue personnel in British Columbia and illustrates that the use of paramedics rather than physicians on EHS helicopters does not suggest inferior care. This review has illustrated that the components making up British Columbia’s wilderness transport network function similarly to those in other jurisdictions, but that there are also opportunities for improvement. In particular, the expansion of winch rescue capabilities in this province would decrease the time to care for patients injured in the wilderness, and further study and publication of response and transport times would allow more meaningful comparison to other jurisdictions.

Table 1 | Public wilderness transport resources based in British Columbia. BCEHS, B.C. Emergency Health Services; CAF, Canadian Armed Forces; SAR, Search And Rescue; HETS, Helicopter External Transport Systems.

<table>
<thead>
<tr>
<th>Agency</th>
<th>Resources</th>
<th>Qualifications</th>
</tr>
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<tbody>
<tr>
<td>BCEHS</td>
<td>Two wheel drive ambulances: 482</td>
<td>Licensed as one of:</td>
</tr>
<tr>
<td></td>
<td>Four wheel drive ambulances: 9</td>
<td>- Emergency Medical Responder</td>
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<tr>
<td></td>
<td>Sikorsky S76 helicopters: 3</td>
<td>- Primary Care Paramedic</td>
</tr>
<tr>
<td></td>
<td>Bell 412 helicopter</td>
<td>- Advanced Care Paramedic</td>
</tr>
<tr>
<td></td>
<td>Private helicopters hired as needed</td>
<td>- Critical Care Paramedic</td>
</tr>
<tr>
<td>CAF</td>
<td>CH-149 helicopters</td>
<td>SAR Tech, encompassing:</td>
</tr>
<tr>
<td></td>
<td>Equipped with winch</td>
<td>- Primary Care Paramedic</td>
</tr>
<tr>
<td></td>
<td>Diverse land vehicles</td>
<td>- Arctic rescue</td>
</tr>
<tr>
<td></td>
<td>Four wheel drive vehicles</td>
<td>- Parachuting</td>
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<tr>
<td></td>
<td>All terrain vehicles</td>
<td>- Diving</td>
</tr>
<tr>
<td></td>
<td>Snowmobiles</td>
<td>- Mountaineering</td>
</tr>
<tr>
<td>SAR</td>
<td>Diverse watercraft</td>
<td>Required training:</td>
</tr>
<tr>
<td></td>
<td>Boats</td>
<td>- Ground SAR course</td>
</tr>
<tr>
<td></td>
<td>Jet ski</td>
<td>- First aid (7 hours)</td>
</tr>
<tr>
<td></td>
<td>Hovercraft</td>
<td>- First aid (16 hours)</td>
</tr>
<tr>
<td></td>
<td>Private helicopters as needed</td>
<td>- First aid (70 hours)</td>
</tr>
<tr>
<td></td>
<td>Equipped with HETS</td>
<td>- Members may have further medical and rescue training</td>
</tr>
</tbody>
</table>

Conflict of interest
The authors have declared no conflict of interest.

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Backcountry triggered avalanches: a summary of risk factors, causes of death, and wilderness medical management

Adam Stich1, Jacob Blanco2

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Abstract

Deaths due to avalanches have a significant mortality burden in Western Canada. The aim of this review is to summarize risk factors, causes of death, and important mitigation and management strategies in treating avalanche victims. Multiple risk factors for avalanches have been identified, which relate to both physical characteristics of the avalanche environment as well as human factors. Winter backcountry recreationists should be mindful of their motivations for exposing themselves to avalanche dangers and remain objective to the physical characteristics conferring avalanche accident risk. Asphyxia is responsible for the vast majority of deaths due to avalanche, while trauma remains an important cause in certain geographic areas. Avalanche training courses educate learners on avalanche rescue sequences, which utilize avalanche transceivers, probes, and strategic shoveling techniques. The primary goal of rescue is to reduce the median time of burial, thereby decreasing the incidence of asphyxia and ultimately, death. Following the extrication of an individual from an avalanche, rescuers may have to begin resuscitation efforts.

Future developments in avalanche safety should focus on public education of avalanche risk factors, incorporation of basic life support into avalanche training courses, and further development of technologies that may increase survivability.

Introduction

Backcountry winter recreation has spiked in popularity over the past few decades.1 In Canada, an average of 12 avalanche deaths occurred annually between 2008–2018, with the majority occurring in British Columbia (82.9%) and Alberta (13%). Snowmobilers contributed 48.8% of these fatalities, while backcountry skiing and out-of-bounds skiing cumulatively accounted for 25.2%.2 While the avalanche mortality burden is relatively low compared to other causes of death, the disproportionate impact seen in British Columbia combined with the rising popularity of recreation in avalanche terrain highlights the necessity for greater avalanche awareness. This is particularly pertinent given avalanche awareness and safety training programs have been found to be effective in preventing avalanche accidents, as well as mitigating consequences in avalanche victims.3,4 The goal of this review is to summarize risk factors for avalanche accidents, causes of death, and important mitigation and treatment strategies helpful in maximizing survivability. This review is not intended to be used as a field guide, nor should it replace formal wilderness medical training.

Avalanche Risk Factors

It is estimated that 90% of deaths from slab avalanches in Europe and North America are the result of human triggering.4 McCammon found that avalanche awareness and safety programs have been associated with a decrease in avalanche mortality, suggesting that there are mitigation strategies that can be employed to prevent avalanche-related burial, critical injury, or death.3

We reviewed the literature to identify risk factors implicated in avalanche triggering or accidents and have separated these into physical features relating to weather, season, or terrain characteristics (Table 1), and human factors relating to avalanche triggering risk, exposure to avalanche terrain, and behavioural factors influencing the decision to expose oneself to avalanche hazard (Table 2).

Several studies have identified physical risk factors for triggering avalanches, all of which can be factored into decision-making regarding exposing oneself to avalanche hazard.4,6 Unsurprisingly, information publicly available through avalanche forecasting, including snowpack instability and high avalanche danger ratings, were found to be associated with an increase in avalanche triggering and accident risk.5–6 McClung et al. identified slab depths between 0.6–1.0 m and slope angles between 33–45° to be associated with the highest risk of triggering an avalanche of sufficient size to cause critical injury or death.7 Additionally, Grimsdottir and McClung found that the risk of triggering avalanches was greater in the alpine environment (2200 m above sea level), in early and mid-winter, and on north, northeast, and east facing slopes.5

A number of studies have identified human factors associated with avalanche triggering risk, accident risk, and exposing oneself to avalanche terrain (Table 2).5,6–8 Individuals aged 25–29 were found to

| Table 1 | Risk factors related to physical conditions. |
|---|---|---|
| **Study (study location)** | **Outcome Studied** | **Risk Factor Identified** |
| Grimsdottir and McClung (2006) (British Columbia) | Risk of triggering avalanche | Snowpack stability rated poor or very poor |
| | | Alpine environment |
| | | Early and mid-winter |
| | | North, Northeast, and East facing slopes |
| Techel et al. (2015) (Switzerland) | Risk of avalanche accident | Avalanche forecast danger level (positive correlation with increasing danger rating) |
| | | Unfavourable snowpack (i.e., persistent weak layer) |
| McClung et al. (2014) (Switzerland and British Columbia) | Risk of avalanche accident | Slab depth; fatality increased with slab depth, however risk of triggering decreased. Risk of accident was highest between 0.6–1.0 m |
| | | Slope angle 33–45°. Highest risk of triggering was between 38–40° |

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be most risk tolerant and at higher risk for avalanche accident. Males were found to be at higher risk for avalanche accident compared to females. Interestingly, Gehring and Latosuo found no association between avalanche terrain usage and danger rating, and found usage was highest on weekends regardless of avalanche danger. Similarly, Techel et al. found no association between avalanche terrain exposure and snowpack instability. These results suggest that the decision to enter avalanche terrain may be influenced more by recreationalist availability than avalanche triggering risk. A lack of formal avalanche safety training was associated with higher risk tolerance as well as avalanche accident risk. With regards to decision-making in avalanche terrain, Furman et al. found that recreationalists were more likely to expose themselves to avalanche terrain if the forecast suggested minimal hazard, a slope was untracked or was familiar to the user, the group had an identified leader, other parties were present in the terrain, or if a skier was committed to a particular line. Furthermore, Sole and Emery found individuals who desired intense experiences or were motivated by “fun-seeking” had a higher risk of avalanche accident.

