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Spring/Summer 2020
Volume 10 Issue 1

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Demystifying artifical intelligence in medicine

INTERVIEW
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CASE REPORT
Transdermal estradiol as a novel off-label treatment for Peyronie's disease

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Improving surgical safety checklists in operating rooms

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ABOUT US

UOJM is an international peer-reviewed journal led and published by the students of the Faculty of Medicine. We welcome submissions in a variety of areas in biomedical research and feature original research, review articles, news and commentaries, case reports and opinion pieces. Our articles are written in both English and French, and represent the only bilingual medical journal in Canada run by students.

Le JMUO est un journal revu, édité et publié par les étudiants de la Faculté de médecine. Nous encourageons les soumissions d'une variété de différents domaines en recherche biomédicale et publions des articles de recherche originale, des articles de revue, des nouvelles et commentaires, des rapports de cas et des pièces d'opinion. Nos articles sont écrits en français et en anglais et représentent le seul journal médical bilingue géré par les étudiants au Canada.

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MESSAGE FROM RINA HUO, COVER ARTIST

This piece is a traditional Chinese ink painting, portraying the snowy mountains gradually melting with the arrival of spring. Two soaring birds are the focus of the painting, fueling in vibrant energy. In light of the recent turbulence, we can be reminded that hardship will pass, leaving room for continuous life and renewal. The medical community will stand with each other and see a new horizon.

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UOJM Article Award

UOJM has always seeked to give a platform to students and researchers to disseminate high quality manuscripts. This goal and the growth of the journal would not be possible without the dedication and contribution of the authors who choose to submit to UOJM. Research can be an arduous task, with both challenging and gratifying moments. However, it is essential to advancing knowledge in any field. Whether it is a review paper or an original research article, authors have the heavy task of supplementing existing literature with their own valuable perspectives.

Starting with this issue of the UOJM, the editors are establishing the "UOJM Article Award" in recognition of the outstanding works submitted by our authors. Key criteria for selection of the article include scientific merit, rigorous design and methodology, originality, significance, timeliness, and clarity of writing style, as applicable.

After careful review of all articles selected for publication in Issue 10.1, we are pleased to announce the following papers as the winner of the inaugural "UOJM Article Award":

"E-cigarette use among Canadian Youth: A review of the literature using an interdisciplinary lens" by Samantha Oostlander, Julia Hajjar and Elise Pausé

"Improving surgical safety checklist completion using distributed responsibility of checklist item completion among operating room team members: A quality improvement project" by Mehr Jain et al.

Editors-in-Chief
Melissa Phuong
Hao Wang

Prix de l'article de UOJM

UOJM a toujours eu pour but d'offrir aux étudiants et aux chercheurs une plateforme afin de partager des articles de recherche de haute qualité. Nous n'aurions pu atteindre cet objectif et UOJM n'aurait pu croître ainsi si ce n'était pour le dévouement et la contribution de nos auteurs qui nous ont choisi. La recherche peut être une tâche laborieuse qui présente à la fois des défis ainsi que des moments gratifiants. Par contre, cette dernière est essentielle à l'avancement des connaissances au sein de n'importe quel domaine. Qu'il s'agisse d'un article de synthèse ou d'un article de recherche original, les auteurs ont la lourde tâche d'enrichir la littérature déjà existante avec leurs propres perspectives si précieuses.

Débutant avec cette édition de UOJM, l'équipe éditoriale a créé le "Prix de l'article de UOJM" en reconnaissance des travaux exceptionnels soumis par nos auteurs. Les principaux critères de sélection de l'article incluent le mérite scientifique, la rigueur du design et de la méthodologie, l'originalité, l'importance clinique, l'actualité du sujet et la clarté du style d'écriture, le cas échéant.
Après une revue minutieuse de tous les articles sélectionnés pour publication lors de l'édition 10.1, nous avons le plaisir d'annoncer que les articles suivants ont remporté le premier "Prix de l'article de UOJM" :

« L'utilisation de la cigarette électronique chez les jeunes Canadiens : Une revue de la littérature avec une perspective interdisciplinaire » par Samantha Oostlander, Julia Hajjar et Elise Pausé

« Améliorer l'exécution de la liste de contrôle de sécurité chirurgicale en répartissant la responsabilité des tâches entre les membres de l'équipe du bloc opératoire : Un projet d'amélioration de la qualité » par Mehr Jain et al.

Rédacteurs en chef
Melissa Phuong
Hao Wang

UOJM Reviewer Award

The publication of high-quality manuscripts cannot be achieved without the contribution of dedicated peer reviewers. High-quality peer reviews are critical to the publication process, as theyprovide constructive feedback to authors to help improve their manuscripts. The UOJM editorial team is enormously thankful to all four reviewers who have volunteered to participate in the peer review process for UOJM. Their time and efforts have been integral to the editorial process, helping to ensure that the quality and standards that define UOJM are upheld for everyissue.

We are honouring two outstanding reviewers with the UOJM Reviewer Award. Key criteria for selection of award recipients included being readily available for peer review when invited and submitting constructive reviews in a timely manner that were demonstrative of critical appraisal. Upon careful review of all peer reviewers, we are pleased to announce Shaza Asif and Michael Reaume as the recipients of the UOJM Reviewer Award. Congratulations and well done, Shaza and Michael!

Managing Editor
Faizan Khan

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La publication de manuscrits de haute qualité ne pourra pas être achevéesans la contribution d'évaluateurs de pairs dédiés. Des évaluations par les pairs de haute qualité sont critiques pour le processus de publication, afin de fournir de la rétroaction critique aux auteurs pour aider à améliorer leurs manuscrits. L'équipe éditoriale du JMUO est énormément reconnaissante de tous nos évaluateurs qui se sont présentés comme bénévoles pour participer dans le processus d'évaluation par les pairs du JMUO. Leurs temps et leurs efforts ont été intégrants au processus éditorial, en aidant à assurerque la qualité et les standards qui définissent le JMUO sont soutenus dans le présent numéro.

Nous honorons deux évaluateurs exceptionnels avec le prix Évaluateur du JMUO. Les critères pour la sélection des récipiendaires comprennent être disponibles régulièrement pour l'évaluation par les pairs quand inviter, et soumettre des évaluations constructives qui démontrent une estimation critique dans un délai raisonnable. Après une considération prudente de tous nos évaluateurs, nous sommes fiers d'annoncer comme récipiendaires Shaza Asif et Michael Reaume pour le premier prix Évaluateur du JMUO. Félicitations et bravo, Shaza et Michael!

Chef d'édition
Faizan Khan

Rédacteurs en chef
Melissa Phuong
Hao Wang

Shaza Asif
MSc. Cellular and Molecular Medicine, University of Ottawa

Hello! My name is Shaza Asif and I am currently doing an MSc in Cellular and Molecular medicine at the University of Ottawa. My research interest lies in understanding the metabolic interplays in both disease and dietary intervention - with a particular focus on intermittent fasting and fatty liver disease. Aside from research, I have a love for reading, traveling, and outdoor activities - with family and friends!

Michael Reaume
MD Candidate, Class of 2021, University of Ottawa

Michael is a third year medical student at the University of Ottawa with a passion for clinical and epidemiological research. He completed his MSc in Biostatistics prior to starting medical school. In 2019, he co-founded the Biostatistics, Epidemiology, and Public Health Interest group (BEPHIG), which aims to provide medical students at the University of Ottawa with opportunities to develop skills and tools necessary to pursue research and to practice evidence-based medicine. Interests outside of medicine include sports (golf and squash) and barbequing.

The University of Ottawa's Journal of Medicine

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UOJM: Preface

Our current issue has been released at what is admittedly a bittersweet time. While there is the usual excitement behind seeing the hard work of authors and our team come to fruition during the production of the first issue for the new year, it is impossible to not acknowledge the ongoing events in the world around us. Shortly at the start of the new year, the escalation of the COVID-19 pandemic rattled us to our very core, and this newly discovered virus greatly transformed our day-to-day lives. It has certainly been a time of loss and anxiety for many of us. We'd like to thank frontline healthcare workers, those in diagnostic and research laboratories, and all essential workers for the sacrifices that they have made to keep our communities safe. As we wait to see how the world continues to change, from the perspectives of trainees in an academic institution, it has also been a fascinating journey to see healthcare, scientific innovation, and public health capture the general public's interest. Rarely is it possible to be able to witness various fields and research groups rally together to rapidly generate new scientific knowledge, use their expertise for peer review, and decide on best medical practice for such a novel disease.

Then, while we were still navigating our way through this new reality, the world witnessed an onslaught of police brutality and racism against the Black community that led to fatal consequences. While anti-Black racism and police brutality were not new to the world at large, the consecutive tragedies also shook the world and re-energized an international movement. During ongoing discussions of these injustices, it has become inevitable to confront the persistence of systemic racism, especially its continued role in academia and medicine. UOJM strongly stands with the Black community and supports Black Lives Matter. We need to continuously work towards being anti-racist in our lives and work together to dismantle systemic racism. UOJM will continue to navigate how to best support our readers and team in these difficult times. There is strength in diversity and knowledge is power, and UOJM will always look for ways to contribute to the education of others to address ongoing challenges. We also welcome any perspectives and submissions on this very important topic.

This issue marks a new start for UOJM as we work towards modernizing the journal. As you may have seen, this is our first issue that does not have a theme. Our decision to go themeless was not an easy one. While we did not want to overturn a UOJM tradition, we also had to think about what would be the most beneficial for the journal going forward. Ultimately, we felt that the benefits of keeping a theme was not enough to justify any stifling of creative freedom for authors. As UOJM grows year after year thanks to our readers and authors, our hope is for it to become the leader in medical school journals in Canada. We think that there is an abundance of talented researchers at uOttawa, and we did not want to discourage anyone from submitting just because their research did not match the theme. We hope that by easing this, we can open the floor to even more amazing works. Embracing a new way of consuming information, this issue is also the first to be accompanied by a podcast. We delivered our first podcast, "An interview with Dr. Christopher Tran", and we hope to continue in subsequent issues. We feel that UOJM should serve as a platform for all forms of research, and we want to give readers an option to listen to certain articles. While podcasts are currently scheduled only for interviews, we want to encourage any interested authors who want to discuss their research to contact us. Several other changes that you may have noticed are to our website and article layout. Our talented Publication Director Sarah Laframboise has overhauled the article layouts, and we welcome any comments or ideas. Please continue to engage with and support us!

Moving forward, UOJM will continue to establish a greater online presence to promote the excellence in research in our community, continue our podcast so that trainees can hear from local physicians, as well as share resources on topics that can be of interest to our community on our website and through social media. As well, to continue UOJM's contributions to the Inaugural Research Day last year, we will be working with the Planning Committee of Research Day 2020 to evaluate abstract submissions as well as compile an Abstract Book to be listed as Supplemental Issue 10.S1. Research Day 2020 will occur solely online, and UOJM is looking forward to being a part of this innovative way to exchange ongoing research in our community with the Faculty of Medicine.

With that, we thank our team for all of their hard work throughout the year and for putting this issue together. We also hope that you, our readers, are all staying safe, and that you enjoy **UOJM Issue 10.1!**

Melissa Phuong and Hao Wang
UOJM 2019-2020 Editors-in-Chief

JMUO: Préface

Cette édition a été publiée en un temps à la fois doux et amer. Bien que l'excitation habituelle à l'entour de la reconnaissance du travail acharné des divers auteurs et de notre équipe se concrétisent lors de la production de cette première édition de l'année, on ne peut négliger tous les évènements en cours dans le monde qui nous entoure. Peu après le début de cette nouvelle année, la pandémie COVID-19 nous a touché jusqu'au plus profond de nous et ce nouveau virus a considérablement transformé notre quotidien. Ce fut certainement une période de tristesse et d'anxiété pour beaucoup d'entre nous. Nous aimerions remercier les travailleurs de la santé de première ligne, les travailleurs des laboratoires de diagnostic et de recherche, ainsi que tous les autres travailleurs essentiels qui se sont sacrifiés afin d'assurer la sécurité de nos communautés. Alors que nous attendons de voir comment le monde continuera de changer à travers le temps, en tant que membre d'une institution universitaire, ce fut également une expérience fascinante d'observer à quel point les soins de santé, l'innovation scientifique et la santé publique en général ont capté l'intérêt du grand public. Rarement est-il possible d'assister au rassemblement de divers domaines et groupes de recherche ayant tous pour but de générer rapidement de nouvelles connaissances scientifiques, tout en utilisant leur expertise pour la revue du travail de leurs pairs, et d'établir des meilleures pratiques médicales pour une nouvelle maladie auparavant si inconnue.

Puis, alors que nous étions encore en train de nous adapter à cette nouvelle réalité, le monde a été témoin d'un assaut de brutalité policière et de racisme contre la communauté noire qui a eu des conséquences fatales. Si le racisme et la brutalité policière contre les individus noirs n'étaient pas de nouveauté pour la plupart d'entre nous, les tragédies qui ont suivi cet évènement ont quand même secoué le monde et redynamisé un mouvement international. Au cours de diverses discussions centrées sur ces injustices, il reste inévitable de noter la persistance du racisme à un niveau systémique, en particulier son rôle continu dans le monde universitaire et médical. UOJM se tient fermement aux côtés des communautés noires et soutient l'initiative Black Lives Matter de tout cœur. Nous devons continuer de travailler et d'être antiracistes dans nos vies quotidiennes et nous devons nous efforcer de travailler ensemble afin de décourager le racisme. UOJM continuera d'améliorer du mieux que possible son soutien envers ses lecteurs et son équipe en ces temps difficiles. La force réside dans la diversité dont la connaissance est le pouvoir et UOJM explorera de nouvelles stratégies afin de contribuer à éduquer les autres afin de relever les défis actuels. Nous accueillons également toute perspective et soumission à propos de ce sujet si important.