Our analysis of avalanche risk factors suggests that while snowpack instability and avalanche danger ratings are accounted for in avalanche forecasts due to their association with increased avalanche risk, these do not necessarily correlate with lower avalanche terrain usage by recreationalists. Users should be mindful of their motivations for exposing themselves to avalanche dangers and remain objective to the physical characteristics conferring avalanche accident risk. This is particularly important for high risk groups—namely, males aged 25–29. The findings of our review also suggest that avalanche safety training remains an effective strategy for decreasing avalanche accident incidence, both by preventing high-risk exposure and by training users to mitigate consequences of avalanche exposure if they occur. Avalanche Canada reports that avalanche safety training course enrollment has been increasing with the boom in popularity of winter backcountry recreation; however, the proportion of enrollment for motorized users has been low compared to self-propelled users. Thus, efforts to improve snowmobilers’ participation in avalanche safety training may help to reduce their disproportionately high avalanche mortality risk.

**Causes of death**

Among several studies analyzing cause of death in avalanche victims, asphyxia was unanimously found to be the most common cause of mortality. Boyd et al. analyzed the causes of avalanche fatality in British Columbia and Alberta between 1984–2005 based on postmortem autopsy or full external examination, and found that the majority of deaths were caused by asphyxiation (75%) and trauma (24%). Similarly, Hohlreider et al. reviewed autopsy reports of avalanche victims presenting to the University Hospital of Innsbruck in Austria between 1996–2005, and found that 91.7% of deaths were attributable to asphyxia, while only 5.5% were due to trauma. McIntosh et al. examined medical records of avalanche fatalities from 1989–2006 from the Utah Avalanche Centre and the Medical Examiner’s records in Utah, and found the leading cause of death to be asphyxia (91.7%), with only 5.4% of deaths being caused by trauma alone. Although these retrospective reviews consistently identified asphyxia as the most significant cause of death, geographical differences exist. In Western Canada, trauma is a significant cause of avalanche mortality. This differs from studies conducted in Europe and the United States and may reflect differences in terrain or type of backcountry activity. Collision with trees is often implicated in traumatic avalanche accidents, which may account for this difference as there is more accessible forested terrain in parts of Western Canada, including British Columbia and Alberta.

<table>
<thead>
<tr>
<th>Study (study location)</th>
<th>Outcome Studied</th>
<th>Risk Factor Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furman et al. (2009) (USA)</td>
<td>Exposure to avalanche terrain</td>
<td>Forecast suggesting minimal hazard</td>
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<tr>
<td></td>
<td></td>
<td>Untracked slope</td>
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<tr>
<td></td>
<td></td>
<td>Familiar terrain</td>
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<td></td>
<td></td>
<td>Group had a leader</td>
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<td></td>
<td></td>
<td>Other parties present</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Skier committed to skiing a particular line</td>
</tr>
<tr>
<td>Gehring and Latosuo (2014) (Alaska)</td>
<td>Factors associated with higher risk tolerance</td>
<td>Risk tolerance decreased with increasing levels of avalanche training</td>
</tr>
<tr>
<td></td>
<td>Exposure to avalanche terrain</td>
<td>Age 25–29</td>
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<tr>
<td></td>
<td></td>
<td>Weekends more common, regardless of avalanche danger</td>
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<tr>
<td></td>
<td></td>
<td>No correlation between avalanche terrain usage and avalanche danger</td>
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<tr>
<td>Techel et al. (2015) (Switzerland)</td>
<td>Exposure to avalanche terrain</td>
<td>No correlation between avalanche terrain usage and unfavourable snowpack (i.e., persistent weak layers)</td>
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<td></td>
<td></td>
<td>Male sex</td>
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<td>Age 25–29</td>
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<td></td>
<td></td>
<td>Desire for intense experiences</td>
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<td></td>
<td></td>
<td>Exposure time</td>
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<td></td>
<td></td>
<td>Male-dominant groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Behaviour motivated by “fun seeking” as opposed to “memory creating”</td>
</tr>
<tr>
<td>Sole and Emery (2008) (Western Canada)</td>
<td>Avalanche mortality</td>
<td>Lack of formal avalanche safety training (due to more risks taken and decreased risk mitigation by victims)</td>
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<tr>
<td></td>
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<td>Male sex</td>
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<td>Age 25–29</td>
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<td>Male-dominant groups</td>
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<tr>
<td></td>
<td></td>
<td>Behaviour motivated by “fun seeking” as opposed to “memory creating”</td>
</tr>
<tr>
<td>McCammon (2000) (USA)</td>
<td>Avalanche accident risk</td>
<td>Lack of formal avalanche safety training (due to more risks taken and decreased risk mitigation by victims)</td>
</tr>
</tbody>
</table>

**Approach to Management in the Field and Safety Equipment**

**Rescue Sequence**

The Wilderness Medicine Society has published guidelines on the Prevention and Management of Avalanche and Snow Burial Accidents. When an individual is buried in an avalanche, they first recommend establishing and ensuring scene safety prior to carrying out the rescue. A visual surface search can then be carried out to identify an incomplete burial. If the visual search is not successful, rescuers are then recommended to perform transceiver search, followed by a pinpoint/probe search and strategic shoveling to uncover the avalanche victim. Contacting local emergency services should not delay the rescue response and can happen at any point during the rescue.

When avalanche rescue is initiated by companions at the scene, as opposed to professional rescue teams, the time to extrication is
shorter (16 versus 150 minutes) and the probability of survival is higher (75% versus 30%).16 The use of avalanche transceivers is also associated with a shorter median burial time (20 versus 102 minutes without transceivers) and reduction in mortality (53.8% versus 68%).17 Furthermore, the probability of survival significantly decreases after 35 minutes of burial.18 Given that asphyxia is the most common cause of death, reducing burial time is paramount and backcountry users should be prepared and able to perform companion rescue efficiently.

Resuscitation
Following the extraction of an individual from an avalanche, a rescuer may have to begin resuscitation efforts if clinically indicated. With limited resources or assistance, this can be a daunting task in the avalanche terrain. In a rescue sequence, the Wilderness Medicine Society advises using the European Resuscitation Council (ERC) Guidelines.25 Section 4 of the ERC guidelines comments on resuscitation in special environments including avalanches, recommending “high-quality cardiopulmonary resuscitation (CPR) with minimal interruption of chest compressions and treatment of reversible causes.”26 Trauma can exacerbate hypothermia and asphyxia, and is an important cause of avalanche death in Western Canada.11 The Wilderness Medicine Guidelines recommend trauma care as an integral part of resuscitation, including appropriately managing suspected spine injuries using validated guidelines such as the Canadian C-Spine Rules or Nexus.2 Moreover, avalanche resuscitation should include management of hypothermia using a combination of insulation and vapor barriers.20

An in-depth discussion of resuscitation and management in the field is beyond the scope of this article. It is, however, important to note that Basic Life Support (BLS) or CPR training is not currently incorporated into avalanche safety courses such as Avalanche Safety Training One or Avalanche Safety Training Two, and therefore may represent an area for future improvement in avalanche safety training.

Developments in Safety Equipment
With increased backcountry usage, there has also been development in technologies that may reduce mortality related to avalanches.22,23 The avalanche rescue airbag is a piece of equipment that allows the user to inflate to emergency balloons that are integrated into a special backpack. An avalanche rescue airbag can decrease the depth of burial during avalanche through decreasing effective density of the user. Although the avalanche rescue bag started as a niche product in the 1970s, it has undergone recent development and is now more widely accepted amongst backcountry users.24 A retrospective review of global avalanche data found a significant reduction in mortality associated with usage of the airbag equipment (22% to 11%).24 As market competition in avalanche airbag technology accelerates, the unit price of airbags will decrease. As the technology becomes more economical and affordable, it is expected that utilization by the backcountry community to continue to increase, having a significant impact on the future of avalanche safety.

Another piece of safety equipment to consider are Artificial Air Pocket Devices. These mouthpieces allow avalanche victims to divert CO2 away from their airway, thereby delaying asphyxiation.25,26 The device appears promising, but there is currently a lack of data demonstrating its effectiveness in real-world use.23

Conclusion
Backcountry enthusiasts who are entering avalanche terrain should take appropriate steps to educate themselves on the risk factors associated with avalanche accidents and strategies to mitigate those risks. Formal avalanche education programs have been shown to reduce avalanche mortality and we recommend that all users undertake this training and ensure they are proficient in avalanche rescue sequences prior to entering the backcountry. Future areas for improvement in avalanche safety include incorporation of first aid and basic life support into avalanche training courses, and further development of technologies that may increase survivability.

Conflict of interest
The authors have declared no conflict of interest.

References
Medicine and the media: a synergistic combination?

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Abstract
As second year medical students, we took part in an interdisciplinary journalism project that examined the links between fishmeal and fish farming industries in various parts of the world. Through this experience, we came to acknowledge a synergistic pairing between the fields of journalism and medicine by examining the similarities and differences in terms of information gathering and knowledge translation. Many journalism principles can aid immensely in the translation of medical knowledge to the general population, including the ability to construct a relevant narrative, gather information with open-ended and closed-ended questions, and ultimately produce a story that is influential and applicable to the audience.

In December 2018, we traveled to the coastline of Peru as fellows with the Global Reporting Program, an investigative journalism initiative based at the University of British Columbia (UBC), which aims to bring under-reported issues around the world into focus. We accompanied a skilled team of UBC Masters of Journalism students who were conducting a reporting project on the global impact of fishmeal production and its supply chain.

As a team, the journalism students worked to deliver a story that highlighted the global impact of fishmeal and fish farming industries in Peru, China, and Western Africa. As two medical students among this group, we often felt out of place and repeatedly asked ourselves what we could offer. We reasoned that we were able to contribute to the integrity of the project by offering a perspective on health-related topics in the story. Furthermore, through our experiences, we found ourselves drawing multiple comparisons between gathering information for medicine and for media. It has been suggested that the media may not accurately convey medical information,\textsuperscript{1,2} but after participating in this project, we concluded that techniques used in medicine and journalism could be complementary in the realm of knowledge translation.

We learned from the journalism students about acquiring information and concluded that their approach was quite different from what is taught in medicine. In medicine, evidence is gathered from a variety of sources in the literature upon which conclusions are based on. In journalism, it is more important to first identify a strong story, then search for powerful “characters” who can reinforce that point. This is a more direct way to illustrate a particular issue, but it can lead to scenarios in the media where contradicting viewpoints may be excluded from the story in order to strengthen its central theme. In best journalism practice, this exclusion is done strategically and in an informed manner.

A noteworthy part of our field work was spent in Chimbote, a fishing-centric coastal city approximately 400 kilometers north of the capital, Lima. This city was once a pristine beach destination, but over the last few decades has become increasingly polluted as fishmeal and fish oil production, canning, and frozen fish industries have implemented factories and plants. Our first impression of Chimbote was the overwhelmingly nauseating stench of rotten fish that seemed to permeate the entire city. A local biologist stated that this smell stemmed from a five to ten-meter layer of sludge at the bottom of the Bay of Chimbote, and illustrated this by digging up a bucketful while we were out on a boat. This sludge is a consequence of decades of unregulated dumping of unprocessed sewage and effluent from the fishmeal factories into the bay. The journalism lens placed great emphasis on the powerful image of the sludge itself, since it would provoke questions and concerns in the audience. Conversely, the medical approach to this environmental issue would undoubtedly be to focus on investigating the health consequences, such as respiratory and dermatological complications that would result from exposure to this unprocessed sewage. That day with the biologist provided us with an undeniable link between industrial activity, environmental damage, and human health consequences evidenced in the people of Chimbote.

In addition to participation in field work, the journalism team provided us an opportunity to act as the “team leader,” where we were responsible for coordinating and conducting interviews. We worked with a local nutritionist and visited a small fishing community, where we investigated the common nutritional deficits and health problems in the area. In preparation for that day, we discussed interviewing strategies with a journalism colleague. She highlighted the importance of starting with open-ended questions and subsequently moving to closed-ended questions. We immediately drew the parallel to medicine where we are instructed to start patient interviews with open-ended questions and later integrate closed-ended questions to obtain specific information. We were struck by how similar principles can apply in professions that one would assume to be vastly different. Though these techniques may be similar, the focus of the interview differs. The medical interview is focused on obtaining the most accurate health information from a patient, whereas a journalism interview works to evoke emotion by gathering quotes from the character that will most resonate with their storyline and target audience.

Together, journalistic and medical interview approaches can work in tandem to elicit a response in the audience that may subsequently inspire change or action. The utility of influential reporting is particularly prominent in healthcare, where the information gathered by health professionals must be disseminated and applied in a variety of settings. Medicine tends to focus on objective findings, with a subjective story lending support and additional details. In contrast, the priority in journalism is a subjective story, with objective findings providing support. Complex medical topics can be made more tangible to the general public when combining subjective stories with objective findings; appealing narratives are likely to influence health-related changes. In our medical education thus far, we have had opportunities for interprofessional education and collaboration, but exclusively with

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other health professions. Participating in this project exposed us to methods of knowledge translation that may not be traditionally utilized in healthcare, and allowed us to work with a multidisciplinary team to highlight the healthcare implications of an important global issue.

The topics addressed in this project—health, environmental change, and economics—are of huge importance to the public. The challenge lies in presenting these issues in a way that inspires action. Combining the reporting techniques commonly used in news media with those used in medicine can be a method to motivate the public to make these changes. Although they seem different in principle, this global interdisciplinary experience demonstrated that these techniques are quite complementary and combining them will lead to a more powerful story, a stronger response, and ultimately, a more successful knowledge translation. To illustrate an example of these synergistic benefits, we would like to direct the reader’s attention to the final product of this project, titled “The fish you don’t know you eat,” which includes a webpage and short films that aired on NBC Nightly News.

Acknowledgements
We would like to thank Peter Klein and the entire UBC Global Reporting Program team for graciously inviting us to participate in this project, as well as Dr. Videsh Kapoor for her ongoing support and mentorship throughout this project.

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References
Caution and guidance for the social media savvy physician

Wajid I. Khan

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Abstract

The advent of social media has brought forth the freedom to communicate information instantly to a large audience and its application in medicine has been beneficial for both patients and practitioners. Healthcare institutions and practitioners are utilizing the power of social media to inform and educate their peers and patients as well as the public. Patients are engaging in social discourse online, enabling them to become more involved in and informed about healthcare. It is in this climate that the matters of professionalism and patient privacy become a concern. Without a formal system of peer-review and the perception of anonymity, posting content on social media websites by healthcare providers is susceptible to crossing professional and ethical boundaries. Medical students and residents should be especially careful when posting online, as unprofessional content is common in their groups. Physicians should also be wary of self-promotion through entertainment, or “medutainment,” which can put patient privacy in harm’s way. When doctors review their intentions and follow guidelines (such as the Canadian Medical Protection Association tips) prior to posting on social media, a beneficial outcome can be achieved.

Over the last decade, the accessibility and popularity of social media have empowered both patients and physicians to share their opinions and stories online. Patients are using Twitter to express their dissatisfaction with healthcare, and joining Facebook groups or websites such as www.PatientsLikeMe.com to connect with other sufferers for support. For physicians, social media can serve as a platform to educate peers, patients, and the general public. Experts agree that physicians should legitimize their roles as public figures by taking an active part in social media to help combat the growing problem of health misinformation. While social media can evidently benefit medicine, it can also have a negative impact upon doctors and patients when content crosses professional and ethical boundaries.

Social media makes it easier for individuals to behave in ways that they would not behave in person. This “online disinhibition effect” is influenced by the lack of a formal review process, absence of social cues, and the perception of anonymity. Consider the case of a group of high-school students who had their acceptance to Harvard University rescinded as a result of posting offensive “meme” content on a Harvard Facebook group. Or, the discovery of past offensive tweets made by Hollywood celebrities in recent years, which has led to significant backlash from the public. When healthcare professionals use poor judgement, they may find themselves in a similar predicament. Indeed, posts containing unprofessional content are common among medical students and residents. In certain instances, individuals harbouring prejudice may circulate racist or discriminating comments. Such was the case with a Cleveland Clinic medical resident who was terminated for commenting on Twitter that she intended to mismanage patients of Jewish ethnicity, among other anti-Semitic remarks. Unfortunately, individuals or groups publicizing hateful and offensive content through social media are a growing problem, and resources to combat the issue are inadequate. Policing hate speech is a controversial topic, and some proponents of free expression suggest hate speech is best remedied with counter-speech or speech that denounces offensive posts. Amidst the debate, a simple yet helpful tip for physicians and students to remember is: if you would not say it in person, refrain from saying it online.