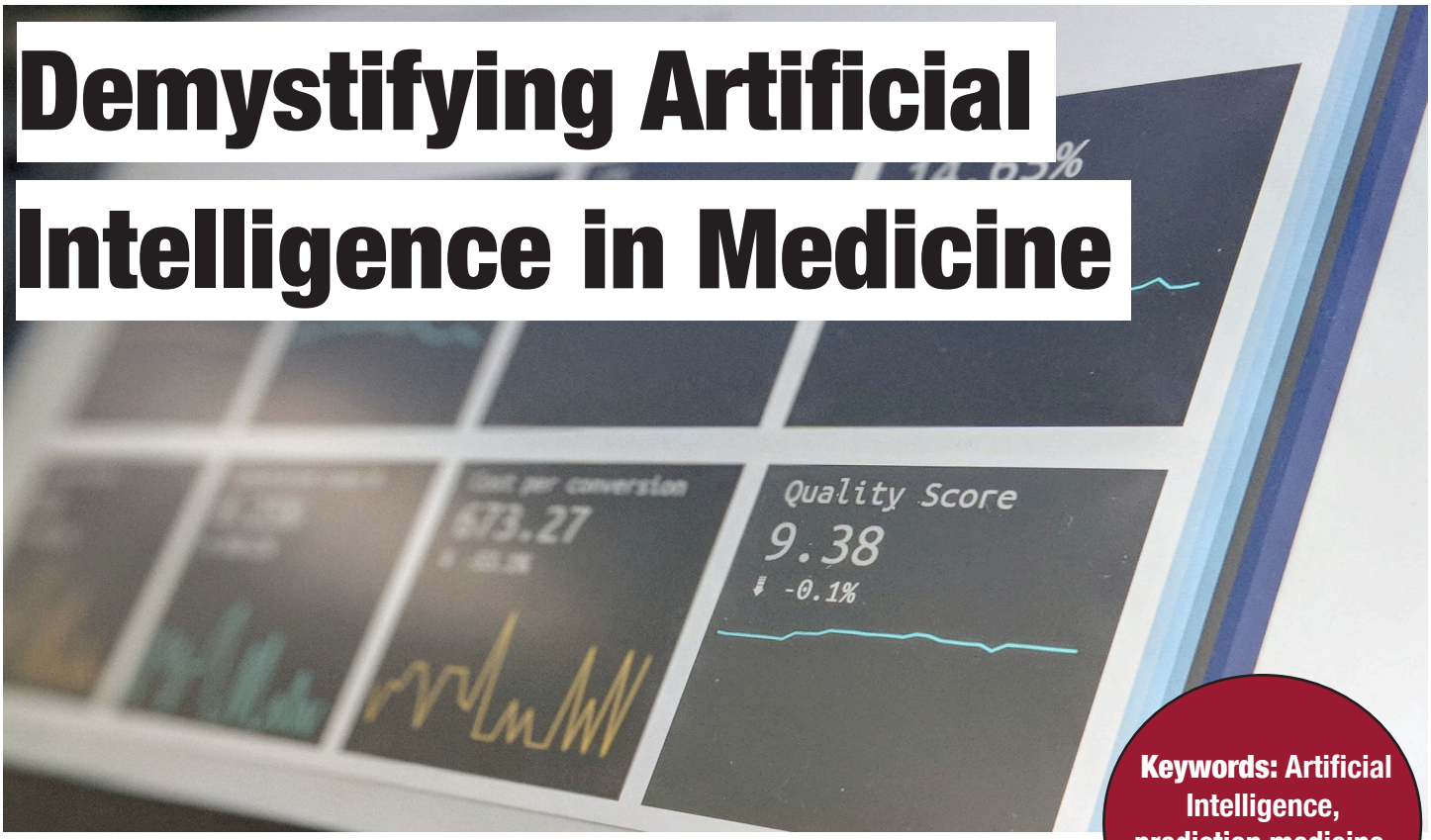
Cette édition marque un nouveau départ pour UOJM qui travaille à moderniser le journal. Comme vous avez pu le constater, c'est notre première édition sans thème spécifique. Cette décision nous n'était pas facile. Bien que nous ne voulions pas bouleverser la tradition de UOJM, nous devions également nous concentrer sur ce qui serait le plus bénéfique pour ce journal à l'avenir. En fin de compte, nous avons estimé que les avantages d'identifier un thème ne suffisaient pas à justifier un quelconque étouffement de créativité des auteurs. Comme UOJM grandit d'année en année grâce à ses lecteurs et à ses auteurs, nous espérons qu'elle deviendra le leader des revues des facultés de médecine du Canada. Nous pensons qu'il y a une abondance de chercheurs talentueux à l'Université d'Ottawa et nous ne voulions pas décourager qui que ce soit de soumettre un article simplement car son étude ne correspondait pas au thème. Nous espérons qu'en facilitant cela, nous pourrons ouvrir la voie à des travaux encore plus exceptionnels. En adoptant cette nouvelle méthode de dissémination d'information, cette édition est également la première à être accompagnée d'un podcast. Nous avons diffusé notre premier podcast, "Une entrevue avec Dr. Christopher Tran", et nous espérons continuer lors de nos prochaines éditions. Nous pensons que UOJM doit servir de plateforme pour tout type de recherche et nous voulons ainsi offrir aux lecteurs la possibilité d'écouter certains articles. Bien que les podcasts ne soient actuellement programmés que pour les entrevues, nous encourageons tous les auteurs intéressés à discuter de leur recherche à nous contacter. Plusieurs autres changements que vous avez peut-être remarqués concernent notre site internet ainsi que la présentation des articles. Notre talentueuse directrice de publication, Sarah Laframboise, a revu la mise en page des articles et nous sommes ouverts à tout commentaire ou idée. Merci de continuer à nous soutenir et à nous aider !

À l'avenir, UOJM continuera d'établir une présence en ligne plus importante afin de promouvoir l'excellence de la recherche au sein de notre communauté, de poursuivre avec des podcasts afin que nos membres puissent entendre la perspective des médecins locaux, ainsi que de partager des ressources à propos de sujets d'intérêt pour notre communauté non seulement à travers notre site internet, mais aussi par le biais des médias sociaux. De plus, pour poursuivre avec la contribution de UOJM à la Journée de Recherche de l'année dernière, nous continuerons de collaborer avec le Comité de planification de la Journée de Recherche 2020 afin d'évaluer les soumissions des abstracts et de compiler un livre d'abstracts qui sera publié lors de notre édition supplémentaire 10.S1. La Journée de Recherche 2020 se déroulera uniquement en ligne et UOJM se réjouit de faire partie de ce biais innovateur d'échange de recherches en cours au sein de notre communauté et de la Faculté de Médecine.

Sur ce, nous remercions notre équipe pour leur travail acharné tout au long de l'année et pour la réalisation de cette édition. Nous espérons également que vous, nos lecteurs, êtes tous en sécurité et que vous appréciez l'édition **10.1 de UOJM** !

Melissa Phuong et Hao Wang
UOJM 2019-2020 Rédacteurs en chef

Demystifying Artificial Intelligence in Medicine



Keywords: Artificial Intelligence, prediction medicine, healthcare

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ABSTRACT

The advent of artificial intelligence (AI) is revolutionising a variety of industries, and its impact on medicine is already apparent. AI is currently advancing the fields of clinical and diagnostic medicine, and its broader application to improve delivery of care is a source of excitement. However, the promise of AI in medicine is accompanied by concerns regarding proper use of data, privacy and ownership considerations, and uncertainty regarding the role of a physician in an AI-reliant world. This piece aims to discuss various advances of AI in medicine, their potential benefits, and associated challenges.

RÉSUMÉ

L'arrivée de l'intelligence artificielle (IA) a révolutionné toute une série d'industries et son impact sur la médecine est déjà apparent. L'IA fait actuellement progresser les domaines de la médecine clinique et diagnostique, et son application plus large afin d'améliorer la prestation des soins suscite notre enthousiasme. Cependant, les promesses de l'IA en médecine s'accompagnent de préoccupations concernant l'utilisation correcte des données, les considérations relatives à la vie privée et l'incertitude quant au rôle du médecin dans un monde dépendant de l'IA. Cet article a pour but de discuter des différentes avancées de l'IA en médecine, de leurs avantages potentiels et des défis qui y sont associés.

1. WHAT IS AI IN MEDICINE?

Artificial intelligence (AI) is a branch of computer science that focuses on building machines capable of independently performing tasks typically associated with human cognition, such as "learning" and "problem-solving" (1). AI relies on tools that can identify patterns in data, and it encompasses various subdisciplines, including robotics and machine learning (1).

In the context of medicine, AI can be classified into physical and virtual branches (2). The physical branch is concerned with robotics, such as surgical navigation systems, or machines used to assist with patient mobility and rehabilitation (3). The virtual branch, which is the major focus of this analysis, is powered through machine learning (ML). In short, ML consists of mathematical algorithms that improve through self-iteration with minimal human intervention (1). These algorithms power the pivotal advances in speech and image recognition, the latter

particularly important in diagnostic imaging and laboratory medicine.

2. AI'S ADVANTAGE IN MEDICINE

2.1 Clinical Medicine

When given enough data for it to fine-tune itself, AI can be applied to life-saving strategies. For example, the early detection of atrial fibrillation was one of the first applications of AI in medicine. The REHEARSE-AF study showed that a smartphone-based ECG monitoring system was better at identifying atrial fibrillation incidence in patients at risk of stroke than routine care (4). Another study using AI to interpret pulmonary function tests showed that AI's interpretation was comparable in its accuracy to that of pulmonologists (5). In clinical nephrology, AI was shown to be useful in predicting the decline of glomerular filtration rate in patients with polycystic kidney disease, and for establishing risk of progressive IgA nephropathy (6,7). In the realm of neurology, the FDA approved, in 2018, a wearable device that can detect generalised epileptic seizures (8). The device connects to a mobile application that can alert relatives or physicians when seizures occur and can provide clinical information and patient localisation (9). In these examples, AI predictions can alert physicians and prompt early interventions to decrease the morbidity associated with atrial fibrillation, respiratory compromise, kidney disease, and seizures. The algorithms provide timely information to physicians; however, the judgment on how to act is ultimately the physician's responsibility.

2.2 Diagnostic Medicine

One of the most practical applications of AI is within specialties that rely heavily on pattern recognition, since AI can learn from vast amounts of data in a fraction of the time it would take a human. In 2019, a systematic review found that deep-learning AI algorithms had equivalent sensitivity and specificity to radiologists (10). Another study demonstrated that an AI algorithm was capable of ruling out cancer in pathology specimens with high sensitivity using computational histopathology (11). Using AI-powered computational decision support systems like this in clinical practice could allow specialists to focus on at-risk specimens and images, freeing up time for patient care or discussions with a patient's primary care provider.

The overarching implications of AI use in diagnostic imaging are vast. An AI system paired with telehealth tools connecting it to a specialist could potentially be used to service populations with scarce human expertise. Such a screening software could also help stratify patients in primary care. Family doctors could use the AI results to reassure patients identified as low-risk while allowing for lower referral waiting times for those identified as high-risk (12).

3. AI IN MEDICINE TODAY: CHALLENGES & CONCERNS

3.1 Caveats in Data Usage

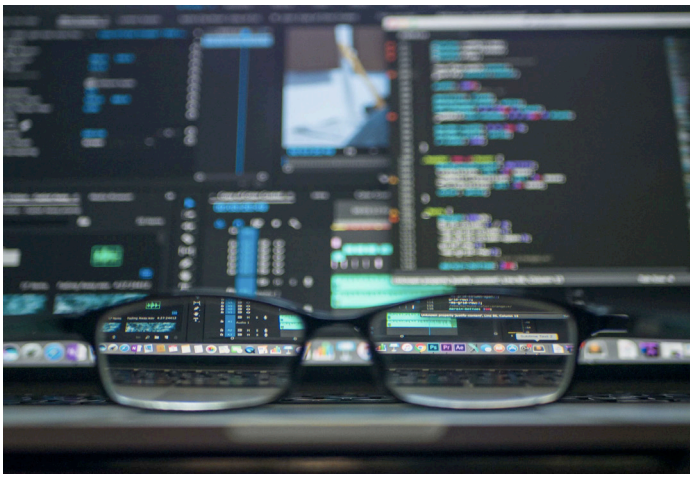
AI is only as good as its input data. As such, healthcare providers should be aware of the scope of the data used to produce a certain predictor or diagnostic software. For example, predictions generated via AI may have limited applicability to patient populations historically underrepresented in clinical trials, such as women and minorities (13). If the algorithm is fed data that does not include these cohorts, then the predictions rendered may not be accurate for these patients. ML algorithms are powerful tools, but if the data fed to them does not correspond to the patients it is intended for, or if the data comes from research of low-quality evidence, a healthcare provider must be able to critically examine its recommendations.

Another source of concern is the "black-box" problem associated with AI. ML algorithms self-iterate and self-improve, and thus the methodology behind an output is unclear. Some advocate for increased transparency and model simplicity at the expense of predictive power (14). Others contest that, when our knowledge of causal systems is incomplete, the ability to explain why an intervention benefits a patient can be less important than the ability to provide such benefits (14). In many areas of medicine,

clinicians often make decisions based on experience and empirical evidence without having an exact understanding as to why certain interventions work (14). Whether it be non-representative data sources or unclear algorithm methodologies, healthcare providers must be aware of the caveats in using AI. Otherwise, they risk becoming complacent, which negatively impacts decisions and care. Providers should understand the basics of the methodology behind AI in order to be able to critically examine its results and synergistically work with them.

3.2 Data Ownership & Security

While the issue of data ownership and protection is not new, it is a fundamental concern with AI, particularly with the advent of ongoing monitoring via medical devices and wearable sensors (9). Attitudes towards data ownership range from proponents of a common ownership between patients and healthcare systems to full ownership by either party (9, 15).



Adding to the concern of data ownership is that of data security. Regardless of who owns patient data, there is always a risk of security breaches or targeted malware attacks. These may result in improper use of information, from distribution of private data to impacts on clinical decision-making by healthcare providers unaware of the data's compromise. Who would be held liable in this case? The answer, as shown by recent scandals involving tech giants like Facebook and Google, are incredibly complex and evolving every day (16). Addressing these concerns will require multidisciplinary efforts involving, among others, public discourse, policy, technology, and regulatory affairs. Legislation will be paramount in order to have all parties involved adhere to common ground rules regarding data safety.

3.3 Can physicians be replaced by AI?

It is important to acknowledge the fear that adoption of AI in medicine will lead to job losses. Historically, technological disruptions have resulted in redundancy of certain professions (e.g. automation in factories or, more recently, taxi vs. Uber drivers) (17). Inevitably, some provider responsibilities will be delegated to AI. However, medicine is more than algorithmic testing and diagnosing. A physician deals with patients as whole individuals within unique sociocultural and economic contexts, and a physician is thus unlikely to ever be fully replaced by a machine. As Hugh Harvey eloquently said, "The biggest impact of AI in medicine won't come from making machines do human-like tasks, but from removing machine-like tasks from humans." (18). The histopathology software described above exemplifies such an instance. In the end, physicians will provide complementary roles to prediction, namely judgment and action.

4. SUMMARY & CONCLUSION

Advances in AI are revolutionising industries around the world, and effect of AI on the way we practise medicine will be no different. AI research in areas such as clinical and diagnostic medicine are already showcasing the power of ML algorithms, and implementation of AI into clinical practice is a promising area of development. As technological advances power the development of modern solutions to improve healthcare, significant concerns arise regarding the proper and safe use of data together with ownership and privacy considerations. Further, a paradigm shift in clinical practice is associated with fears of AI replacing healthcare practitioners. However, the future of AI in medicine points more towards synergy rather than takeover.

Widespread adoption of AI into clinical practice will not solely be shaped by scientific progress, but also by legislation of regulatory and health policies. Much like how risks and benefits are weighed for anything in medicine, the same must hold true for the use of AI. The promise this technology holds, when used adequately within substantiated frameworks, will be worth the substantial effort needed to integrate it into practice.

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E-cigarette use among Canadian Youth: A review of the literature using an interdisciplinary lens

Keywords: E-cigarettes, youth, vaping, interdisciplinary

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ABSTRACT

Objective. The increasing use of e-cigarettes among Canadian youth is a concerning population health issue. Vaping, the act of using an e-cigarette, was initially marketed as a healthier alternative to smoking traditional cigarettes, however its use has unintended, negative consequences on its users. One of the most concerning consequences is the presence of "e-cigarette, or vaping, product use associated lung injury" (EVALI) which has led to several hospitalizations. Youth are particularly affected by these negative consequences. This is likely a result of both exposure to marketing, which is a well-established determinant of youth behavior, as well as inadequate public policy. The purpose of this paper is to present a review of the current literature surrounding the issue of e-cigarette use among youth from an interdisciplinary perspective.
Method. A narrative review was conducted to summarize the state of e-cigarette use among young Canadians and conceptualize this problem from the perspective of public policy, biomedicine, health economics and education.
Results: The results of this review are a summary of the current state of the literature framed using an interdisciplinary perspective. Recommendations for how these interdisciplinary perspectives can be brought together to provide effective solutions for this population health issue are provided.
Conclusion: Identifying and understanding this problem through an interdisciplinary approach will broaden students, health care professionals, and researchers' perspectives by promoting a holistic understanding of how this issue is impacting multiple systems in Canadian society.

RÉSUMÉ

Objectifs. L'utilisation croissante de la cigarette électronique chez les jeunes Canadiens est un problème de santé publique préoccupant. « Vaping », l'acte d'utiliser une cigarette électronique, a été initialement commercialisé comme une alternative plus saine aux cigarettes traditionnelles. Cependant, son utilisation a des conséquences négatives non intentionnelles sur ses consommateurs. L'une des conséquences les plus inquiétantes est la présence de "lésions pulmonaires associées à l'utilisation des cigarettes électroniques, ou vaporisation de produit" (EVALI), qui a entraîné plusieurs hospitalisations. Les jeunes sont particulièrement touchés par ces conséquences négatives. Cela est probablement dû à la fois à l'exposition au marketing, qui est un déterminant bien établi du comportement des jeunes, et à une politique publique inadéquate. L'objectif de cet article est de présenter une revue de la littérature actuelle sur la question de l'utilisation de la cigarette électronique chez les jeunes tout en adoptant une perspective interdisciplinaire.
Méthodes. Une analyse narrative a été réalisée afin de résumer l'état de l'utilisation de la cigarette électronique chez les jeunes Canadiens et de conceptualiser ce problème du point de vue des politiques publiques, de la biomédecine, de l'économie de la santé et de l'éducation. Résultats: Les résultats de cette revue sont un résumé de l'état actuel de la littérature, tout en adoptant une perspective interdisciplinaire. Des recommandations sont formulées sur la manière dont ces perspectives interdisciplinaires peuvent être réunies afin d'apporter des solutions efficaces à ce problème de santé publique.
Conclusion. L'identification et la compréhension de ce problème par le biais d'une approche interdisciplinaire permettra d'élargir les perspectives des étudiants, des professionnels de la santé et des chercheurs en favorisant une compréhension holistique de l'impact de cette question sur les multiples systèmes de la société canadienne.