Patient confidentiality is another concern when doctors use social media. The tendency for online content to stray into medical education entertainment, or “medutainment,” can place privacy at risk. Medutainment is commonly observed in medicine when the purpose is to entertain or sensationalize in order to promote oneself. One such case involving a breast reduction surgery led to an undesirable confrontation between the surgeon and his patient. After obtaining patient consent, the surgeon shared a video of the procedure on Snapchat in which he held the patient’s breast tissue and told his audience, “Look at how much extra breast tissue you might be carrying around.” Later during a follow-up visit, the patient appeared visibly upset and asked the surgeon, “You hold up my breast tissue for the world to see and call that education?” and then stated, “I assumed you’d treat my experience with respect.” Although the surgeon had obtained consent before posting the video, the patient nevertheless felt her privacy was exploited. Such situations can be avoided by placing the interest of the patient above the need for self-promoting medutainment. More importantly, a fully informed consent process that includes educating patients about the risks of having their information disseminated online should be implemented. Patients should be reminded that public content may be viewed by anyone, including audience members who may be immature or underage. Furthermore, complete removal may be impossible because the content can be downloaded or shared. Patients can also be invited to view and approve their content prior to posting.

When utilized appropriately, the benefits of social media in medicine can outweigh the harms. It offers physicians the convenience of communicating medical knowledge instantaneously to a wide audience. Moreover, it enriches medical education by fostering collaboration, resource sharing, moral support, and feedback from peers and faculty. Indeed, research shows that integration of social media into one’s practice can promote excellence in abilities described in the CanMEDS framework, such as communication, interpersonal skills, professionalism, knowledge translation, and scholarly approach. Pathologists in the United States, for example, have made great educational strides by posting de-identified case images on social media. Medical Wikis, such as Radiopedia and WikiSurgery, are crowdsourced encyclopaedias maintained by volunteers and utilized by students as well as professionals. Furthermore, microblogging on Twitter is becoming a popular choice for medical journals and online journal clubs to share news of the latest medical literature.

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Interestingly, a positive correlation between a journal’s impact factor and the size of its Twitter following has been described. The Journal of Cardiovascular Electrophysiology has taken advantage of this trend by integrating the peer-review process into Twitter. Cardiologists can post electrophysiology cases with images, and by including the hashtag #JCEtweetpress, the cases can be peer-reviewed by professional editors and published in the journal.

Social media is also tremendously useful for engaging patients in healthcare and notifying the public. Hospitals use microblogging to broadcast notifications for organ donations, health fairs, bioterrorism alerts, fundraising, and results of satisfaction surveys. Alternatively, the Centers for Disease Control and Prevention uses social media to connect followers with information on health and safety topics. Medical blogs are also an excellent way for patients and physicians to exchange dialogue about important topics and make informed decisions about healthcare. For example, the New York Times’ health blog Well posts on topics ranging from medical research to patient well-being. Readers can share their comments and stories, and the most popular pieces are placed in the “Reader Picks” section. Another highlight is their sub-column Ask Well, which brings physicians and experts together to answer health questions such as “When is the Best Time to Get Your Flu Shot?” and “How Do You Treat Positional Vertigo?” Podcasts are another social medium popular for their episodic format. Healthcare podcasts such as Dr. Brian Goldman’s White Coat Black Art provide listeners with an in-depth perspective on healthcare issues relevant to Canadians while also encouraging discussion on such topics. From microblogging on Twitter to blogs, podcasts, and YouTube videos, a variety of social media platform options are available to healthcare practitioners and institutions.

Social media has now become an integral component of society. It is important to realize that while technology allows sharing of information instantly across the globe, healthcare professionals must uphold high moral and ethical standards while doing so. Patients entrust physicians with their care, and physicians have a responsibility to take the necessary precautions to protect patient confidentiality and dignity as well as perpetuate a positive public perception of their profession. To aid in this process, the Canadian Medical Protection Association (CMPA) has published articles on social media etiquette for Canadian medical students and physicians. The CMPA recognizes that social media is a powerful tool for exchanging information, provided that users are mindful of the pitfalls. Their tips (summarized below) can serve as a helpful guideline for healthcare professionals to navigate social media professionally and mitigate mistakes made online.

CMPA’s top ten tips for using social media in professional practice:
1. “Have an objective and select the right platform.” Facebook and Twitter are great for engagement, updates, and networking. Blogging and podcasts are best for informing the public, while YouTube is appropriate for educational videos.
2. “Avoid social media for one-on-one discussions.” Online chats place patient confidentiality at risk.
3. “Establish clear boundaries.” Separate your personal and professional accounts.
4. “Recognize that the reach is wide and the audience is unknown.” Keep information general as it may be difficult to tailor advice to a specific audience.
5. “Consider the impact of your communication style and reach.” Present information using professional language with credible sources.
6. “Generate interest and participation.” Invite and respect differing viewpoints and opinions.
7. “Be aware that libel, slander, and defamation apply.” Avoid untrue or damaging statements.
8. “Develop a social media policy.” Inform staff and patients of your policy.
9. “Manage privacy and minimize breaches.” Become familiar with security settings and policies.
10. “Follow College guidelines.”

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The author has declared no conflict of interest.

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The role of the public on physician remuneration in Canada: the cases of British Columbia and Ontario

Brendan McNeely

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Abstract
In Canada, publicly funded universal healthcare incorporates many stakeholders including provincial governments, healthcare professionals, and the general public. A recent move to openly disclose the dollar value billed each year by each healthcare provider in Ontario has received divided feedback. While this disclosure holds healthcare professionals accountable for their billing, it provides an exaggerated surrogate measure for their take-home salary. It is important to determine how well the public understands this limited information as public perception, through political pressure, may have important consequences for future determinations of healthcare policy, physician remuneration, and the quality of public healthcare as a whole.

Currently only British Columbia, Manitoba, Ontario, and New Brunswick publicly disclose physician names and their respective billing amounts.1 This holds important implications for the determination of future financial contracts between provincial governments and their respective medical associations. For example, as the Ontario government aims to reassess remuneration for healthcare billing following a new financial contract between legislators and the Ontario Medical Association (OMA), it is essential that any changes to the contract between physicians and policy makers are evidence-based and in the best interest of both the public seeking medical care and the healthcare providers.

The current four-year healthcare compensation contract in Ontario outlines an average health service billing increase of 1% per year. However, this increase does not account for the overhead costs of running a medical practice, such as staff salary, office space rental, supplies, and equipment, all of which continue to increase with inflation (~3% per year).23 To mitigate the discrepancy between government billing and the associated overhead costs of a medical practice, physicians will be required to see more patients to maintain the same take-home salary. With a growing and aging population in Canada, there is already an increased demand for healthcare services; as such any subsequent increase in patient volume will likely come at the expense of physician work-life balance and/or decreased quality of patient care, including decreased duration of appointments. Moreover, the Supreme Court of Canada has declined an appeal by the OMA to prevent the public disclosure of the highest billing Ontario physicians by name.4 While the public disclosure of such information will maintain transparency and accountability already present for many physicians, the true context of how the billing relates to healthcare practitioner income may be lost, particularly within specific specialties or towards specific physicians. For example, medical specialties like Ophthalmology and Orthopaedics incur greater operational costs, therefore it is important to also determine whether public perception may be skewed for specific specialties.5

Meanwhile in British Columbia, the Medical Services Commission has released their annual report (colloquially known as the “Blue Book”) since 1986 while the current financial agreement between legislators and B.C. physicians is in place until 2022.6 Listing B.C. physicians alphabetically, the “Blue Book” presents each physician’s total yearly billing for the healthcare services they provided but does not list the remuneration of salaried physicians. Physician remuneration in British Columbia has received substantially less media attention than recent changes in Ontario, although B.C. physicians continue to make less than the national average.7 Based on their current financial agreement, the discrepancy in financial compensation between B.C. physicians and their provincial counterparts may be further exacerbated in the coming years. The current Physicians’ Master Agreement in British Columbia only allocates a 0.5% annual increase in billing rates per year,8 whereas across the other provinces excluding Quebec, yearly billing increases range from 1% to the respective province’s annual increase in cost of living (~2.5–3%).6-12 Despite a one-time payment of $7500 to physicians who earned over $75,000 in 2018, the financial agreement is not conducive to recruiting physicians from other provinces to practice in British Columbia.9 In addition, the exaggerated discrepancy will likely set B.C. healthcare professionals behind their colleagues and could ultimately result in B.C. physicians seeking job opportunities elsewhere. However, this is speculative and the relocation of practicing Canadian physicians between provinces is a topic which requires further investigation. With a reduced number of working physicians, there could be additional strain on the B.C. healthcare system including longer waiting times and increased physician burnout. Public support for potential B.C. physician advocacy groups during financial contract discussion could serve as an avenue for the public to reduce the discrepancy between British Columbia and the rest of Canada and potentially reduce wait times and improve patient care in British Columbia through physician recruitment and retention.