INTRODUCTION

The rapid increase in the use of e-cigarettes among Canadian youth has garnered considerable media attention. Electronic cigarettes, or e-cigarettes, are battery powered devices that heat an enclosed liquid into a vapour that is then inhaled by its user (1). The aerosolized liquid, also called e-juice or e-liquid, typically contains a solvent, often propylene glycol and/or glycerin, as well as nicotine and flavorings (1). Vaping, the act of using an e-cigarette, has been acknowledged as a healthier alternative to smoking traditional cigarettes (2). Thus, many have argued in favour of promoting e-cigarette use among smokers to reduce tobacco-related harms and to aid in smoking cessation (3, 4). Despite its possible benefits for smokers, the wider availability of e-cigarettes in the Canadian market has raised concerns over its use among non-smokers, particularly youth. The nicotine content of e-cigarettes is worrisome as this substance is very addictive and has detrimental effects on the developing brains of adolescents (5). In addition to delivering nicotine in quantities similar to that of traditional cigarettes, newer e-cigarettes that use benzoic acid and nicotine salt allow nicotine to be delivered more enjoyably, causing a less harsh sensation in users' throat and mouth (6). This may in turn allow for deeper inhalation of vapour and more effective delivery of nicotine (6). It may also increase the appeal of e-cigarettes among young people (5).

The use of e-cigarettes among youth likely resulted from exposure to marketing, a well-known determinant of youth smoking (7-9). Television, celebrity endorsements and social media all have a powerful influence over the behaviours of youth and are being utilized to promote e-cigarettes. For example, at the Sundance Film Festival in 2018, Juul, a popular e-cigarette brand, gifted guests with dollar bundles of its popular e-cigarettes, and celebrities posed for photos in front of a Juul advertisement backdrop (10). E-cigarettes have also been promoted by e-cigarette retailers and brands, through popular gaming and social media apps including PokemonGo, Twitter, Snapchat, Instagram, YouTube and Facebook (11-15). Little research has examined the commercial promotion of e-cigarettes in Canada (16-18). Therefore, it is unknown how much of the current literature on this topic is reflective of the Canadian context. However, we do know that most Canadian adolescents are exposed to e-cigarette promotions. In 2017, 74% of the Canadian youth aged 16-19 years old, reported having seen an advertisement for vaping products in the previous month, most often on social media and at temporary vending locations, and 36% of those exposed considered these e-cigarette promotions to be appealing (16).

In May 2018, the sale of e-cigarettes was legalized in Canada (19). Large e-cigarette companies, some now affiliated with multinational tobacco corporations, have moved into the Canadian market and anecdotal evidence suggests that the promotion of e-cigarettes has subsequently increased (20-23). Public health advocates, physicians and school boards have been sounding the alarm about the increased access, use and harmful effects of e-cigarettes among youth and have called for greater control over this product (20, 24-25). This paper presents a review of the issue of e-cigarette use among youth from an interdisciplinary perspective. We explore this problem from the perspective of public policy, biomedicine, health economics and education. We also discuss how this problem can be further understood through research, field epidemiology and engagement with various stakeholders. By presenting this issue using an interdisciplinary approach we aim to broaden students, health care professionals, and researchers' perspectives, and provide a holistic view of how this relevant issue is impacting Canadian society.

METHODS

A narrative review was conducted to summarize the current state of the literature on e-cigarette use among Canadian youth and explore this problem from the perspective of public policy, biomedicine, health economics and education. A literature search was conducted using PubMed, Medline, Scopus, Google scholar and Google. As this is an emerging population health issue, both peer-

reviewed articles and grey literature such as news media articles, government websites, and government funded reports were included. A search was conducted using the terms: e-cigarette, vaping, Canada and youth. A total of 75 articles were included in this review and framed using an interdisciplinary perspective.

RESULTS

Public policy perspective

The increased use of e-cigarettes among youth can be understood as a political problem requiring better public policy. E-cigarettes containing nicotine were legalized and formally regulated by the Canadian federal government in 2018 when amendments to the Tobacco and the Non-smokers' Health Act were enacted (19). This law, now called the Tobacco and Vaping Product Act (TVPA), allowed Health Canada to regulate vaping products including their manufacturing, sale, labelling and marketing (19). Recognizing the need to protect youth, the TVPA endeavored to restrict promotional activities that appeal to this demographic. Current regulations prohibit sponsorship, branded merchandise, lifestyle marketing, testimonials and endorsements, the depiction of a person or cartoon character, the restriction of certain flavours such as candy, as well as any other form of advertising believed, "on reasonable grounds", to appeal to young people (19, 26). Contrary to the federal restrictions that apply to tobacco products, the online retailing of e-cigarettes and point-of-sale advertising are permitted unless restricted at the provincial level. Laws and regulations that restrict the sale and advertising of e-cigarettes to youth vary by province. While most provinces had enacted laws setting the minimum age for purchasing e-cigarettes at 18 or 19 years old before the introduction of the TVPA, others, such as Alberta, Saskatchewan, and the territories, had not yet done so (27). In many provinces, product displays and prominent advertising were prohibited in stores accessible to youth (27). Others without such restrictions when the TVPA was introduced, like Ontario and Alberta, saw advertising of e-cigarettes proliferate inside and outside convenience stores and gas stations (20-21, 23).

Alarmingly, the use of e-cigarettes has increased since the introduction of the TVPA and in spite of provincial legislation. The proportion of Canadian youth aged 16-19 years old who reported vaping in the past 30 days had more than doubled within two years; from 8.4% in July-August 2017 to 17.8% in August-September 2019 (28). The frequency of vaping also increased; the prevalence of youth that vaped 20 days or more in the last month reached 5.7% in 2019, up from 1.8% observed two years prior (29). Many stakeholders and parents have raised their concern over youth's uptake of e-cigarettes, particularly the JUUL brand whose standard product contains upwards of 50 milligrams of nicotine per millilitre, which is higher than other e-cigarette brands (30-31). While the company denies that it markets to Canadian youth, some medical professionals propose that its enticing flavours, sleek USB-like design, and affordability are all factors intended to appeal to this demographic (32). In 2018, 10.8% of Canadian youth aged 16-19 years old who had vaped in the past 30 days reported JUUL as their habitual brand, up from 0% in 2017 (29). This increase is significant given that JUUL had only been available in Canada for one month at the time of the survey (29).

In response to these worrisome trends and calls for tighter regulations, Health Canada signaled its intent to review the TVPA and initiated public consultations in 2019. Changes under consideration include further restrictions on advertising content and limiting the placement of e-cigarette advertisements in retail environments, public places, and print media as well as before, during and after child/youth television programming (33). Limits on nicotine content, regulation of e-cigarette design features, the prohibition of additional flavours and online sales are also being considered (19). In parallel, provinces and territories that have not yet regulated the sale and advertising of e-cigarettes have recently indicated their intention to do so (27). The increasing use of e-cigarettes among youth has likely arisen, in part, due to inadequate policies that failed to prevent youth from accessing e-cigarettes and protect them from the influence of marketing.

Biomedical Research Perspective

The increased use of e-cigarettes has led to the increased incidence of "e-cigarette, or vaping, product use associated lung injury" (EVALI) in hospitals across North America (34). Individuals entering the hospital with these lung-related ailments are typically cited as experiencing severe cough, fever, chest pain, abdominal pain, vomiting, and shortness of breath (35-36). According to Health Canada, an EVALI case must also have the following criteria: a negative result for tests of lung infection or infection that is not the sole

cause of the presenting symptoms, lung abnormalities detected via diagnostic imaging, history of e-cigarette use in the 90 days prior to symptom onset and no evidence to support another possible diagnosis (36). This issue is of great concern to healthcare professionals, who are not yet equipped with best practice guidelines for the treatment of EVALI. As a result, increased pressure is being placed on biomedical researchers to determine EVALI's underlying pathophysiology to guide future medical interventions.

Literature examining the mechanisms underlying EVALI is in its infancy. A study conducted by Blount et al (2019) is one of the most recent contributions to understanding how e-cigarettes impact biological function. In this study, fluid samples were taken from the lungs of 29 individuals with EVALI. All samples contained Vitamin E acetate, 23 contained tetrahydrocannabinol (THC) or its metabolites and 16 contained nicotine metabolites (37). Vitamin E acetate, the esterified and more stable form of Vitamin E, is often added to food, pharmaceutical and supplement products, where it is absorbed into the body through oral and transdermal routes (38). While ingestion and dermal application are not typically associated with adverse health effects, inhalation of vitamin E acetate can interfere with normal lung functioning (39). When inhaled, the aliphatic tail of vitamin E acetate anchors itself into pulmonary surfactants which are a mixture of lipids and proteins that play a role in lowering the surface tension within alveoli cells (site of gas exchange in the lungs) (40-41). When the phospholipids are exposed to vitamin E acetate, they transition from a gel to a liquid crystalline structure which can impair respiration by impacting the surfactants' ability to control surface tension (40-41). In the case of vaping, the vitamin E acetate is heated up in the device prior to inhalation which can cause the acetate group to split off from the main molecule to create ketene, a reactive compound that has the potential to be a lung irritant depending upon the concentration inhaled (39, 42). It has been proposed that vitamin E acetate is being added to illicit THC cartridges which may further complicate the mechanism by which e-cigarette use interferes with normal lung functioning (43). Further studies are required before confirming a causal link (37). Additionally, other mechanisms leading to the negative effects of e-cigarette use may have yet to be identified.

The use of computed tomography (CT) and radiographs are techniques which can also offer unique insights into what areas of the lungs are affected by EVALI. Two main imaging patterns are common on the scans of those presenting with EVALI: basilar-predominant consolidation and ground-glass opacity (44-45). Basilar-predominant consolidation refers to tissue at the base of the lungs that is filled with liquid instead of air (44). Ground-glass opacity refers to partial areas of the lungs that are filled with liquid instead of air and indicates an interstitial thickening or partial collapse of the alveoli (46). Interestingly, in some individuals these anomalies have reduced after cessation of e-cigarette use and glucocorticoid therapy, which reduces the inflammatory response (44, 45-48). Antimicrobial and antiviral therapies are also being considered for treatment, as symptoms of EVALI overlap with that of pneumonia and influenza (47-48).

While the long-term effects of EVALI are not fully understood, in vitro studies using human epithelial cells show that chronic exposure to toxic components of e-cigarette vape (propylene glycol, glycerin, and nicotine) disrupt airway epithelium which can lead to damage in multiple organs (49). Similarly, in vivo studies using mice show that chronic exposure to these toxic components leads to increased inflammation, organ damage, and cardiorenal and hepatic disease (50). Altered organ physiology may in turn lead to a reduced ability to fight off infectious diseases such as influenza (51). While the chronic impact of e-cigarette use in humans requires further exploration, the negative acute effects on lung functioning, such as pulmonary edema and shortness of breath, in previously healthy youth are cause for concern (52). To minimize the potential health hazards related to vaping, the current recommendations provided by the CDC and PHAC are: to avoid initiating the use of e-cigarettes, to stop or avoid e-cigarette use with THC additives for those who continue to use them, and to

avoid acquiring e-cigarette products from informal and illicit sources (47, 53).

In addition to lung-related harms, the nicotine content of e-cigarette poses a particular risk to the developing brain of adolescents which undergo a marked reorganization, particularly in areas related to cognition, executive function, short-term memory, motivated behavior, emotional control and reward processing (5). Notably, studies conducted using animal models have found that adolescents are uniquely vulnerable to nicotine exposure largely due to the immaturity of nicotinic acetylcholine receptors throughout the brain (5). These receptors play a role in regulating the mesolimbic dopamine system by mediating the firing of dopamine neurons in the ventral tegmental area (54). Nicotinic acetylcholine receptors in this area have been previously implicated in studies examining tobacco addition (55). Compared to adults, when exposed to nicotine, adolescent rodents exhibit increased sensitivity to the rewarding effects of nicotine, enhanced locomotor activity and blunted withdrawal symptoms (56-58). Perhaps what is of greatest concern is that chronic exposure to nicotine in adolescents has been suggested to have lifelong impacts on serotonergic signalling and result in remodelling of dendrites in areas such as the nucleus accumbens (59-60). This can result in diminished cognitive function, reduced attention span, enhanced impulsivity, and increased anxiety-like and depression-like emotional states in adulthood (61-62). Regardless of the concentration of nicotine present in e-cigarettes, it is clear that even brief exposure to low doses of nicotine can result in long-term changes to adolescent brains (5).

Economic Perspective

The use of e-cigarettes among youth can be understood as an economic issue burdening the public healthcare system. Although e-cigarettes have existed for more than a decade, an outbreak of EVALI was not announced until 2019, likely as a result of increased use, particularly by the youth demographic (34). As this outbreak is recent and on-going there are no published estimates regarding the cost of e-cigarette use or its economic impact. However, with numerous individuals requiring extensive medical intervention, costs related to EVALI are likely to leave a lasting impact. According to the CDC, as of November 5th 2019, 95% of over 2,000 individuals with EVALI were hospitalized in the United States (63). The median age of those hospitalized was 24 years old, with 77% being under the age of 35 (63). The public health agency of Canada reported that as of April 7th 2020, there have been 19 vaping-related lung illnesses, however the demographic characteristics of those affected are unknown (64) Individuals experiencing EVALI may require the speciality services of an intensive care unit (ICU) and according to The Canadian Institute for Health Information, an overnight stay in the ICU in 2016 cost approximately $3,592; three times higher than a general ward bed (43, 65). The use of e-cigarettes will contribute to increased pressure on an already resource-strained health care system and contribute to increased health care costs.

Educational Perspective

The use of e-cigarettes by youth in schools has also emerged as a behavioral problem in this context. Much like traditional cigarettes, the attitudes of young people towards e-cigarettes is influenced by the opinions and vaping behaviours of friends and family (9). Some young people believe that e-cigarettes are more socially acceptable, and their use is viewed as an expression of social identity (9). Indeed, vaping currently boasts a “cool factor” for youth (9), reminiscent of smoking cigarettes in past decades. As such, peer influence and perceived social norms are likely drivers of e-cigarette use in schools. Action at the provincial and local level have been taken to curb this behaviour. For example, the Smoke-Free Ontario Act has banned vaping on school grounds and within 20 meters of school property since October 2018 (66). In Ottawa, St. Joseph High School has initiated the removal of washroom doors and a $250 dollar fine to any student caught vaping inside the school (67). Other school boards throughout Canada have followed suit and have banned vaping on school property (24). Concern regarding the use of e-cigarettes in adolescence is related to the effects of nicotine on the developing brain, particularly the prefrontal cortex, which is involved in the control of attention and executive functioning (68). Exposure to nicotine during adolescence has been shown to compromise emotional and cognitive processing and disrupt working memory (5, 69).

Health Canada has been actively involved in mitigating youth vaping practices. At the end of 2018, it launched a vaping prevention public education campaign that targeted youth, parents and other adults (19). As part of

this campaign, movie theatres were used as a platform to disseminate information to youth about the dangers of vaping, and signs prohibiting smoking/vaping were placed at public venue entrances (19). Interactive teaching sessions in high schools and community centers across Canada are being conducted to cultivate more discussion and awareness around the dangers of vaping (19). Vaping Awareness Kits have also been provided to schools that do not participate in these sessions and includes: posters, "no vaping/no smoking" signs, activity sheets for students, and tip sheets for teachers and parents to increase awareness and support vaping discussions with youth (19).

DISCUSSION

E-cigarette use among youth is a significant population health issue in Canada. The interdisciplinary perspectives presented above helped to conceptualize the current issue by using diverse professional lenses to analyze the context in which this issue emerged. Below we suggest some ways in which interdisciplinary and intersectoral collaboration can help pave the way for effective and sustainable solutions.

Given the impact of e-cigarettes on public health, continued monitoring of vaping among youth will be required to understand the scale and evolution of this problem, and its contributing factors. Public consultations regarding the review of the TVPA has allowed stakeholders including members of the general public, academia, municipalities, public health advocates, and health professionals and their associations, to engage with the policy-making process and provide feedback (70). Since the ultimate goal is to protect youth, direct engagement with young individuals is necessary to understand their motives for using e-cigarettes and identify the sources that influence this behavior. Qualitative approaches such as focus groups could provide valuable insights on youth's perception and use of e-cigarettes. Involving youth in the policymaking process would also be a powerful and meaningful way to engage young individuals. Some Canadian youth are already advocating and lobbying for stricter regulation of e-cigarettes (71).

In terms of engaging the health care sector, the Ontario Agency for Health Protection and Promotion Act 2007, requires institutions such as hospitals, long-term care facilities and retirement homes to report disease outbreaks to their local health authority (72), which then work with these institutions to investigate all reports of suspected and confirmed outbreaks (73). In these cases, field epidemiologists are employed to investigate the public health issue and offer guidance in the process of selecting and implementing interventions to lessen and prevent illness/death in a timely manner (74). Field epidemiologists could be deployed to investigate the use of e-cigarettes and the linked EVALI hospitalizations in order to identify the products responsible for this condition. Public health agencies may then disseminate findings in the form of reports and warnings to the public.

Health Canada may serve as a strong ally in partnering with school boards throughout Canada to mitigate the issue of vaping among youth. The Canadian School Board Association has stated that it is seeking assistance from the federal government to enhance educational programs to better educate students about the dangers of vaping (75). Funding assistance from the government would allow school boards to follow through with effective programs, such as a newly introduced physical education program supplemented with a component on the health effects of vaping (75). Engagement within schools is also crucial in moderating the issue of youth vaping. School policy should be reinforced by staff, including the confiscation of vaping products found on school property and the reporting of incidents to by-law, which requires students to pay a $250 fine (67). Communication between teaching staff and parents is vital to raise awareness and disseminate information between the school and the home. Providing parents with information on vaping, including how to identify the products and their adverse health effects, is an important way to ensure that parents remain vigilant and aware of their adolescents' behaviours while at home. Cohesion between government legislation, school policy, advertisements and educational promotion will provide more consistent messaging to youth, and will be a more

effective strategy in mitigating youth vaping.

CONCLUSION

E-cigarette use among Canadian youth is a concerning population health issue. Vaping was marketed as a healthier alternative to cigarette smoking and promoted as a means to reduce smoking-related harms. However, rather than having a net benefit for public health, it has had unexpected deleterious consequences due to the effects of nicotine, THC, vitamin E acetate and other potentially unknown chemicals. Youth are an overrepresented population currently affected by vaping related consequences, which may have been the result of effective marketing techniques used by e-cigarette companies as well as inadequate public policies. Identifying and understanding this problem through an interdisciplinary approach that engages stakeholders including policy makers, public health agencies, field epidemiologists, biomedical researchers, school boards and youth themselves has the potential to create more effective and sustainable solutions. Partnerships between school boards and governmental bodies can enhance educational resource allocation and align messaging to youth through several platforms.

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Préparation à l'externat: études médicales de premier cycle à l'Université d'Ottawa

Keywords: Medical School, Clerkship, Medical Student, Medical Education

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ABSTRACT

For medical students, the transition from pre-clerkship to clerkship is a key period within the four-year program. Thus, at the University of Ottawa, it would be essential to regularly review the curriculum, especially the Integration Unit (last unit of the pre-clerkship) and the Link Block (first unit of the externship). This quality improvement study aims at strengthening the current medical curriculum to improve clerkship preparation by focusing particularly on the Integration Unit and the Link Block. A literature review was conducted to find relevant theoretical models supporting curriculum changes that intend to improve knowledge integration during pre-clerkship. Curriculum mapping of the Integration Unit and Link Block was also performed to conceptualize and to concretize the incorporation of the curricular changes. In the integration unit, curriculum was divided into 54% didactic classes, 19% practical aspects and 21% workshops. For the Link Block, 22.3% contributed to didactic classes, 28.6% to workshops and 48% for practice in the hospital setting. Clerkship preparation can be improved by optimizing integration throughout pre-clerkship, particularly during the last unit of second year (Integration Unit). Positive modifications include: prioritizing active learning as opposed to passive learning; focusing on cognitive integration at the classroom level; building on complexity using a life-cycle approach aiming to have most complex subjects at the end of pre-clerkship; and having an associated physician skills development session to each case-based learning sessions.

RÉSUMÉ

Pour les étudiants en médecine, la transition entre le pré-externat et l'externat est une période clé des études médicales de premier cycle. Ainsi, à l'Université d'Ottawa, il serait primordial d'effectuer régulièrement une révision du curriculum, plus particulièrement l'unité d'intégration (dernière unité du pré-externat) et le stage préparatoire (première unité de l'externat). Cette étude d'amélioration de la qualité vise à apporter des recommandations afin d'améliorer le curriculum médical actuel de manière à améliorer la préparation à l'externat en s'attardant particulièrement à l'unité d'intégration et au stage préparatoire. Une revue de la littérature a été complétée afin de faire ressortir les concepts théoriques sur lesquels se fondent les modifications au curriculum qui ont pour but d'améliorer l'intégration de connaissances lors du pré-externat. Le mapping du curriculum de l'unité d'intégration et du stage préparatoire a également été effectué afin de conceptualiser et concrétiser l'incorporation des modifications au curriculum.Lors de l'unité d'intégration, le curriculum est divisé en 54% de cours didactiques, 19% d'activités pratiques et 21% d'ateliers. Pour le stage préparatoire, 22,3% était alloué aux cours didactiques, 28,6% aux ateliers et 48% à la pratique en milieu hospitalier. La préparation à l'externat peut être améliorée en optimisant l'intégration au cours du pré-externat, particulièrement durant la dernière unité de la deuxième année (unité d'intégration). Des modifications potentiellement bénéfiques comprennent : prioriser l'apprentissage actif à l'apprentissage passif ; mettre l'intégration cognitive en premier plan en salles de classe ; bâtir progressivement en complexité en visant à avoir les sujets les plus complexes à la fin du pré-externat en utilisant une approche de cycle de vie; et associer une séance de développement des compétences des cliniques à chaque séance d'apprentissage par cas.

INTRODUCTION

Pour les étudiants en médecine, la transition entre le pré-externat et l'externat est une période clé durant le programme médical (1). En effet, il s'agit d'un processus dynamique incluant à la fois l'utilisation et l'acquisition d'une toute nouvelle série de compétences ainsi qu'un changement drastique d'environnement (2). Cette transition, d'un côté, mène à l'épanouissement des étudiants en médecine mais, de l'autre, peut également susciter du stress auprès de cette population (2). Le succès d'un curriculum de pré-externat peut être mesuré selon la capacité des étudiants à utiliser les concepts scientifiques fondamentaux dans un contexte clinique (3). Selon Ginsburg et al., un curriculum de pré-externat qui ne parvient pas à présenter l'information en créant une diversité de liens à la dimension clinique de la médecine rend le rappel de connaissances difficile à l'externat pour les étudiants. La notion d'intégration en éducation médicale est de plus en plus omniprésente dans la littérature médicale. En effet, la Fondation Carnegie souligne l'importance de son incorporation au sein des curriculums médicaux dans son rapport Educating Physicians (4). D'un point de vue pédagogique, un curriculum qui met au premier plan l'intégration a le potentiel d'optimiser l'apprentissage des étudiants en visant un progrès longitudinal permettant une transition plus fluide du pré-externat à l'externat et, éventuellement, à la résidence (5).

Il est donc de mise que les curriculums médicaux soient constamment étudiés et analysés d'un œil critique. En effet, depuis la naissance de l'éducation médicale en 1765, la réforme de curriculum définit et redéfinit la structure des programmes médicaux mondiaux (1). Avec les changements se produisant dans la société, en termes de santé médicale et sociale de la population, il est important que les modifications au curriculum reflètent l'évolution temporelle de ces tendances (6).

Cette étude vise à renforcer le curriculum médical actuel de l'Université d'Ottawa de manière à améliorer la préparation à l'externat en s'attardant particulièrement à l'unité d'intégration et au stage préparatoire. À la suite d'une revue de littérature et d'un mapping du curriculum, cette étude suggère des modifications au curriculum visant à optimiser l'intégration au cours du pré-externat.

MÉTHODOLOGIE

RECENSION STRUCTURÉE DES ÉCRITS

a) Exploration d'un modèle standard approuvé pour développer un curriculum médical

Une recherche de la littérature a été effectuée en utilisant la base de données Ovid MEDLINE, recommandée pour les sujets touchant la pédagogie. Les mots-clés suivants ont été utilisés : medical education AND curriculum mapping AND mapping validation. Le premier terme, medical education, a été utilisé afin d'avoir un aperçu du montant de littérature se trouvant sur le sujet, trouvant 41 198 articles. À la suite de l'ajout des autres mots-clés, de la filtration des articles selon leur pertinence et de la saturation des données, le nombre total d'articles utilisés était de huit (7-14). Aucun article n'a été trouvé sur une approche systématique de valider un mapping de curriculum (9).

b) Comparaison des curriculums médicaux canadiens

Une revue de la littérature grise a été effectuée grâce aux moteurs de recherche Google et Google Scholar et a permis de faire ressortir l'information pertinente reliée aux curriculums des écoles de médecine du Canada. Des dix-sept écoles de médecine, seize ont été incluses dans l'analyse. En effet, il n'y avait pas assez d'information publique sur le curriculum de médecine de l'Université de Sherbrooke, ce qui a mené à son exclusion. De plus, c'est en naviguant les sites web des différentes écoles de médecine qu'une gamme d'autres articles pertinents ont été trouvés (1, 5, 15-17).

c) L'intégration et la préparation à l'externat

Des recherches additionnelles sur les curriculums médicaux ont été effectuées dans la base de données ERICProQuest. Une combinaison de mots clés a permis de trouver 3808 articles reliés à notre sujet de recherche: ti(medical curriculum) OR ti(medical clerkship) AND ti(preparation) OR yi(consolidation) OR ti(integration) NOT ti(anatomy). Les articles sélectionnés portaient sur la consolidation et l'intégration de l'information au pré-externat en vue de la transition à l'externat dans le contexte du programme de médecine. 60 articles ont été analysés et, de ce nombre, 3 ont été retenus du point de vue de l'applicabilité au projet de recherche (14, 18, 19). Une autre recherche ((medical curriculum) AND integration AND integrated) a généré 91 résultats, dont 20 ont été sélectionnés et 1 seul retenu (4). Un seul article a été trouvé grâce à une recherche dans la littérature grise (6).

MAPPING DU CURRICULUM

Un mapping du curriculum de l'unité d'intégration et du stage préparatoire a été effectué afin de déterminer la répartition des cours didactiques, des ateliers et des sessions pratiques. Le portail Elentra a été utilisé pour comptabiliser le nombre d'heures dans chaque catégorie. Les cours didactiques obligatoires (qui correspondent majoritairement aux cours de Société, individu et médecine (SIM)) et non-obligatoires ont été rassemblés dans l'onglet cours théoriques. La composante pratique comprend les cours de Développement d'aptitudes cliniques (DAC), les cliniques simulées et séance d'Examens Cliniques Objectifs Structurés (ECOS). La composante ateliers comprend les cours identifiés comme ateliers dans le portail ainsi que les séances d'Apprentissage par cas (APC). Les auto-apprentissage et extra décrivent les modules d'auto-apprentissage et les séances additionnelles respectivement. Le stage préparatoire, quant à lui, comprend les mêmes composantes que celles de l'unité d'intégration, ainsi qu'un horaire de garde.

RÉSULTATS

RECENSION STRUCTURÉE DES ÉCRITS

a) Mapping du curriculum

Un curriculum cherche à faire un parallèle entre le curriculum planifié (objectifs et attentes d'un programme), le curriculum prodigué (à travers des cours et des professeurs) et le curriculum vécu auprès des élèves (ce que les étudiants retiennent) (11). Le curriculum souhaité cherche donc à ce que le curriculum prodigué ressemble au curriculum vécu, afin de s'assurer que les compétences jugées nécessaires à acquérir sont transmises aux étudiants. Les difficultés encourues se situent entre les attentes de connaissances à acquérir et la façon de les enseigner en sélectionnant le contenu, en intégrant la matière, en s'assurant de sa clarté et en évitant les répétitions (7). Ceci doit être fait en considérant un style d'apprentissage selon les étudiants, un horaire adéquat et une organisation logique des idées, et ce, en ajoutant une méthode d'évaluation permettant la rétroaction et l'amélioration d'un curriculum (7). Les types de sessions éducatives incluent des cours magistraux, des classes inversées, des séances en laboratoire, des séances en petits groupes, des expériences cliniques, des séances de compétence clinique, des clubs de lecture et des ateliers sur le professionnalisme (10).

Le développement d'un curriculum médical est unique, puisque la composante clinique/pratique est importante afin de rendre les étudiants confortables dans un contexte hospitalier (7). La section du pré-externat sert donc à développer un curriculum concentré sur la composante théorique afin de pouvoir utiliser ces connaissances lors de la section d'externat pour l'aspect pratique et l'utilisation des connaissances acquises. Dogra (11) ajoute à cela trois modèles, soit le modèle horizontal, le modèle vertical et le modèle spiral. Le modèle horizontal comprend l'acquisition des connaissances de base ainsi que les liens devant être faits entre divers sujets tels l'anatomie, la physiologie et la pathologie. Le modèle vertical se concentre sur les connaissances déjà acquises au préalable en tissant des liens entre la théorie et le contexte clinique. Le modèle spiral est un ensemble du modèle horizontal et du modèle vertical, ce qui amène une diversité au curriculum. En effet, les connaissances à acquérir font partie de la dimension horizontale du pré-externat lorsque les bases de la médecine sont apprises. Ces informations sont revues et tentent d'être maîtrisées à travers la dimension verticale, où les mêmes notions apprises en salles de classe sont revues, mais cette fois-ci en milieu hospitalier. Certaines études, dont Yamani (13), amènent une parenthèse à cet égard : malgré l'importance du contenu théorique, son utilisation amène aussi une impression d'ennui et de manque de contenu ainsi qu'une faible utilité en milieu pratique. De même, Wood (14) appuie l'importance de s'éloigner de la composante magistrale et théorique afin de se concentrer sur des sessions d'apprentissage par problèmes permettant une transition moins drastique entre le pré-externat et l'externat.

Le curriculum médical a changé avec le temps, incluant l'apport d'une composante plus critique aux notions apprises en cours (8). L'emphase se porte davantage sur le raisonnement clinique et le jugement critique plutôt que la mémorisation. L'importance d'intégrer le raisonnement critique permet de développer les compétences de prise de conscience et de décision ainsi que d'améliorer l'inférence, l'évaluation, la résolution de problèmes, la prédiction et l'analyse des idées (8). Le curriculum intégratif, quand à lui, se veut de se baser sur des connaissances fondamentales afin de permettre une évolution alimentant le curriculum et le fragmentant pour en obtenir une meilleure compréhension (13). Pour ce faire, il s'agit d'apporter des expériences d'apprentissage pour faire des liens entre les

connaissances acquises et la pertinence clinique (13).

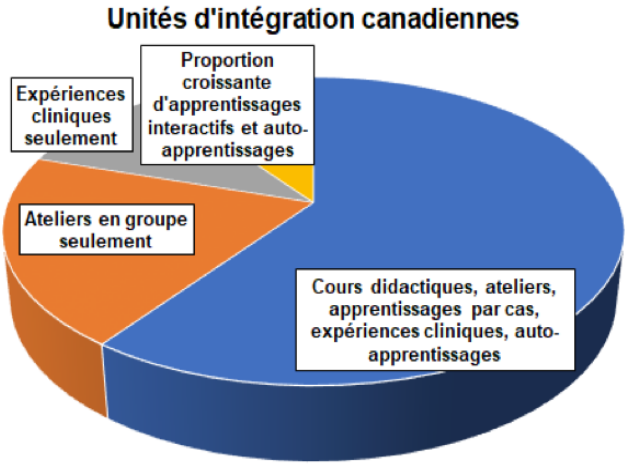

Figure 1. **Proportion d'écoles utilisant chaque méthode d'enseignement pour leurs unités d'intégration.**

b) Comparaison des curriculums médicaux canadiens

Des seize écoles canadiennes incluses dans l'analyse, dix avaient une unité spécifique dédiée à l'intégration, cinq n'avaient pas d'unité d'intégration, et une comprenait trois courtes unités d'intégration dispersées dans le curriculum au cours du pré-externat. Les unités d'intégration des dix écoles étaient placées à la toute fin du pré-externat. La moyenne de la durée des unités était de 12,4 semaines. Six écoles avaient des unités plus longues (9 à 24 semaines) que celle de l'Université d'Ottawa (Figure 1). De plus, cinq écoles comprenaient une composante d'intégration longitudinale, dont deux ayant aussi une unité d'intégration.