Importantly, a potential next step as provinces look to further openly disclose their physicians’ billing amounts is for future research to be aimed at determining the public’s understanding of healthcare provider remuneration. Evidence-based policy making serves as a contemporary effort to match government expectations to relevant on-the-ground conditions.13 As such, determining public opinions on physician remuneration can serve to direct future changes at the legislative level and ensure that healthcare professionals are accurately compensated.14-15 Moreover, in an effort to maximize physician health and the care of their patients, it is essential to assess how public perception affects remuneration for healthcare billing across all specialties and their respective patient visits/procedures.1 Providing a base of verified information from which the public can make informed decisions can help direct the governing bodies concerning physician compensation.

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Ultimately, provincial governments across the country should continue to work with their respective healthcare providers to determine fair compensation. In addition, there exists a role for the public to support healthcare providers by advocating for fair healthcare compensation to their local governments. First, it is essential that the public is fully informed as to the manner and degree in which healthcare providers are compensated in order to form well-informed opinions. In particular, when publicly disclosing information pertaining to remuneration of its employees, governments should openly include all pertinent information including the operating costs of a practice and whether the physician is salaried or compensated on a billing/fee-for-service platform. Providing contextual information in combination with the specific billing values would thereby provide the public with the full picture of physician remuneration. Altogether, open transparency on the part of physicians and governments can inform decisions that result in improving patient care countrywide.

Conflict of interest

The author has declared no conflict of interest.

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An analysis of current trends in multimedia platform usage and surgery

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Abstract
The past few years have seen a significant increase in social media use amongst surgeons/surgical trainees across various subspecialties. In this paper, we argue that social media can positively impact the field as it serves as a platform for furthering education and important social movements. That being said, physicians and educators must be aware of the shortcomings it poses as well. These include threats to professionalism, privacy, and quality of information.

Background
As of 2019, there are 3.48 billion social media users globally, with a yearly increase of 9%5. Social media can be defined as “an online-mediated technology that facilitates the creation and sharing of information, ideas and other forms of expression via virtual communities and networks.”2 A broader definition of social media can be taken to include modalities such as podcasts, tablet apps, and blogs.

While a majority of people use social media for networking amongst friends, sharing media, and staying on top of current trends,3 a substantial amount of people have started to use social media for professional purposes. This is especially true amongst certain surgical subspecialties. In a 2012 national survey, the number of U.S. plastic surgeons using social media for professional purposes almost doubled from 28.2% in 2010 to 50.4% in 2012.5 A similar increase was seen in U.K. colorectal surgeons during the years 2013–2016,4 and even amongst neurosurgeons with 70% of neurosurgeons across the U.S. reporting social media use for professional purposes in 20177.

The rise in social media use amongst surgical trainees and surgeons can be seen to positively impact the field in the sense that it can help with knowledge dissemination, patient engagement, and the erosion of harmful stereotypes. That being said, surgeons should be aware of the potential for harm as well, which includes threats to professionalism and the potential to adversely impact public perception.

Trends in education and social justice
Social media can greatly assist in the dissemination of knowledge to surgeons, surgical trainees, and the general public given the widespread reach that the internet has.8-10 The presence of platforms, such as Research Gate and Twitter, have made information readily accessible to users. Surgical journals that have social media accounts have significantly higher outreach and engagement rates than journals that do not.11 Information is even distributed in more informal ways such as “Tweetorials,” which take the form of short explanations of tricky medical/surgical concepts.12 It seems that surgical trainees have been quick to pick up on this, with a 2016 study finding that general surgery residents who were Twitter participants increased their board examination percentile scores by 13.7% on average. One hundred percent of these users also reported that daily microblogging prompted them to engage in academic reading.13

While traditionally, surgical education was only available to those financially and geographically privileged, social media has the potential to increase access to education for those working in resource poor settings globally. This is a major leap forward from traditional publication methods, which involve considerable financial commitment and minimal scope for interaction. It is important to note that social media does not only provide access to educational resources to surgeons, but to patients as well. These are often accessible and in real time, such as Facebook Live Q&A discussions.14

In addition, there is now considerable advancement in interactive multimedia social media platforms, which play a prominent role in surgical training. Platforms like YouTube contain a plethora of videos with surgeons narrating various surgical procedures. Virtual reality platforms, such as Medical Realities, are often integrated with social media platforms to promote access.15 A growing body of literature suggests that virtual reality has enormous potential to enhance technical surgical skills outside of the operating room in a safe, low-risk manner.16

Social media can also serve as a catalyst for other progressive, social-based initiatives in surgery. Recently, it has been used as a platform to tackle age-old and harmful stereotypes by highlighting the increasing diversity of the surgical profession. The hashtag #ILookLikeASurgeon, in reference to women in surgery being misidentified, went viral on Twitter with more than 128 million impressions and roughly 40,000 tweets.17 Addressing harmful stereotypes is an important step towards breaking down barriers to diversity in surgical practice. Studies have shown that up to 91% of practicing women in surgery have experienced some form of gender-based discrimination.18 Female surgeons report being frequently mistaken for other types of hospital employees. The lack of representation for women and minorities amongst surgical specialties continues to intimidate and distance qualified applicants from pursuing these careers. Additionally, showcasing this diversity to patients would make diverse patient populations more comfortable when accepting care.

Threats to professionalism, confidentiality, and quality of information
Professionalism in surgery is essential for surgical practice, patient care, and maintaining public trust. A rise in online social media use has resulted in breaches in professionalism and patient confidentiality...
in medical communities. A national survey of American medical schools documented instances of unprofessional content posted online by medical students and residents, often in legal violation. They found that 13% of the cases involved a direct breach in patient confidentiality and that schools may not have adequate policies to address such online postings.

These lapses of judgement may be especially prone to happen in surgical subspecialties such as cosmetic surgery, where the sharing of outcomes may involve identifiable visual information. Given the nature of various social media platforms, such as Facebook, patients now have access to the personal information of their physicians as well, resulting in professional lines being blurred. Again, instances range from a “friend request” putting a physician in an awkward situation, or a physician being stalked and even assaulted through information gained from social media.

With an increased use of social media for the purpose of medical education, there is also an increased risk for the spread of misinformation. Given the unregulated nature of many social media sites, there is a greater potential for the circulation of poor-quality information. This can pose harm to patients who engage with social media for health purposes. Additionally, social media tends to highlight individual experiences that may be anecdotal, which might not be representative of collective, evidence-based knowledge.

Conclusion

With billions of users worldwide, social media has revolutionized the way people communicate and consume information. Given the pervasiveness and considerable benefits of social media, it is imperative that medicine and surgery adapt accordingly. Moving forward, surgical programs should consider providing social media and interactive multimedia training sessions for residents and staff to increase proficiency in these platforms. Rather than avoiding social media due to fear of unprofessional behaviour or threats to privacy, medical students, residents, and physicians should be educated about confidentiality, social media regulations, and boundaries. With technology advancing at an exponential rate, the medical community needs to embrace social media and utilize the enormous potential that it has.

Conflict of interest

The authors have declared no conflict of interest.