Aux dix écoles ayant des unités d'intégration, les activités d'apprentissages comprenaient un mélange de cours didactiques, ateliers, APC, expérience clinique et/ou auto-apprentissage (Figure 2).

c) L'intégration et la préparation à l'externat

Roberts (19) énonce les attentes de la société envers les médecins comme la communication, la sensibilité, la conscience culturelle et l'approche holistique à la gestion et la prévention des maladies. Dans son analyse critique du modèle SPICES de Harden, Roberts explique qu'afin que l'APC soit efficace, les sessions en classe devraient être intégrées à des sessions d'apprentissage en clinique. Il stipule également que l'apprentissage en communauté est important afin de préparer plus de médecins pour les soins en communauté. De plus, le contenu du curriculum devrait refléter les besoins médicaux de la population, le nouveau savoir médical et l'évolution du rôle du médecin.

Selon Newell (18), une approche intégrée à la gériatrie est nécessaire; il faut mettre au premier plan l'importance des connaissances médicales, fonctionnelles, psychosociales, économiques et éthiques, ainsi que l'habileté d'intégrer ces concepts dans un environnement multidisciplinaire. Les auteurs font aussi la suggestion d'objectifs d'apprentissage pour un curriculum de gériatrie, suggérant un programme de visites familiales au foyer par des équipes multidisciplinaires d'étudiants chez des familles multigénérationnelles.

Selon Khalil et Kibble, le plus haut niveau d'intégration est atteint par l'entremise des activités cognitives accomplies par les élèves plutôt que par la conception du curriculum (4). Deux principes généraux mettent les membres du corps enseignant au centre de la création d'un programme intégré efficace. Premièrement, il est nécessaire de créer des activités d'apprentissage en salle de classe qui relient les sciences fondamentales et cliniques. Deuxièmement,

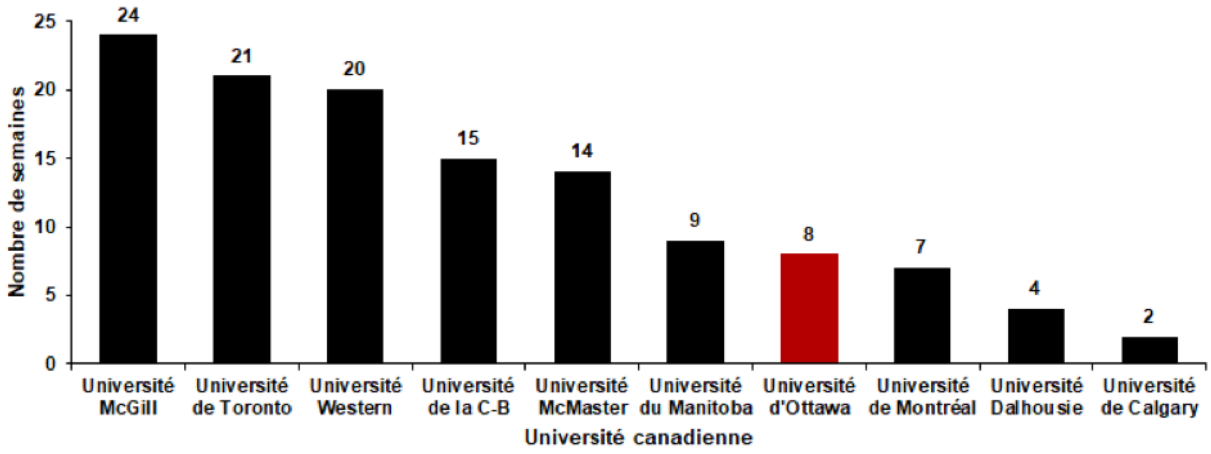

Figure 2. **Durée de l'unité d'intégration pour les différentes écoles de médecine du Canada.**

on constate que les approches d'apprentissage actif sont en général plus efficaces pour l'apprentissage. Ainsi, les auteurs soulignent qu'il est important que tous les membres de la faculté aient comme but commun de créer des connections entre le matériel et de prioriser les méthodes d'apprentissage actif.

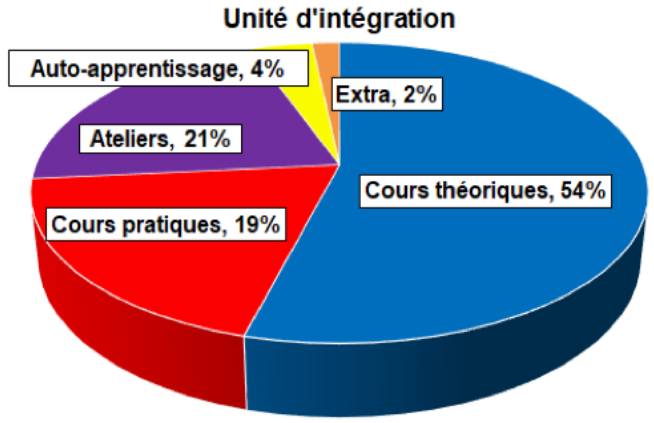

Figure 3. **Répartition du curriculum pour l'unité d'intégration.** Répartition a été calculée en comptabilisant les huit semaines de l'unité d'intégration.

Kulasegaram (16) présente un nouveau curriculum de pré-externat visant à suggérer des expériences éducatives qui mettent la priorité à la préparation à l'apprentissage futur, parallèlement et au-delà de la performance immédiate. En effet, le curriculum a été conçu afin que chaque objectif de la semaine et de l'unité soient liés aux éléments futurs du pré-externat, ce qui maximise l'intégration. L'apprentissage actif est plus efficace que l'apprentissage passif, et l'intégration cognitive en salle de classe peut mener à un meilleur raisonnement clinique (4).

MAPPING DU CURRICULUM

La répartition de l'unité d'intégration telle qu'illustrée s'échelonne sur huit semaines et le curriculum est divisé en cours didactiques, d'ateliers, d'activités pratiques, de modules d'auto-apprentissage et de séance extra (Figure 3). La répartition en fonction de la semaine permet de mieux visualiser les nuances de catégories entre semaine (Figure 4). Toutes les semaines de l'unité comprennent une proportion de cours théoriques de près de la moitié des cours, celle-ci étant plus importante lors de la semaine 3. De plus, les ateliers représentent une plus grande proportion de la semaine 8. La catégorie proportion de cours pratiques est assez régulière de la semaine 4 à la semaine 7, alors qu'elle est absente lors de la semaine 3. Les semaines 3 et 8 sont plus courtes en étant inférieures à 20h alors que la semaine 7 est la plus occupée avec presque 35h de cours (Figure 5).

Le stage préparatoire, quant à lui, s'échelonne sur trois semaines et est divisé en cours didactiques, ateliers, pratiques en milieu hospitalier et de séances d'extra (Figure 6). La semaine 1 est la seule qui comprend la catégorie de cours théoriques, correspondant à plus de la moitié des cours (Figure 7). Le reste se subdivise en ateliers interactifs sur des concepts de base tel qu'une révision de l'interprétation d'une radiographie pulmonaire ou d'un électrocardiogramme ou même la rédaction de notes médicales. Les semaines 2 et 3 ne comprennent aucune composante théorique, toutefois celles-ci se composent majoritairement d'une composante pratique et d'ateliers interactifs (Figure 7). Une évolution est perçue, où les cours théoriques se font remplacer graduellement par la composante pratique.

DISCUSSION

RECENSION DES ÉCRITS

De manière concrète, Newell (18) aborde le sujet du curriculum de gériatrie. Des séances en clinique spécifiques à la gériatrie (ex: DAC) pourrait aider à consolider les connaissances et à offrir aux élèves une exposition clinique adéquate avant l'externat. De plus, incorporer au curriculum de gériatrie des visites à domicile ou des visites chez les patients hospitalisés permettrait d'augmenter l'exposition clinique des étudiants. Utilisant le raisonnement de Roberts (19), chacune des sessions d'APC devrait être associée à une session de DAC visant à consolider les connaissances cliniques. De plus, l'apprentissage en communauté est absent du curriculum durant l'unité d'intégration. Des visites à domicile pourraient renforcer le niveau d'exposition à la médecine communautaire et maximiser l'exposition aux soins palliatifs. Ainsi, une révision du curriculum gériatrique permettrait d'offrir un enseignement intégré adéquat adapté à l'évolution des besoins de la population.

L'intégration cognitive des concepts devrait principalement s'effectuer en salle de classe (4, 16). Cela peut être accompli en jumelant chaque maladie présentée cliniquement à une explication pathophysiologique. À l'unité d'intégration

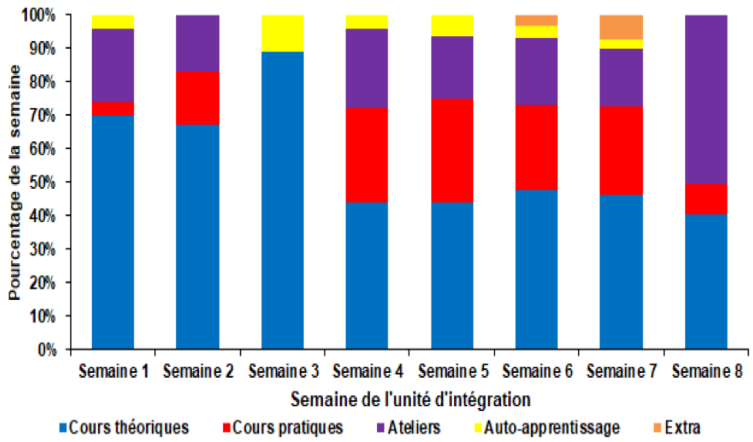

Figure 4. **Répartition relative de l'unité d'intégration par semaine.**

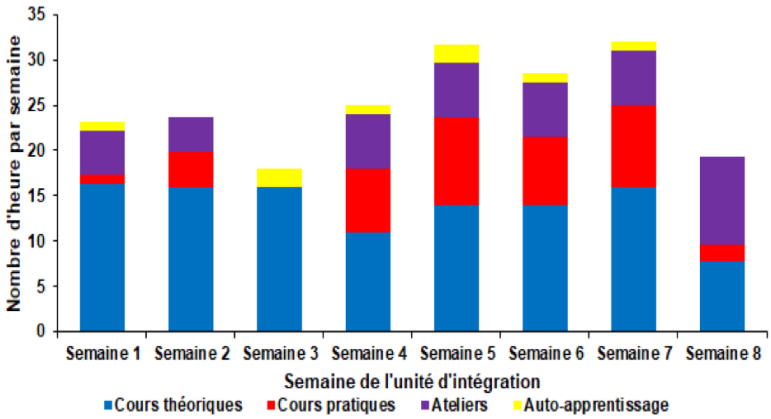

Figure 5. **Répartition absolue de l'unité d'Intégration par semaine.**

de l'Université d'Ottawa, les concepts cliniques sont rarement accompagnés de la physiopathologie, ce qui met en évidence le manque d'intégration de science fondamentale. Khalil et Kibble (4) indiquent qu'il serait bénéfique d'augmenter les sessions d'apprentissage actif par rapport à l'apprentissage passif pour optimiser la rétention de connaissances. Ainsi, l'ajout d'activités d'apprentissage actif de type varié, tel que des sessions d'APC et de DAC, aurait un impact positif sur le curriculum de l'unité d'intégration pour complémenter les nombreux cours didactiques (16).

Kulasegaram (16) affirme que l'intégration est renforcée si les sujets étudiés se succèdent de façon longitudinale, où chaque sujet s'appuie sur le précédent. Il serait donc bénéfique de réorganiser l'ordre des sujets de l'unité d'intégration afin de suivre la chronologie du cycle de la vie. De plus, la médecine intégrative devrait inclure une dimension non-médicale afin d'avoir une approche holistique de la personne et de sa maladie (19). Lors des unités du pré-externat avant l'unité d'intégration, les cours de SIM adressent les enjeux touchant la société et les individus. La présence de ces cours devrait persister lors de l'unité d'intégration afin de s'assurer d'avoir une approche globale du patient.

La ressemblance principale entre universités canadiennes était l'emphase sur les disciplines cliniques. En effet, la majorité des écoles de médecine canadiennes adoptent la méthode d'apprentissage par système lors du pré-externat, et la laisse typiquement de côté à la dernière unité. Il serait bénéfique que les écoles revisitent leur curriculum afin de s'assurer de la présence de science fondamentale dans leur unité d'intégration.

Une certaine partie des programmes dédient la dernière unité à la résolution de cas cliniques complexes, avec ou sans patients standardisés, offrant ainsi une dimension d'apprentissage actif. De son côté, l'Université de Western Ontario dédie la dernière unité au complet à l'exposition clinique en offrant des mini-rotations aux élèves dans une gamme de spécialités. Ce type de curriculum est non-seulement axé sur l'apprentissage actif, mais aussi sur l'exposition clinique. L'Université de Calgary se distingue en éliminant toute évaluation formelle durant la dernière unité du pré-externat. Cette approche peut minimiser le stress des étudiants avant leur entrée à l'externat. Une autre différence notable est l'approche chronologique au cycle de la vie propre au curriculum de l'Université de Toronto, permettant de mieux inciter l'intégration.

MAPPING DU CURRICULUM

La répartition plus importante en cours théorique de l'unité d'intégration à l'Université d'Ottawa concorde avec la littérature revue quant à la proportion plus importante de cours didactique lors de la portion pré-externat (7, 11). Selon ces sources, le modèle horizontal occupe les deux premières années du pré-externat pour enseigner la composante fondamentale de la médecine. Yamani (13) mentionne l'importance d'éviter la division brusque des sections théoriques et cliniques du pré-externat et de l'externat en permettant davantage de contexte clinique vers la fin du pré-externat, donnant la chance aux étudiants d'apprécier l'utilisation de leurs connaissances et de connaître les notions nécessitant plus de révisions. Le stage du pré-externat, lui aussi, est soutenue par la littérature revue; en trois semaines, le curriculum passe progressivement d'une majorité théorique à une majorité plus clinique/pratique. Ceci offre aux étudiants l'opportunité

de se repérer en milieu hospitalier et de commencer progressivement leur rôle d'externe.

Burell et al. (8) discutait de l'évolution du curriculum et de l'importance d'intégrer le développement de la pensée critique. En effet, la composante e-Portfolio nécessite que l'étudiant écrive une réflexion, alors que l'ECOS nécessite de verbaliser et de pratiquer cette même pensée critique. Comme Ellaway et al. (12) le mentionne, les modèles de curriculum varient entre écoles. Le temps libre joue un rôle dans le curriculum intégratif prenant de plus en plus d'importance (13). En effet, cela donne l'option aux étudiants d'explorer d'autres manières d'apprendre avec leur propre temps et techniques d'apprentissage (auditive, visuelle et/ou kinesthésique). De cette façon, l'intégration des notions peut sembler plus facile lorsqu'un cas semble résumer des notions vues en cours.

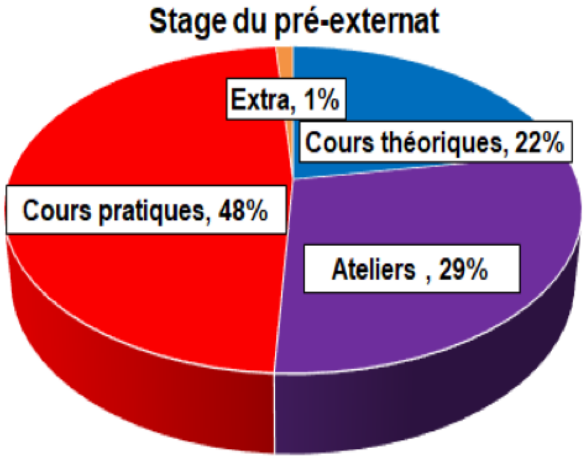

Figure 6. **Répartition du curriculum du stage pré-externat.** Répartition a été calculée en comptabilisant les trois semaines de l'unité de stage pré-externat.

RECOMMANDATIONS SUGGÉRÉES

La préparation à l'externat peut être améliorée en optimisant l'intégration au cours du pré-externat, plus particulièrement durant la dernière unité de la deuxième année (unité d'intégration). Avec les données du mapping du curriculum ainsi que les résultats trouvés lors de la recension des écrits comparant quelques universités canadiennes, nous suggérons les recommandations suivantes:

1. Garder les cours SIM à la dernière unité et les utiliser pour couvrir les sujets de médecine humanitaire importants, permettant d'avoir une approche holistique de la maladie, et favorisant l'intégration
2. Réorganiser l'unité en ordre chronologique et bâtir en complexité en suivant le modèle du cycle de la vie
3. Ajouter des sessions de DAC complémentaires aux thèmes de chaque semaine (en clinique et en communauté)
4. Éduquer chaque enseignant sur la manière de promouvoir l'intégration en salle de classe

En suivant les recommandations présentées, un nouvel horaire pour l'unité d'intégration de l'Université d'Ottawa a été créé et se retrouve dans l'Annexe A. Puisque les volets francophone et anglophone suivent le même curriculum pour le pré-externat (ce qui inclus l'unité d'intégration), il est à noter que les recommandations énoncées dans cet article s'appliquent de manière équivalente aux deux volets. Cela n'est pas nécessairement le cas pour le stage préparatoire à l'externat puisqu'il diffère entre les deux volets, plus particulièrement en ce qui concerne les activités cliniques.

CONCLUSION

Cette étude a permis une évaluation de la composante pré-externat de la faculté de médecine de l'Université d'Ottawa en portant une attention particulière à l'unité d'intégration et au stage préparatoire à l'externat en démontrant les points forts de même que les facettes pouvant être améliorées. Dans le cadre de cette étude, une revue de littérature en profondeur a été réalisée et une analyse comparative a permis d'évaluer le contenu et la structure des curricula de toutes les écoles de médecine du Canada. De plus, une méthodologie claire a été décrite pour le mapping du curriculum, ce qui n'avait pas été fait auparavant dans la littérature.

Or, un sondage suite à l'implémentation des recommandations de cette étude permettrait de déterminer l'impact et l'efficacité des mesures suggérées. Il est aussi important de considérer que ces recommandations, malgré le fait qu'elles ont été élaborées en fonction des curricula d'autres universités canadiennes, ne prennent pas en compte la satisfaction des étudiants dans ces mêmes universités. Il va de soi que les résultats de cette étude sont des suggestions générales pour l'Université d'Ottawa et ne s'appliquent pas nécessairement à toute faculté de médecine canadienne et leur nuance curriculaire. Les directions futures à la suite de ce projet

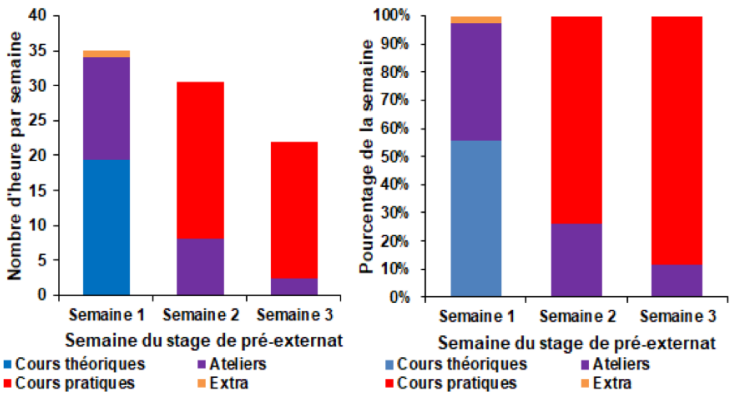

Figure 7. **Répartition d'heures absolue et relative du stage de pré-externat.**

incluent la participation des experts de contenu des unités évaluées dans cette étude, afin de connaître la faisabilité d'un changement de curriculum. Il serait aussi bénéfique d'approfondir notre sujet de recherche en comparant les objectifs du pré-externat et de l'externat dans le but d'assurer une bonne représentation des sujets/spécialités couverts lors de l'externat afin de maximiser la préparation à chaque rotation de l'externat.

La société dans laquelle nous vivons est en constante évolution, et il est important d'évaluer les méthodes et les structures d'enseignement pour que les étudiants aient une formation qui reflète le monde pour lequel elle les prépare.

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Perspectives from an Endocrinologist at the Ottawa Hospital- An Interview with Dr. Christopher Tran

Keywords: Career Advice, Interview, Medical Education, Endocrinologist

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ABSTRACT

Dr. Christopher Tran is an endocrinologist at The Ottawa Hospital known for his work on medical education and eConsults. He is also a friendly, familiar face for second-year uOttawa medical students in the English stream during their Endocrinology Block. We sat down with Dr. Tran to talk about his current work as well as his perspectives on research and social media use among academics. Dr. Tran also provides advice to medical students with regards to deciding on a medical specialty to pursue and how to approach the CaRMS application process.

RÉSUMÉ

Dr. Christopher Tran est endocrinologue à l'Hôpital d'Ottawa et est connu pour ses intérêts en enseignement médical et consultations en ligne. Il est aussi un visage familier pour les étudiants en deuxième année de médecine de l'Université d'Ottawa, volet Anglophone, qui ont eu la chance de le rencontrer durant leur bloc d'endocrinologie. Avec Dr. Tran, nous nous sommes assis et avons discuté de son travail actuel ainsi que de ses perspectives de recherche et de l'utilisation des médias sociaux au niveau académique. Dr. Tran offre également des conseils aux étudiants en médecine par rapport au choix de spécialité ainsi que sur la façon d'aborder le processus de demande de CaRMS.

Can you tell us a bit about your academic background and your current professional roles?

I'm an academic endocrinologist at the Ottawa Hospital. Prior to that, I finished medical school in Toronto and internal medicine and endocrinology residency training at Ottawa. I then completed 2 or 3 more years of what we call a Clinical Scholar Program. At the Ottawa Hospital, there are different roles that you may have heard of like clinician, educator, investigator, and so on. I'm a clinician educator.

What was your master's degree on specifically?

I did a Master of Medical Education. It was a distance program where you complete six courses. Each course is based on a medical education topic, such as curriculum, assessment, faculty developments, and clinical teaching. For each course, you have to write an assignment that ranges from 2,500 to 4,000 words. Once you pass that, you write a 15,000 words thesis project. It took me quite some time, but I'm happy I finished it. At the end of the day you learn a lot.

How did you choose your career in endocrinology as opposed to some of the other internal subspecialties or even outside of internal medicine?

I knew I didn't want to do surgery, so it was down to primary care services versus internal. I applied to both specialties for CaRMS in my fourth year of medical school, but during

my electives, I chose endocrinology because it sort of mirrors both primary care and internal medicine. I did my endocrinology elective, and I really fell in love with it. Even before that, my senior medicine resident on internal medicine just sat down with me one day and showed me how to write everyone's sugars down, how many units of insulin were given, and how to adjust day-to-day. I just fell in love right then and there. I don't think he had any intention of convincing me to go into endocrinology by doing that, but that small gesture made such a big ripple. During my elective in endocrinology, I ended up doing really well and matched to internal medicine. I didn't do endocrinology right away. When I finally did endocrinology in my second year, I knew that was the specialty for me because every day after I went home, I kept thinking to myself, "oh I should have done this better." I was trying to impress other people during that rotation.

Notice how I didn't really tell you what part specifically about endocrinology I thought was interesting. I can go on and on and on about that, but sometimes you just need to know – where do you see yourself in the future? One way to do that is to see if you can see yourself working with the people who are in that field. For example, all the endocrinologists and residents that I worked with, I felt like I could jive with them. Little things like that helped me with that decision.

Why did you choose to work in an academic center as opposed to a community clinic?

I'll be very candid here. Sometimes you have a choice and sometimes you don't. A lot of it is just what is out there. There are pros and cons of academic versus community, and I think I would have been happy with either. Academia is great because you really stay with the mothership. You're trained in the mothership for medical school and residency, so it's hard to leave and work in the community. I like to stay in academics, and I've been working in Ottawa since 2011. Just knowing that I can bump into people who I've worked with before and those who are not necessarily in my field is quite nice. I like that you can really get involved in medical school and teaching. You can do research and education as a community physician as well. A good example is Dr. Khamisa. She does community medicine, but she's still very much involved in medical education. It was always very intuitive for me to stay academic. A little bit of luck is also always appreciated, right? When I was about to finish my residency, it just so happened that the division had a few people retiring and another person who was looking to get rid of one of their clinics. I happened to be at the right place at the right time, which helped with the decision.

As a physician, you're also active on Twitter. Do you see a world where social media plays an important role for medical specialists?

When I post something, maybe I'll get a like and a retweet, if I'm lucky, but do I see that as the future? The answer is yes and no. Even some of the most tech-savvy people are not on social media. I like using it for conferences because it helps me remember what I just learned in that talk. If I want to go back to a conference that I attended two years ago, but I don't remember anything at all about how it changes my practice, I could scroll back to my previous post. It's really just for me, but it's nice if other people see it too. I don't use Twitter very often, but I've managed to find other endocrinologists that work across Canada and that happened to just follow me. It's another way to make connections and network, because you can just DM them with certain questions. I haven't looked into how you harness that into medical learning yet. There are some students that I'll follow. If they post a poster and you just click that like button, it probably makes them happy. I think it's a good way to get recognized for what you do.

Do you see social media playing a greater role in the world of research?

The people that really like social media and do research, their arguments are that in the world of academic medicine, how do you prove to everyone that you deserve your spot and that you should stay there? It's all about publications; you publish or perish. Questions such as "how many

publications do you have?" and "are these high impact journals?" are very important. There's something else called altmetrics. Some people don't have publications in the New England Journal of Medicine or Lancet, but they have a wide following on Twitter. They're considered experts by just posting on social media. That should be something, right? If it does get to a point where someone decides that your academic portfolio includes your social media presence, I guess it will mean something in the academic future. I don't see a world where you will be expected to be on Twitter all the time in addition to publishing. However, there are a lot of people who do use it, and it's a really good way to get easier exposure.

Can you tell us about how you developed an interest in research, the research you do, and whether you consider it to be an integral part of your career?

I suppose research is an integral part of my career, but everyone has a different percentage when it comes to research time to clinic time. There is the expectation that you do some scholarly work, and you hope it gets published or disseminated through social media or a poster. Everyone's going to tell you if you start a project, always think about the publication at the end of the day. People don't generally think about research at the start of their career. You came into medicine to help people. It doesn't come natural to everyone, but when you get immersed in the research, you actually enjoy the project. You have something that you can call your own. When you're in academia, you want to be known as the person who knows that one thing. That's advice I was given by a few people. Another piece of advice that I've received is you have to pick something that annoys you. Something that annoys me is written communication and letters that physicians send to each other because a lot of the time, they're not really organized and not really clear. My master's project was looking at the current communication between the specialist and the primary care provider through something called eConsults. If you take something that doesn't interest you and doesn't annoy you, you're going to go into it and like it for a bit but then eventually get bored. So many scholarly projects start, but don't stop. The only way you're going to finish a project is if it annoys you because you want to see it to the end.

You have quite a bit of research on eConsults. Can you tell us about eConsults?

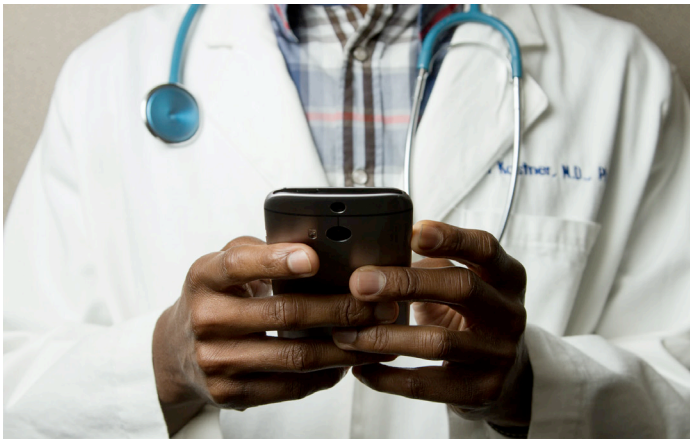
I got involved with eConsults when I was an R2 and wanted to do endocrinology. I emailed the Program Director at the time for any projects. She then introduced me to Dr. Erin Keely, an endocrinologist, and Dr. Clare, a family doctor. They met with me in 2010 and talked about how so many patients get sent from family doctors to specialty offices when the answer to their questions could have been answered by a quick phone call or email consultation. Through that came eConsults, which is electronic consultation. Long story short, your family doctor or even a specialist can send a clinical question based on a patient they just saw to a specialist for advice. They then get that advice back and can choose whether or not to implement that advice for their patient. What's so good about it? The patient doesn't have to wait weeks or months just to see the specialist.

When it came time to decide what to do for my master's project, I married written communication and electronic communication together. You have a bunch of specialists giving advice to primary care providers, but no one is actually telling them if that is a good way to give the advice or not. What is it about the quality of advice that makes it a good eConsult? No one really knows. Also, if you have eConsultants who are giving poor advice, do we want to let them know about that so they can improve? That was basically my master's project in a nutshell – trying to improve written communication from specialists to primary care providers through eConsults.

Regarding specialists not providing optimal consults compared to others, what are some other downsides you've found with eConsults?

As you can imagine, it doesn't replace the actual specialist. If there's a physical exam that has to be done, then you still end up having to see the specialist. Even so, with the information that the eConsult gives you, you can make the in-person visit a little bit more efficient. Another downside is increased workflow for the primary care providers in that the family doctor actually has to spend time preparing the eConsult and sending it to the specialist. What's the difference between that and sending an actual referral to a specialist? There are a few more steps involved when writing an eConsult but not too many. The primary care provider also has to actually implement the advice. For example, I'm an endocrinologist, and if I tell a primary care provider that, "This osteoporosis case is so easy. All you

have to do is give an intravenous bisphosphonate and call it a day," the poor primary care provider may not have the means to do that. Thus, part of the project is to tell the specialist to give your primary care provider actionable advice. There are some downsides, but they're few and far between I would say. Overall the positives outweigh the negatives.



Do you have any advice to students who are interested in doing research as well as any comments on strategies for balancing clinical versus research duties during training and throughout one's career?

As a clinical student and as a resident and as a staff, you're going to have a ton of balls in the air that you'll be juggling. It's the same thing as balancing everything else in your life. I've been trying to stop saying "I don't have time for that". I now start to say, "I can't commit the time right now". If you really want to do something, you will always find time to do it, especially if a deadline is looming. The advice I give is "you just have to know yourself best". You have to know what really drives you. If you think research is important, but you need deadlines, then you just have to make deadlines. You have to make an agenda and book it in your calendar that you're working on this project at this time. If you have a supervisor, you tell that supervisor, "I will give you this by the end of this day" and then you'll be held accountable for it. You do have time if you look for it.

Also, just make sure you're sleeping well. Don't do too much screen time at night. Don't drink too much coffee if it doesn't make you sleep well. Find other hobbies outside of medicine. These are all things you've heard before because they make sense. Don't just do things because you have to do it. Do something you actually like doing. You will get so much better at time management with the more responsibilities you get because it's more of a necessity.

On the topic of choosing a career in a specialty, what factors do you think students should take into account as they contemplate pursuing a career in a particular specialty?

There's general career advice that I tend to give people: it is important to not only think about the peaks of why a specialty or subspecialty may be awesome, but also to reflect on the lows of it as well. Wellness has gained some traction over the past few years, and you don't want to be burned out by your job. You must think about reasons why people don't want to do your specialty, and then if you can endure those or ideally like them, that specialty should be for you. For example, why don't people like to do endocrinology? Most of what we do is diabetes, and a lot of people, for understandable reasons, don't want to dedicate most of their career to the field of diabetes. But I absolutely love it. There are so many ways to treat a chronic disease as complex as diabetes, and you have to always take the patient into consideration. It's not just the blood work. You must consider other elements such as the patient's social and financial stressors and incorporate all these new wonderful medications, gadgets and gizmos that are out there. Others, however, might cite various reasons as to why they don't like diabetes. Basically, their reasons for not liking my specialty are reasons I can either endure or really like. For example, there are no procedures in endocrinology, which I'm fine with. I really didn't like surgical procedures much as a student or resident. People also like instant gratification, but it doesn't really matter to me. There are not that many instant gratification moments in endocrinology. When you deliver a baby or when you decompress a pleural effusion, these are what I call "I'm a doctor" moments. In my osteoporosis clinic, it's, "Here, take this medication once a week and I'll see you in 18 months to two years." I like that I can be proactive in the treatment process when dealing with chronic diseases. I can go on and on about different examples of endocrinology as well as other specialties. I love the weird and wonderful pheochromocytomas and acromegaly pituitary stuff, but if you don't like diabetes, you really might not be able to have a meaningful career in endocrinology. Similarly, if you like neurology and love ALS, but you hate stroke, maybe

becoming a neurologist isn't the best choice. Factors like these are what goes into a decision. You should think about what you can endure because at the end of the day, those are the things that are going to burn you out, which you want to avoid in your career.