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Young physicians on YouTube: helping patients connect with health care

Lauren Rietchel1

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Abstract
Medical channels, created by young physicians on YouTube, are popular sources of medical information. They may help demystify the vast world of clinical knowledge and empower patients to seek help from their professional healthcare providers. By understanding clinical decision-making and the complexities of healthcare systems from an online physician's perspective, patients may be more understanding of their own physician’s clinical rationale. This may lead to better communication with their doctor and an improved therapeutic alliance. Despite the conveniences in overcoming patient barriers through this format, medical advice should continue to maintain professional standards of clinical practice and strive to reach only the intended audience.

There is a growing community of young physicians on YouTube, often under or around 30 years of age, who run successful medical channels targeting the general population. Although not standardized, common themes include general medical entertainment for a public audience, synopses of daily life for various medical specialties, and medical information or advice. Some physicians even describe thought processes behind clinical decision-making, a component patients have expressed greater demand for since the rise of collaborative decision-making and patient autonomy. For those seeking a medical opinion, the internet is one of the first resources accessed for guidance and research prior to consulting in-person medical advice. However, a lack of health literacy (the knowledge to make good health decisions) among patients has been identified as a major global healthcare challenge. While a study that evaluated highly formal medical channels on YouTube (with educational videos on different diseases) found a large benefit to patients in this regard, the following commentary proposes that more casual individual physician YouTube channels can show a similar benefit to patients through demystification of the medical profession, which may ultimately benefit patients by 1) increasing their trust in physicians; 2) improving their satisfaction with health care; and 3) providing an updated, refreshing approach to accessing a younger generation of patients. This commentary will also address some of the ideas that may be explored in future research on these types of channels.

Doctor Mike, a family physician on YouTube based out of New York City, is an example of how transparency in medicine can be built with an online community of people. With 4.26 million followers, he is able to answer inquiries directly from subscribers, explain medical advice in a clear and explicit way, and promote healthy living to an audience equivalent to a population almost twice as large as that in the Greater Vancouver area. His videos include himself explaining why vaccines are important and why certain symptoms should prompt a person to seek medical advice. He educates patients with evidence-based research and shares medical stories that explain the daily clinical decision-making processes within a physician’s mind, such as the approach in deciding whether to prescribe an antibiotic to a patient or not. He fosters a trustworthy community that arguably allows people to feel confident seeking out advice from their own doctor. Patients may be hesitant to trust the opinion of just one doctor, so if a patient completes prior research or understands decision-making processes better through these other physician videos, then they may feel more comfortable with their in-person physician offering similar opinions. One study assessing the patient-physician relationship found that the knowledge level of a patient was highly correlated to their trust in their physician. A high level of trust was found to be related to higher adherence, higher satisfaction with care, and better health outcomes overall. By increasing the transparency of medical decision-making and medical recommendations through these types of YouTube channels, patients may feel a greater sense of trust in the healthcare system and in their own providers, possibly strengthening their own patient-physician relationship. It can also be expected that there may be a greater sense of accountability within the medical community for healthcare professionals to stay up-to-date and continue to deliver high-quality care if patients are able to access this type of information online.

Another frequent theme of the young physician YouTube community is the explanation and portrayal of residency training. A popular YouTube resident physician, Violin MD, shows the daily life of an internal medicine resident, including a first-person perspective of the grueling and frequent 24-hour call schedule, encounters with difficult decision-making, and complex multidisciplinary patient care. When the general population watches this exhilarating yet exhausting lifestyle through an accessible platform like YouTube, patients may develop greater understanding and empathy towards their own busy physician. They may be more appreciative of the uncertainties and delays in medicine when a physician runs late or needs to order an additional test, and recognize their doctor's imperfections (e.g., in the context of mistakes and the breakdown in patient care). Greater connection with and understanding of a physician leads to higher patient satisfaction with healthcare, which is supported by the observation that the primary reason for physician complaints is a breakdown of communication with a physician, not that physician’s medical knowledge. With an increased appreciation of the medical profession through these kinds of YouTube videos, patient satisfaction with care might increase, and the incidence of filed complaints against physicians may decrease. A topic of further research could aim to describe the relationship between use of physician video media platforms and the frequency and/or type of malpractice complaints.

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Since physicians posting on these online platforms are often young, this refreshed approach to medicine may make it more accessible to groups often missed in the healthcare system. Young adults aged 18–25 are the least accessible group in medicine,23 frequenting physicians only in extreme circumstances,21 and perhaps could be accessed with the assistance of this type of video platform. When the importance of visiting the doctor or the complexities of the medical system are explained, barriers to care for this demographic may decrease, which might even increase the rate of physician visits. While further research is required to address this topic, young people may not feel fully comfortable with their primary care doctor until after they find information on a streaming platform where a younger doctor is able to empower them to seek out medical care.

The young medical community on YouTube may also present challenges, including adherence to patient confidentiality and the maintenance of professional behavior. This is an important aspect to consider, as one major concern of the internet is the dissemination of unprofessional topics and behaviors reaching an unintended audience.22 The content depicted, if deemed unprofessional, can exert a large influence on the opinions of patients worldwide and should be carefully monitored.22 As well, if a patient mistakenly thinks their medical issue is resolved by watching a video and does not attend a medical appointment as a result, then these channels could even be viewed as harmful if they cause a delay for necessary medical care.

If patients are able to understand that the purpose of the YouTube physician community is to educate the general public and promote healthcare, and that visiting an in-person healthcare professional is an important step in health management, then improved patient-physician and patient-healthcare system relationships are anticipated. Formal research should be conducted on the benefits and harms of informal medical channels on YouTube, as well as their ultimate impact on patient care and the therapeutic alliance, given that this platform reaches such a large audience. A formalized evaluation and rating system of individual physician YouTube channels would help bring credibility to this platform as a resource for medical knowledge.

Conflict of interest
The author has declared no conflict of interest.

References
Launching resident-led simulations to augment the undergraduate medical school curriculum

Paul A. Moroz¹, Sarah L.M. Douglas², Dib D. Gill³

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Abstract

There is good evidence for the benefits of simulation-based learning in medicine. However, difficulties with financing physician teachers and accessing simulation infrastructure are commonly cited barriers to simulation training. We developed a low-cost simulation program meant to augment early didactic teaching in the undergraduate medical curriculum with the help of residents as simulation teachers. Residents were provided with specially designed cases highlighting clinical aspects of recent curricular material. Residents were well suited for undergraduate teaching given the near-peer phenomenon. We described how our program could be replicated with minimal financial investment using a standard mannequin, a computer, and a supportive residency program.

Introduction

On the journey to become physicians, pre-clinical medical students around the world are taught foundational concepts primarily through didactic lectures and textbook readings. This learning environment offers limited opportunity to make clinical decisions or observe their impacts which, despite focused preparatory courses, can result in a jarring transition into clinical education.¹ Case-based learning (CBL) attempts to address this gap by presenting students with a text-based clinical scenario and a series of questions meant to build knowledge relevant to a real-world problem.² Unfortunately, a pre-written case offers no opportunity to interact with a patient, integrate physical examination skills, or make decisions which alter the course of the case. CBL is an excellent tool for helping students grasp new concepts, but it calls for a counterpart that allows students to bend, twist, and stretch their knowledge to make the decisions that will arise in clinical training. This counterpart is simulation-based learning.

Simulation-based learning strives to accurately imitate real world scenarios through deliberately planned problems which participants must solve in real time. Simulation training has been used in the aviation industry for years as a means of safely teaching trainees to deal with dangerous or uncommon situations. Within medical training, simulation plays the same role.³ This teaching technique allows medical students to make clinical decisions and receive immediate feedback, while posing no risk to patients. Simulation has been shown to improve the utilization of treatment algorithms among medical students and residents.⁴⁻⁶ Knowledge retention also increases from 20% in lectures alone, to 50% when knowledge is discussed (e.g., in CBL), and up to 75% when knowledge is put into practice, as done in simulations.⁷ In 2015, a systematic review and meta-analysis showed an improvement in patient safety when simulations were incorporated into medical training.⁸ Even universal skills like leadership, teamwork, and communication have been shown to improve following simulation training.⁹ So why is this valuable teaching technique not more prevalent in undergraduate medical curricula?

Although data are limited, the main barriers to simulation in pre-clinical training included limited faculty availability for teaching, limited financial resources, and student availability.¹⁰ In 2018, our group of undergraduate medical students from the Island Medical Program at the University of British Columbia (UBC), in partnership with the University of Victoria, sought out to better prepare students for clinical medical education by launching an extracurricular simulation program. In the context of an undifferentiated patient presenting to the emergency department, we developed cases allowing students to use their history taking and physical examination skills to make clinical decisions. The simulated emergency room setting was felt to be most conducive for bridging the gap between pre-clinical and clinical training as students were able to investigate a complaint, establish a differential diagnosis, institute a treatment plan, and practice lifesaving procedures. The successes, challenges, and methodology of our program are discussed below, with the hope that it can be adopted in other undergraduate medical programs.

Residents as Teachers

Lacking the funds to hire faculty physician teachers, we opted to connect with residents and fourth-year medical students to host the simulations. We felt that this relationship could offer significant benefits to both the teachers and learners. Proficiency in teaching is a core objective in many residency programs.¹¹ Running simulations creates an opportunity to practice the art of teaching without the pressure of a waiting room full of patients. These opportunities may be particularly helpful for residents pursuing academic positions or fellowship training. Residents are valuable teachers because they bring the benefits of a “near peer” to the classroom. In addition to being more familiar with the knowledge base and comfort levels of medical students, having recently been in their position, residents are also perceived as more approachable.¹² We recognize that staff physicians would be more adept with the intricacies and advanced management of simulated topics. However, the goal of our simulations was to highlight core decision-making in the diagnosis and treatment of relatively common conditions.

We recruited teachers by emailing residents in the UBC Family Medicine, Internal Medicine, and Emergency Medicine residency programs in Victoria, BC. All residents participated voluntarily and simulations were scheduled around resident availability, typically after business hours. In cases where residents were unavailable, we
recruited fourth-year medical students to run simulations. All teachers were given a curated list of simulation topics and asked to instruct only on the material that they were comfortable with.

Many of our teachers have hosted multiple simulations and expressed a desire to continue teaching undergraduate students. During our feedback sessions, teachers conveyed that running simulations was helpful for reinforcing their own knowledge base and building confidence with teaching. We recognize that residents are often busy with clinical duties and that relying solely on resident volunteers may not be sustainable. In the future, partnering with a residency program that has allocated time for residents to teach undergraduate students may foster a mutually beneficial relationship that provides medical programs with reliable access to near-peer teachers.

**Materials and Methods**

All simulations were held in the Royal Jubilee Hospital simulation lab in Victoria, BC. The simulation lab included specialty equipment such as high-fidelity mannequins, vital sign monitors, airway equipment, mock medications, and other equipment typically found in an emergency room resuscitation bay. The mannequin could produce physical exam findings such as peripheral pulses, respirations, pupil reactivity, abnormal chest sounds, and cyanosis. More advanced simulation equipment such as a defibrillator and an anesthesiology workstation were also available.

Each simulation was taught by a resident or fourth-year medical student who received a choice of case topics accompanied with learning goals, a case outline, and information about the knowledge level of their students. This ensured that students were not faced with clinical scenarios which they lacked the ability to solve. In the case of a chest pain simulation, students may have identified the need for an electrocardiogram, but lacked the training to interpret the results. Acknowledging this expected limitation, teachers volunteered the result of the test and offered a brief explanation of the diagnostic tool without delving into its intricacies.

Starting in October 2018, we hosted a simulation every four to six weeks over a ten-month period, covering seven different clinical themes (Table 1). Each session had eight to ten student participants and contained two to four related cases. At the start of each session, the teacher reviewed core principles relevant to the simulation with the student group, such as how to conduct a primary survey in trauma, the differential diagnosis for syncope, and imaging modalities in abdominal pain. The students were then split into four to six person teams and assigned roles—typically one physician leader, several nurses, and a recorder. Regardless of their role, all team members were encouraged to voice their ideas regarding the case. The teacher would present a clinical vignette with the patient's chief complaint and the team would proceed to take a history and physically examine the mannequin. The role of the teacher during the simulation was to help the case progress by answering history questions, adjusting the mannequin's behaviour, announcing positive or negative physical exam findings, and providing the results of investigations or interventions. The teacher was instructed to stop in to redirect the group if they were unable to proceed or if they focused on a topic that was not central to the simulation. With the completion of each case, the teacher provided a resolution to the patient's hospitalization, debriefed with students, and addressed any remaining questions. Informal feedback was collected from the students and teachers for improving future sessions.

**Looking Back**

In reflecting on the feedback and experiences of the students and teachers involved, perhaps the most challenging component seemed to be molding simulations to simultaneously fit different knowledge levels. Our sessions were open to all medical students, meaning that some cases had first, second, and third-year students present. At times, senior students would dominate the case and bypass high yield learning points that would have been useful for junior students to reason through. Other times, senior students would become disengaged while the teacher reviewed core concepts. These issues can be avoided by limiting each simulation session to a particular year of training. If this is not possible, groups of mixed training levels may fare better if teachers encouraged the use of “time outs” or intermittently stepped

<table>
<thead>
<tr>
<th>Simulation Theme</th>
<th>Core simulation concepts</th>
<th>University of British Columbia curriculum week pertaining to simulation</th>
<th>Attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trauma, motor vehicle accident</td>
<td>Overview of primary survey, approach to shortness of breath, diagnosis and management of pneumothorax</td>
<td>Week 6 and 7 Pneumonia, cough, and COPD</td>
<td>6 Students</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Week 10 Abdominal pain</td>
<td>2 Teachers</td>
</tr>
<tr>
<td>Endocarditis</td>
<td>Chest pain differential, cardiac features, risk factors, cardiac workup</td>
<td>Week 66 Hypotension, Shock</td>
<td>4 Students</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Week 56 Chest pain</td>
<td>1 Teacher</td>
</tr>
<tr>
<td>Stroke</td>
<td>Neurological exam in unresponsive patient, assessing causes of stroke, altered level of consciousness differential</td>
<td>Week 22 Stroke</td>
<td>6 Students</td>
</tr>
<tr>
<td>Arhythmia</td>
<td>Chest pain differential, workup for abnormal ECG, treatment for common arrhythmias</td>
<td>Week 43 Arrhythmia</td>
<td>8 Students</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Week 56 Chest pain</td>
<td>2 Teachers</td>
</tr>
<tr>
<td>Syncope</td>
<td>Types of syncope, differential and workup for syncope</td>
<td>Week 8 Heart murmur</td>
<td>7 Students</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Week 43 Arrhythmia</td>
<td>2 Teachers</td>
</tr>
<tr>
<td>Head Injury</td>
<td>Initial management, disability assessment, sequelae of head trauma, imaging modalities to consider, interventions to reduce rising intracranial pressure</td>
<td>Week 20 Spinal cord injury</td>
<td>4 Students</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Week 29 Head injury</td>
<td>1 Teacher</td>
</tr>
<tr>
<td>Appendicitis, Abdominal Pain</td>
<td>Differential and workup for abdominal pain, physical exam findings in appendicitis, appropriate workup and management of abdominal pain</td>
<td>Week 10 Abdominal pain</td>
<td>5 Students</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Week 12 Gastrointestinal bleeding</td>
<td>1 Teacher</td>
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<td></td>
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<td>Week 16 Pregnancy</td>
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</tbody>
</table>

**Table 1** | Summary of simulation topics, content, and attendance
We identified two common themes among the simulations which drew the most participants. The first was hosting simulations focusing on topics which students had recently covered in classes. The opportunity to apply newly acquired concepts and collect clinical pearls gave students the ability to prepare for both curricular exams and clinical practice. The second was advertising that procedural skills teaching would be incorporated into the simulation, for example, airway interventions, basic ultrasound, or cervical collar application. We believe that many students are aware of the utility of these skills and were eager to gain competence ahead of their clinical rotations.