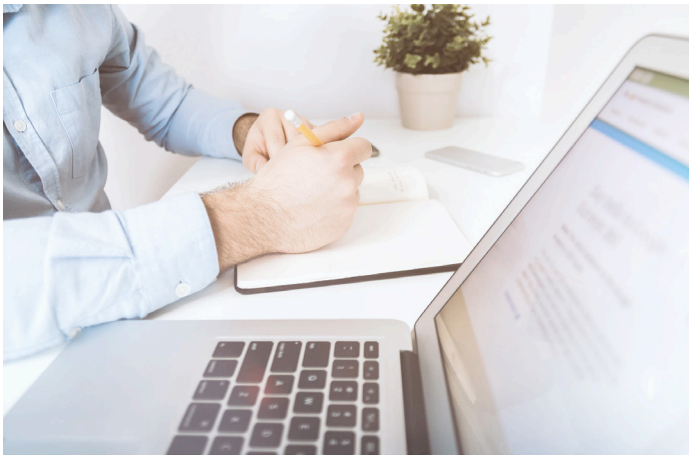
Are there any factors that you think students are not taking account early enough?

That's a great question. It's hard to answer because it's so hard to know what the right career is for you. After I applied to CaRMS, I did my anesthesia rotations for the very first time, and I thought that it was really cool. I know I just told you that I don't like doing procedures and then here I am, considering anesthesiology! I basically liked the pharmacology behind it and the whole 95% calm and 5% absolute terror. What I'm getting at is that it's so hard to know exactly what you want to do before because you might have ended up having a specialty that is actually better for you. I just sort of say, it's in a personality. It's very natural for us as medical students, residents, physicians to always optimize things. But, I say that you can always try to be comfortable with the second best and third best because you don't know which one is actually the best for you.

Another thing is just being very open to everything. Your heart might be set on one specialty, but if you didn't try other specialties, another one may actually be better for you. They're just too many things out there. When I tried to match for residency, I did not get my first pick. I got my second pick, and I was kind of sad, but it probably ended up being very good for me to come to Ottawa versus staying in Toronto. Maybe I thrived more in Ottawa or maybe I would have thrived more in Toronto, but I'm already here and I am very much happy now.

Would you be able to provide any advice for students who are interested in pursuing a career in internal medicine and specifically, endocrinology?

There's advice that will get you any specialty and there's advice that might get you the specific one you want. Honestly, the generic advice is so much more important. You need to be happy. Because if you're not happy, you won't do very well. It's not easy. There's a lot of mental health issues out there that everyone just sort of turns a blind eye to. You need to feel supported. Part of being happy is knowing yourself. Know what annoys you. Know what can bring you up when you're feeling down. And have that supportive network.



Otherwise, pick a specialty that really interests you. Also don't be so worried about what other people want. It's a very natural, human thing. Don't have that mentality because you only know your own program. You have to compete against the rest of Canada and the rest of the world. Pick the specialty that you like and don't be so worried about the competition. Remember you're happy, you're awesome, and you treated everyone nicely. You'll get what you want.

Other advice - if you can, get a research project in the area that you want to pursue. It is helpful, especially earlier on, but it's not a make or break. I can't talk on behalf of other people who look at CVs, but when I look at them, I'm looking for stuff like: Are you doing stuff outside of school? Are you doing one research project or maybe more? If you're doing a research project, how involved are you? I'm not saying beef up your CV, but it's one piece of the puzzle when it comes to interviewing for a spot you want. If you're applying for internal medicine, and you have some research in internal medicine, then that looks good. If you've wanted to do radiology all your life, and you have all your research in radiology, but you now want to do internal medicine, then in your interview you're going to say, "I know what you're thinking! My CV is all radiology. But hey, this is why I like internal medicine." And being successful in that part is getting back to what I said earlier – knowing yourself. This is nothing outside of the usual advice which is: to find something that you like to do and be involved in research if you can, while doing a few extracurriculars

and leadership roles. Because if anything, what it'll do is it makes the interview go by so much easier. You have to interview anywhere, and they're always going to ask you stuff about reflections. While you'll have some ePortfolio posts you can look through, you'll want to talk about some of these experiences that you've had personally. Those are usually in your CV.

And finally, clerkship-wise, I'll use internal medicine as an example. When you do your internal medicine rotation, you just tell everyone that you're interested. I've had students who say, "I don't want to tell them or else they'll have higher expectations of me." But if you don't meet those expectations, then it will just be an inspiration to work a little harder. Tell everyone that you're interested because then they might actually give you more responsibility, and that's what you want. You just do everything that no one else wants to do. You may have heard of something called scut work. It's an awful phrase, but what do you call scut work when you become an attending physician? You just call it work. This is all stuff that has to be done for the patient, and sure, it's not glamorous. But if you are able to do that or do stuff like calling families, calling pharmacies - you show them that you're able to go beyond the call of duty. I'll just say to do that on all the rotations you're on.

That way when you are doing your rotations, you're always looking in the future. You're going to need reference letters for your applications. You might ask, "Well, who is a better person to write a letter? The person who is more famous or the person who knows me the best?" And honestly, I don't really think it matters at the end of the day. If you apply for a program that only wants well-known clinicians, then maybe you don't want to go to that program. You want a person who might know you very well. And then if they agree to write a letter for you, then you just have to be shameless about it and say, "Great, I'm going to email you on this date. I'm going to give you my CV at that time. I'm going to tell you about some of the cases we saw together." You should remind them because it might be 3-4 months from the time you ask them. Even if they really like you, they might forget some things.

That's not the secret to success, but they're some things that can help you in the future if you want that specialty. But just being nice to everyone, showing up on time, and doing stuff that no one else wants to do is a really good start. There's nothing specific to internal medicine. For internal medicine, it can be competitive, but I think it has the second most spots among all the residency rotations out there, so there is a program that wants you.

Transdermal estradiol as a novel off-label treatment for Peyronie's disease: A case report

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ABSTRACT

Introduction: This is a single-patient case report of a 75-year old married male with long-standing Peyronie's disease (PD). The patient's main symptoms were painful erections as well as secondary anxiety and depression. The symptoms could not be resolved through standard treatments without considerable side effects.

Objectives: To describe a patient with PD, whose persistently painful erections and psychologic distress were eliminated by a novel off-label treatment involving transdermal estradiol. This report also aims to present a novel off-label treatment for patients with paraphilias.

Methods: An interview with the patient, chart review, and a literature search were conducted. Informed consent was obtained from the patient and this report was approved by the Research Ethics Committee at the Royal Hospital in Ottawa.

Results: Treatment with transdermal estradiol decreased the patient's sex drive and virtually eliminated his erections with no undesirable side effects. The patient and his wife still enjoy sexual relations without the need for penile erection.

Conclusions: This case report presents a novel off-label treatment for PD. It also introduces a novel off-label method to treat men who wish to decrease their sex drive (e.g. men with paraphilic disorders). Replication of this treatment intervention in men with PD and new studies of its use in men with paraphilic disorders are warranted.

RÉSUMÉ

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Keywords: Peyronie's disease, Treatment, Case Report, Men's Health

INTRODUCTION

Peyronie's disease (PD), a condition affecting up to 9% of men, is an abnormal curvature of the penis caused by excessive deposition of fibroid plaques in the tunica albuginea (1, 2). Common symptoms include chronic sexual dysfunction and mild-to-moderate pain during erections (3). The negative impact of PD on mood and quality of life is also well documented, with many PD patients suffering from mood/anxiety disorders, low self-esteem, emotional distress, etc., all of which may hinder an individual from seeking out relationships and lead to social isolation and stigmatization (2, 4, 5).

The clinical course of PD typically consists of both an acute and a chronic phase. The acute phase, also known as the inflammatory phase, is characterized by erectile

pain and progression of penile curvature (6). The chronic phase occurs after the first 6-18 months, during which the pain will disappear in more than 90% of patients and the curvature will stabilize (1, 3).

Treatment of PD can involve both surgical and/or non-surgical interventions. Surgical options, which are most suitable once the progression of the curvature has stabilized, include plication, grafting, and penile prosthesis, with the latter being the gold standard for definitive treatment (2, 7). In terms of non-surgical interventions, intralesional drug injections such as collagenase clostridium histolyticum (CCH), interferon alfa 2b, and verapamil may be used during the acute phase in order to slow the progression of the curvature (7-10).

Here, we report an unusual case of PD, in which the patient's persistently painful erections and psychological distress were relieved through treatment with transdermal estradiol.

CASE REPORT

In November 2009, a 64-year old Caucasian married gentleman presented to the Sexual Behaviour Clinic at the Royal Hospital in Ottawa with the desire to decrease his sex drive and frequency of penile erections. The patient, otherwise healthy, had been suffering with PD since May 2002 and had been prescribed several standard urologic treatments. A trial of biweekly intralesional verapamil injections over the course of eight months had minimal effects on curvature and pain. In April 2004, surgical plication had moderately improved his penile curvature but did not decrease the painful erections, which the patient described as a "sharp and intense pain". He had also developed secondary anxiety and depression. He was referred to the Sexual Behaviours Clinic when he declined a proposed penile implant.

The patient voluntarily consented to a treatment trial with oral medroxyprogesterone acetate (MPA), known by the brand name "Provera", which helped to decrease both his sex drive and frequency of erections. However, after taking MPA for three months, the patient reported the debilitating side effects of fatigue, gastrointestinal (GI) problems, paresthesia and weakness in arms and legs, dizziness (including tripping and falling), and episodes of "blurry vision". Changing dosage and dosage intervals did not help. The patient elected to discontinue treatment with MPA in November 2016.

In August 2017, the patient was prescribed 1.25 grams of EstroGel, a 0.06% transdermal estradiol gel. The patient experienced a reduction in sex drive and erections just as he did with MPA, but without the intolerable side effects. The patient reported a greatly improved psychological state, with less stress and anxiety in regard to his sexuality, described as an inner "mental peace".

The dosage of transdermal estradiol gel was increased to 2.5 grams in August 2018, which further decreased the patient's sex drive and caused the desirable side effect of virtually eliminating his erections. Unlike MPA, the patient did not experience any undesirable side effects. Since then the patient and his wife have continued to be completely satisfied with the treatment which he wishes to continue.

DISCUSSION

While most patients with PD experience pain during the acute phase of the illness, this symptom is typically self-limited (1). As such, PD treatments tend to target penile curvature with the goal of restoring sexual functionality as opposed to alleviating the pain alone (3). Therefore, the treatment presented in this report may be useful for a patient during the painful (acute) stage of the disease, or for cases where the pain persists on a more chronic basis.

In addition, pain may preclude patients from benefiting from the standard treatments of PD. Since pain is generally indicative of active disease progression, it is considered a relative contraindication to surgery (6, 11). CCH injections, the only FDA approved non-surgical treatment for PD, work by degrading the collagen type I and II fibres in the fibroid plaques, and have been shown to reduce curvature. However, the presence of painful plaques is known to be characteristic of patients with a poor treatment response (7). Therefore, a treatment that targets pain reduction such as this one may allow patients to become eligible for other treatments in the future, but more research is required to explore this further.

It is important to acknowledge that use of transdermal estradiol as a monotherapy does not exclusively decrease the pain during erections, but decreases erections all together as well as sex drive, which would likely be undesirable and distressing for some men. However, these may be suitable outcomes for those suffering from severe

The implications of this case are numerous, as they extend not only to other patients with PD, but also to any patients seeking to decrease sex drive and/or frequency of erections, such as patients convicted of sexual offense and men with problematic paraphilias. Current treatment for these patients involves psychotherapy with or without use of pharmacological therapy, such as hormone therapy, antiandrogens, gonadotropin-releasing hormone analogs, and selective serotonin reuptake inhibitors. Use of MPA for treatment of paraphilias is common, but its poor side effect profile often decreases compliance (12). Drugs that lower testosterone are the mainstay of pharmacotherapy for these patients, but it is important to consider the long-term dangers of lowering testosterone, such as increased risk of osteoporosis (13).

Use of oral estradiol to treat patients convicted of sexual offense has been previously investigated, but side effects such as nausea, vomiting, cardiac disturbances, and feminization (gynecomastia, redistribution of body fat, etc.) have limited its long-term success (14). Transdermal estradiol, which does not have the cardiovascular side effects of oral estradiol, presents a novel off-label treatment for both PD and paraphilias. There is no published study to our knowledge that uses transdermal estradiol in PD, although studies testing its application in men with prostate cancer have successfully lowered PSA levels and have not elicited significant side effects other than gynecomastia (15, 16).

In contrast to oral estradiol, transdermal estradiol avoids first-pass metabolism by the liver, which is thought to explain why its side effects are minimal compared to those of oral estradiol (17). There are many health benefits of transdermal estradiol that have made it a widely-used hormone therapy agent in postmenopausal women, such as relief from mood swings, vaginal dryness, and night sweats, as well as decreased risk of coronary artery disease and preservation of bone density (18). The latter two benefits have also been observed in male patients, but further research is warranted in order to better characterize use of transdermal estradiol in men (15).

CONCLUSION

Transdermal estradiol as demonstrated in this case, is a novel off-label treatment for PD, specifically in treating the symptoms of pain and secondary psychological distress. Future research should investigate whether transdermal estradiol may be used for the off-label purpose of voluntarily curtailing erections in patients convicted of sexual offense and men with problematic paraphilias.

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Improving Surgical Safety Checklist Completion Using A Distributed Responsibility Model Among Operating Room Team Members

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ABSTRACT

Background. Surgical safety checklists are a standard of care for safe operating room practice, but their use has not been associated with reductions in adverse perioperative outcomes in some settings. Non-adherence and partial checklist completion may contribute to this lack of effect.

Objective. To examine whether a novel multifaceted surgical safety checklist approach, that utilizes distributed responsibility of checklist item completion (by allocation of questions and responses among operating room staff and a memory aid), increases surgical safety checklist compliance.

Methods. A multicomponent strategy consisting of a novel surgical safety checklist focused on distributed responsibility of checklist item completion was evaluated in orthopaedic operating rooms at The Hospital for Sick Children in Toronto from July to August 2016. The intervention consisted of a wall-mounted reusable checklist with questions and responses designated to specific operating room team members. Team training was provided beforehand, operating room team leaders were identified to promote the intervention, and revisions to the checklist content and process were implemented based on feedback on feasibility and clinical sensibility. Checklist compliance was assessed by checklist item completion using a before-and-after study design.

Results. We assessed 45 and 59 surgeries in pre-intervention and intervention groups, respectively. Overall, 87% (1,354/1,560) of checklist items were observed. Checklist item completion significantly increased in the post-intervention group (77% [615/802]) compared to the pre-intervention group (27% [150/522]) (P<0.001).

Conclusions. These findings suggest that a multicomponent strategy of designating responsibility for item completion and use of a memory aid among operating room team members can improve compliance with surgical safety checklist item completion.

RÉSUMÉ

Contexte. Les listes de contrôle de sécurité chirurgicale sont norme de soins pour une pratique sûre au bloc opératoire mais leur utilisation n'a pas été associée à une réduction des résultats adverses péri-opératoires dans certains contextes. La non-adhérence et le remplissage partiel des listes de contrôle peuvent contribuer à cette absence d'effet.

Objectif. Examiner si une nouvelle approche multidimensionnelle de la liste de contrôle de sécurité chirurgicale utilisant la responsabilité répartie des tâches, par la répartition des questions et des réponses parmi le personnel du bloc opératoire et un aide-mémoire, augmente la conformité à la liste de contrôle de sécurité chirurgicale.

Méthodes. Une stratégie à plusieurs volets consistant en une nouvelle liste de contrôle de sécurité chirurgicale axée sur la responsabilité répartie de l'exécution des tâches a été évaluée dans les blocs opératoires orthopédiques de l'hôpital des enfants de Toronto (Hospital for Sick Children) de juillet à août 2016. L'intervention consistait en une liste de contrôle murale réutilisable avec des questions et réponses destinées à des membres spécifiques de l'équipe du bloc opératoire. Une formation préalable a été offerte à l'équipe, des chefs d'équipe du bloc opératoire ont été désignés pour promouvoir l'intervention, et des révisions du contenu et du processus de la liste de contrôle ont été mises en œuvre basés sur les commentaires en rapport avec la faisabilité et la sensibilité clinique. La conformité à la liste de contrôle a été évaluée en complétant les éléments de la liste de contrôle à l'aide d'un plan d'étude avant-après.