We received strongly positive feedback from the students involved in our simulations. With student permission, we included some of the comments we received:

I found it interesting having the opportunity to apply what I learned in class to a clinical situation. It was also good to see some of the anesthesia procedures being simulated before going on the wards. – Third-year student

You can get lost in the textbooks. The ER sim lab was a great change of pace. It was an exciting and fun way to learn. – Second-year student

The active nature of the sim lab was inspiring, refocusing, and fun; integrating and applying our learning while on the go consolidated it far better than simply hearing about it. – Second-year student

I felt like I was integrating and applying classroom learning in an engaging way that was preparing me for clerkship. – First-year student

Looking Forward

Our group is keen to continue providing medical students with simulation opportunities to augment their learning. The reason we have organized these simulations, and subsequently prepared this article, is because we believe that simulation-based learning should be regularly incorporated into every medical school’s pre-clinical curriculum. Goolsby et al. showed that a single focused simulation training session was enough to impart medical students with confidence and knowledge that lasted throughout their emergency rotation. A study surveying medical students after a similar simulation initiative found that participants valued the learning experience and benefited from the opportunity to apply knowledge and develop an approach to clinical problems. Undergraduate medical programs lacking the resources to secure training equipment and teachers may overcome these barriers with improvisation. As described above, residents made for strong accessible teachers and likely derived benefit from hosting simulations. With the completion of an academic year’s worth of simulation sessions, we will be connecting with the residency programs in Victoria in hopes of securing dedicated time for residents interested in simulation teaching.

Although we were fortunate to have an advanced simulation lab available to us at no cost, we seldom utilized the high-fidelity features or specialized training devices. Our most utilized simulation device, the adjustable vital sign monitor, can be replicated through a free program on a standard computer. The physical exam findings produced by high-fidelity mannequins can be verbalized by teachers when students gesture toward a physical exam maneuver. We believe that the purpose of simulation in early medical training is to explore clinical reasoning rather than to perfect physical exam skills. We found that junior students would often become preoccupied by difficulties with interpreting simulated findings that were not central to the case. To mitigate this in future sessions, we may transition to completely verbalized physical exam findings.

A standard low-fidelity mannequin, a laptop computer, and a resident are the only resources required to bring simulation training to pre-clinical medical students. With the strategies outlined above, we believe that a comparable simulation experience can be created at most medical training programs with minimal financial expenditure.

Conclusion

We developed an extracurricular simulation training program aiming to supplement undergraduate curricular learning and prepare medical students for clinical training. This learning environment provided a safe opportunity for students to integrate concepts and practice clinical decision-making. Although residents made for effective teachers given the near-peer phenomenon, we recognize that relying on resident volunteers may not be sustainable at a larger scale. This issue may be mitigated by partnering with a residency program that offers dedicated time for teaching endeavors. Simulation organizers may also find improved student engagement if simulations cover recent curricular material, incorporate procedural skills, and limit participants to the same training level.

There is good evidence for the benefits of simulation training in medical education. We suggested low cost alternatives to commonly cited barriers to simulation training in the form of standard mannequins, free digital resources, and resident simulation instructors. We hope that the experiences and methodology outlined in our paper can be used to bring simulation training to pre-clinical curriculums around the country.

Conflict of interest

The authors have declared no conflict of interest.

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Mixed reviews: critiques and compliments of physician rating websites

Braedon Ronald Paul

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In an era dominated by social media, physician rating websites are rapidly growing in popularity. Among these sites, RateMDs.com has gained the most popularity among Canadians. Launched in 2004, RateMDs.com features over 1.7 million active physician profiles across Canada and the United States and over 2.6 million posted reviews. As of 2018, over 57,000 of these profiles were of Canadian physicians, representing well over 50% of actively practicing physicians in Canada. Part of its appeal undoubtedly lies in its simplicity; any visitor may rate their doctor using a one to five-star rating system based on punctuality, staff, helpfulness, and knowledge, as well as narrative comments. The entire process can be completed in a matter of minutes and, most notably, can be done anonymously.

While non physicians tend to view rating websites favourably, their rising popularity has been viewed less approvingly among some physicians, who argue that such sites do more harm than good. Among other reasons, these sites have been heavily criticized for the lack of accountability held by anonymous reviewers. Despite these criticisms, both Canadian and U.S. studies have found that posted ratings are predominantly positive. Negative ratings still occasionally take their toll, though, with some physicians going so far as to launch defamatory lawsuits claiming damaged reputation and loss of income.

As these rating systems rely entirely on the subjective experience of a patient, “hidden roles” of the physician, such as after hours paperwork, liaising with other providers, and lab test follow-up, are rarely taken into consideration. Moreover, unnecessarily ordering imaging and bloodwork or loosely prescribing inappropriate medications to quell patient concerns might be rewarded with positive ratings. In a similar manner, failing to perform these same tasks might result in a negative review—this places pressure on physicians to abandon guidelines and incorporate costly and potentially unsafe practices into the care they provide. Indeed, while patient-reported outcomes are crucial to the improvement of healthcare systems, patient satisfaction and best patient outcome are often at odds.

Perhaps even more concerning is the fact that reviews are unverified. Consequently, there are no barriers in place to prevent an individual from posting a review that is grossly exaggerated or, in some instances, demonstrably false. Such reviews can understandably cause significant distress and even risk damaging the career of any physician who falls victim. Early last year, for example, an infectious disease specialist in Kingston, Ontario was involved in a defamation physician who falls victim. Early last year, for example, an infectious disease specialist in Kingston, Ontario was involved in a defamation lawsuit following a series of slanderous comments posted to RateMDs.com and OntarioDoctorDirectory.ca. These comments, which falsely portrayed him as incompetent and a danger to his patients, were ultimately revealed to be written by an individual who had never set foot in his office. In light of this and other similar cases, the Canadian Medical Protective Association (CMPA), a prominent medical malpractice insurer, has started to offer physicians advice on how to manage their online presence and, if needed, how to draft letters to offending websites requesting the removal of defamatory comments. Concerns regarding rating validity are not exclusive to negative reviews, however. In fact, a 2010 study of physician-rating websites revealed several positive narrative reviews that appeared to be written by the physicians themselves. Consequently, ratings on unverified physician-rating platforms should be viewed with a dose of healthy skepticism by patient and physician alike.

Despite several shortcomings of physician-rating websites, they also play an important role in patient-centred care, in that they empower patients to freely and openly share their healthcare experiences, both good and bad. If used appropriately, these online platforms also serve to benefit physicians by offering valuable insight into their medical practice from the perspective of patients. Such an opportunity is particularly helpful for reflecting on and honing the “soft skills” of medicine that are rarely formally evaluated throughout medical training and practice. As such, one cannot dismiss these platforms as entirely ineffective.

Regardless of how truthful online comments may be, the premise of anonymous reviewing raises another dilemma. While it is certainly true that receiving several complaints of a similar nature is likely to uncover an area needing improvement, the ability to openly criticize a provider who is unable to adequately address concerns without risking patient confidentiality inevitably leads to an uneven playing field. To help address this issue, online reputation management services have started to emerge. By distributing patient experience surveys that reflect the content of physician-rating websites, these services work to “drown out” negative reviews by collecting and submitting positive reviews, thus inflating a physician’s overall score. However, by selectively submitting positive reviews, such services themselves raise concerns about the reliability of online ratings. Similarly, there is no mechanism in place to prevent physicians from selectively encouraging reviews from patients who they believe will rate them positively, a technique that is well documented outside of medicine. However, for physicians who wish to remove particularly damaging or defamatory reviews, few options exist aside from pursuing legal action, which can be costly, timely, and laborious, or flagging comments for removal, which requires the review to be deemed inappropriate by the hosting website. As of 2018, a physician wishing to have negative reviews removed from RateMDs.com must purchase a package plan, which can cost anywhere from $179 to 359 USD per month.

While physicians should feel encouraged to monitor their profiles if they so desire, most will face some form of online criticism at some point in their career, whether it be through RateMDs.com or another online source. As such, ongoing efforts should be focused on improving the validity of these platforms in order to ensure content is
accurate and criticisms are constructive. One plausible solution would be for these websites to incorporate a more scientifically rigorous psychometric methodology into the design of their rating systems, allowing a more reliable translation of subjective patient data into validated objective data. Although such changes would surely improve the current system, it is unlikely that this transformation will occur in the near future. In the meantime, physicians should feel encouraged to reach out to the CMPA with any questions or concerns regarding their online presence. Provincial physician-support services, such as the Physician Health Program of BC, are also available for physicians seeking guidance.20 Regardless of one’s stance on this issue, one thing is certain: physician-rating websites will continue to thrive for years to come. Perhaps it is time they were rated themselves.

Conflict of interest
The author has declared no conflict of interest.

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1. RateMDs Inc. RateMDs [Internet]. Westlake Village: RateMDs Inc.; [cited 2019 Oct 11]. Available from: https://www.ratemds.com
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