Résultats. Nous avons évalué 45 et 59 interventions chirurgicales dans les groupes de pré-intervention et d'intervention respectivement. Dans l'ensemble, 87 % (1354/1560) des éléments de la liste de contrôle ont été observés. Le taux d'achèvement des points de la liste de contrôle a augmenté de manière significative dans le groupe post-intervention (77 % [615/802]) par rapport au groupe pré-intervention (27 % [150/522]) (P<0,001).

Conclusion. Ces résultats suggèrent qu'une stratégie multidimensionnelle consistant à désigner la responsabilité de la réalisation des tâches et l'utilisation d'un aide-mémoire parmi les membres de l'équipe du bloc opératoire peut améliorer l'adhérence à l'exécution des éléments de la liste de contrôle de sécurité chirurgicale.

Keywords: Surgery, Safety, Checklist, Surgeon, Intervention

INTRODUCTION

Preventable adverse events in surgical healthcare are common, but are amenable to reduction using patient safety initiatives and systematic improvements in clinical care.[1,2] Surgical safety checklists have been shown to improve perioperative safety and reduce preventable adverse events in many healthcare scenarios, such as in the case of delays to antibiotic administration or scheduling delays; however, their effectiveness is not consistent and can be influenced by contextual factors.[3-8] Such situational factors are known to influence the success or failure of checklists in practice. Particularly, relevant factors include the existing professional cultures and infrastructure for patient safety initiatives, and the quality of communication and collaboration in the operating room (OR).[9,10] Methods used for implementation and educational strategies on the use of surgical checklists to promote use among healthcare professionals also influences their effectiveness.[11] Examples of successful strategies used to increase effectiveness of checklist implementation include demonstration of the checklist process to team members, incorporation of the checklist process into the existing OR routine, and an emphasis of the applicability of checklist items to all team members.[12-14]

The use of surgical safety checklists in Ontario has been mandated by the local government for all surgeries since September 2009.[15] The suggested surgical safety checklist for use in Ontario was adapted by the Canadian Patient Safety Institute from the World Health Organization template, but is subject to modification by individual hospitals to account for differences in patient populations and local practices.[16,17] For example, pediatric surgical healthcare differs from adult care in terms of perioperative risk, procedure complexity, and patient involvement in decision making.[18-20] Furthermore, the successful use of surgical safety checklists in pediatrics requires that differences between children, in terms of preoperative anxiety, the capability to provide assent or consent, and the provision of family-centered care be recognized when undertaking the checklist.

Despite this widespread introduction of surgical safety checklists in Ontario and acknowledgment of its benefits by users, there has been no largescale reductions in perioperative adverse outcomes observed for either adult or pediatric populations.[15,21,22] Partial and non-compliance are significant factors associated with marked reductions in the magnitude of the effectiveness of the checklist in Ontario.[6] A previous observational study at the Hospital for Sick Children in Toronto (SickKids) indicated that completion of checklist items was poor. The aim of this project was to improve surgical safety checklist compliance through the evaluation of item completion using a novel, multicomponent checklist focused on distributed responsibility among OR staff.[23]

METHODS

According to the policy activities that constitute research at SickKids Ontario, this work met the criteria for operational improvement activities exempt from ethics review. We obtained approval for this QI project from the local Quality and Risk Management Department. A waiver of written informed consent was also granted to observe OR staff completing surgical safety checklists during the project.

Setting and population

Orthopaedic ORs were chosen for the setting of the intervention because a previous project at SickKids indicated that specialty specific checklists may increase compliance.23 Moreover, orthopaedic procedures require most of the items on the surgical safety checklist to be considered, such as the side of surgical site, the display of essential imaging, and the availability of surgery-specific equipment and implants. All orthopaedic procedures undertaken in these ORs were eligible for inclusion. Non-orthopaedic and out-of-hours (6pm to 8am) procedures were excluded.

Intervention design

Using a before-and-after study design, we prospectively evaluated the effect of a multicomponent QI intervention aimed at improving completion of surgical safety checklist items among team members in a convenience sample of children who underwent orthopaedic surgery at SickKids from June to August 2016. The novel surgical safety checklist process and content was developed by the hospital's Perioperative Service Surgical Safety Checklist committee consisting of anesthesiologists and nurses. This new surgical safety checklist used during the project consisted of 15 questions with 21 items that required responses, and the content of the checklist was adapted from the Canadian Patient Safety Institute Canadian surgical safety checklist to meet local OR systems and practices.

Name:	MRN:
Procedure(s):	Side: LEFT RIGHT n/a
	ALLERGIES

SURGICAL SAFETY CHECKLIST		Initials of responsible team member
Surgeon Recording — BRIEFING		
CONFIRM PATIENT'S IDENTITY, SITE, PROCEDURE, & CONSENT	YES ❑	Surgeon
IS THE SITE MARKED	YES ❑ N/A ❑	Surgeon
IS ESSENTIAL IMAGING DISPLAYED	YES ❑ N/A ❑	Surgeon
IS THERE A RISK OF BLOOD TRANSFUSION (EBL >7ML/KG)	YES ❑ NO ❑	Surgeon
IS ESSENTIAL EQUIPMENT AND/OR IMPLANTS AVAILABLE	YES ❑ N/A ❑	Nurse
ANESTHESIA CHECKS (MACHINE & MEDICATION) COMPLETED	YES ❑	Anesthetist
DOES PATIENT HAVE A KNOWN ALLERGY	YES ❑ NO ❑	Anesthetist
HAVE ESSENTIAL LABORATORY INVESTIGATIONS BEEN CHECKED	YES ❑ N/A ❑	Anesthetist
PATIENT WEIGHT CONFIRMED (_____ Kg)	YES ❑	Anesthetist
Nursing Recording — TIME OUT		
CONFIRM THAT ALL TEAM MEMBERS HAVE INTRODUCED THEMSELVES	YES ❑	Nurse
SURGEON VERBALLY CONFIRMS, WITH ANESTHETIST AND NURSE:	PATIENT ❑ SITE ❑ PROCEDURE ❑	Surgeon
ANTICIPATED CRITICAL EVENTS:		
SURGEON REVIEWS: WHAT ARE THE CRITICAL STEPS, OPERATIVE DURATION, ANTICIPATED BLOOD LOSS?	❑	Surgeon
ANESTHESIA REVIEWS: ARE THERE ANY PATIENT-SPECIFIC CONCERNS?	❑	Anesthetist
NURSING TEAM REVIEWS: HAS STERILITY BEEN CONFIRMED? ARE THERE EQUIPMENT ISSUES OR CONCERNS?	❑	Nurse
ANTIBIOTIC PROPHYLAXIS WITHIN THE LAST 60 MINUTES?	YES ❑ N/A ❑	Anesthetist
Nursing Recording — TIME OUT		
NURSE VERBALLY CONFIRMS WITH THE TEAM:		
• THE NAME OF THE PROCEDURE RECORDED	❑	Nurse
• THAT INSTRUMENT, SPONGE AND NEEDLE COUNTS ARE CORRECT (OR NOT APPLICABLE)	❑	Nurse
• WHETHER THERE ARE ANY EQUIPMENT PROBLEMS TO BE ADDRESSED	❑	Nurse
SURGEON, ANESTHETIST AND NURSE REVIEW IMPORTANT INTRAOPERATIVE EVENTS AND KEY CONCERNS	❑	N/A

Figure 1. **Surgical safety checklist wall-mounted reusable memory aid used in the operating room during the study intervention.**

A prior QI project at the hospital indicated poor division of responsibility of various aspects of the checklist, and at this time a memory aid to assist checklist completion was not routinely used.[23] The current intervention included a reusable wall-mounted checklist in each OR to guide surgical safety checklist completion. This was intended to aid item recall as a memory aid, engage team members through team training, and provide a framework for checklist questions and responses designated to specific OR team members. Each section of the 3-part surgical safety checklist (briefing, timeout and debriefing) was led by a designated team member. During checklist completion, there was verbal confirmation of each checklist question and response by the responsible team members, a written confirmation by checkmark on the wall-mounted checklist to confirm the response, and initials of the designated respondents were included beside each item on the wall-mounted checklist **(Figure 1)**. The wall mounted checklist also served as a constant visible memory aid. Team training was provided beforehand on the use of the wall mounted checklist, OR team leaders were identified to promote the intervention, and revisions to the checklist content and process were implemented in small Plan, Do, Study, Act (PDSA) cycles based on feedback on feasibility and clinical sensibility.

Data collection

Prior to the intervention, surgical safety checklist completion was assessed for one month in June 2016. The intervention was introduced in July 2016 and observed from July to August 2016. In the period immediately preceding or during the study, there were no other changes in clinical practices, education, or safety initiatives in the operating room directly related to surgical safety checklists. The same observer assessed checklist completion in the pre and post intervention group.

Procedure details and demographic data on patients undergoing surgery were collected, including age, American Society of Anesthesiologists' (ASA) physical status classification, scheduling of surgery (elective or urgent) and procedure type.[24] To assess the impact of the intervention, checklist item completion and time to complete checklist were recorded. All observations and data collection before and after the intervention were completed by the same investigator (MJ). Survey and observational data from the operating room were recorded using Research Electronic Data Capture (REDCap) hosted by SickKids, Toronto.[25]

Statistical Analysis

Descriptive statistics were reported as appropriate for the

data distribution. Differences in the proportions of item completion between groups were tested using Fisher's Exact Test as the sample size was small. 95% confidence intervals (CI) were calculated where appropriate. Statistical significance was defined as two-tailed p<0.05. Multiple comparisons were not adjusted for, as the intended use of the data was for QI and analyses were considered to be exploratory. All statistical analyses were performed with Microsoft Excel and STATA 15 (STATACorp LP, College Station, TX)

RESULTS

We identified 45 and 59 orthopaedic surgeries for before and after project intervention, respectively. Demographic characteristics of children in the cohort are summarized in **Table 1**. The majority of procedures were elective, and most children were either ASA physical classification status 1 or 2.

Characteristic	Pre-intervention N = 45	Post-intervention N = 59
Age in years, *median (IQR)*	8 (5 - 13)	11 (8 - 14)
Scheduling of surgery, *n (%)*		
Elective	35 (79)	54 (92)
Emergent	10 (22)	5 (8)
ASA Physical Status Classification, *n (%)*		
1	26 (58)	23 (39)
2	10 (22)	21 (36)
3	8 (18)	13 (22)
4	1 (2)	2 (3)
5	0 (0)	0 (0)

ASA, American Society of Anesthesiologists; IQR, interquartile range

Table 1. **Characteristics of children undergoing orthopaedic surgery before and after the project intervention.**

In total, 86.8% (1,354/1,560) of all checklist items were assessed for the surgeries included in the cohort. Mean (standard deviation) time to complete all sections of the intervention-guided checklist was 188 (53) seconds. Checklist item completion significantly increased 29% (150/522) after implementation in comparison to 77% (615/802) before implementation (p<0.001).

For each of the sections (briefing, time-out, and debriefing) of the checklist, item completion significantly increased after the intervention. Briefing item completion increased from 21% (70/340) to 81% (410/504) (p<0.001), time-out item completion increased from 47% (73/156) to 75% (172/228) (p<0.001) and debriefing item completion increased from 13% (7/56) to 47.1% (33/70) (p<0.001).

Percentage responses to individual checklist questions are summarized in **Table 2**. Ten of the 15 questions showed higher item completion in the post-intervention group. Checklist items that did not differ between groups were identification of patient allergies (79% vs. 88%, p=0.4), patient weight confirmation (66% vs. 73%, p=0.5),

Item	Pre-intervention N = 45	Post-intervention N = 59	*P*
Briefing			
Patient has confirmed identity, site, procedure, consent	3	68	<0.001*
Is the site marked	26	86	<0.001*
Is essential imaging displayed	8	86	<0.001*
Is there a risk of blood loss >7 mL/Kg	0	80	<0.001*
Is essential equipment and/or implants available	26	79	<0.001*
Anesthesia checks completed	0	88	<0.001*
Does patient have a known allergy	79	88	0.4
Have essential laboratory investigations been checked	0	86	<0.001*
Patient weight confirmed	66	73	0.5
Time Out			
Confirm that all team members have introduced themselves by name and role	0	56	<0.001*
Surgeon verbally confirms with anesthetist and nurse: patient, site and procedure	90	84	0.6
Anticipated critical events	0	79	<0.001*
Antibiotic prophylaxis within 60 minutes	97	83	0.03
Debriefing			
Nurse verbally confirms with the team the name of the procedure recorded, that instrument, sponge and needle counts are correct, and whether there are any equipment problems that need to be addressed.	7	57	<0.001*
Surgeon, anesthetist, and nurse review important intra-operative events and key concerns	18	37	0.2

* Statistical significance was defined as two-tailed P < 0.05.

Table 2. **Completion percentage of surgical safety checklist item completion before and after the multicomponent study intervention.**

confirmation of patient, site, and procedure during the time-out (90% vs. 84%, P=0.6), and review of intra-operative events and key concerns during the debriefing (18% vs. 37%, p=0.2) as shown in **Table 2**.

DISCUSSION

In a paediatric specialist hospital setting, the proposed multicomponent strategy of conducting the surgical safety checklist, through distributed responsibility and use of a memory aid, was found to significantly increase surgical safety checklist completion. Increases in surgical safety checklist completion were evident for all sections of the checklist (briefing, time-out, and debriefing), and most checklist questions were found to be better answered after the introduction of the project intervention.

The findings of this project suggest that this multicomponent strategy of distributed responsibility and using a memory aid can be an effective method to increase surgical safety checklist compliance in tertiary pediatric settings in Ontario. Adherence to surgical safety checklists was known to be already poor in this setting and there was only partial completion of the checklist for most procedures before the project intervention. Whether the magnitude of change observed here can be replicated in other settings with higher rates of checklist adherence and engagement is unknown. Nonetheless, our results are consistent with those of Vazquez-Gonzalez et al., who used a similar approach consisting of a reusable checklist board, team training, and role allocation, and found improved checklist completion and quality in two large university hospitals.[26] Similarly, Wolff et al. found that a system of checklists and reminders of best practice integrated into patient medical records improved hospital inpatient care for patients with stroke or acute myocardial infarction.[27]

Completion of surgical safety checklists can strengthen the perceived quality of teamwork and communication in the OR and reduce preventable errors due to failures in team interactions.[28] This may be a function of communication during checklists improving open dialogue among team members and promoting a culture of patient safety; however, when surgical safety checklists are used sub-optimally there is a suggestion that they can have a negative effect on the function of the OR team by disrupting otherwise positive communication.[29] When adherence is low or when checklists are completed by team members as a "box ticking exercise", miscommunication, omission of critical information, and disruption of other safety checks can occur.

Adherence to surgical safety checklist completion is influenced by many factors, including approaches used for checklist implementation, team education and engagement, local leadership, integration into existing practices, and individual beliefs.[8,30-32] To be successful, safety initiatives targeting increased surgical safety checklist adherence need to first identify these local barriers to checklist implementation. It is arguable that a multicomponent or multifaceted strategy is required to successfully address the complex interaction of factors that can influence individual and team behaviors in the OR and to translate evidence into meaningful changes in practice.[33]

One of the key reasons for our decision to distribute responsibility among OR team members was to overcome individual reasons for poor communication and negative power relationships that can exist among healthcare providers with traditionally different hierarchical statuses.[10] While the checklist itself is a cognitive aid and serves to increase precision and focus under stressful conditions, the process of adding a physical wall-mounted checklist also served to add a memory aid for checklist content. Although checklists improve performance, errors and omission of critical steps can still occur.[34,35] Even with the introduction of the wall-mounted reusable checklist, a large proportion of items (23%) in this project were still not completed. This highlights the importance of other factors influencing compliance, and the need to educate healthcare providers and effectively promote safety initiatives.

In each of the three checklist sections, adherence was found to be increased overall after the intervention but there was no difference found for some individual checklist items. Most of the individual checklist items without significant improvement already had higher completion rates (all greater than 60%) before the study intervention, and although there was a trend for improvement for most of these, the convenience sample size used was sufficient to detect only large effect size differences.

Limitations of this project include a possible Hawthorne effect from the presence of an observer during surgical safety checklist completion.[36] Secondly, outcome assessor

and surgeries observed were not randomized; however, the same trained observer and setting was used for both pre- and post-intervention observations, mitigating differential effects between study groups. Healthcare initiatives with a focus on communication often cannot be implemented as single component interventions due to the complexity of human factors that influence outcomes. As a result, in this project we cannot comment on the effects of individual elements of the multicomponent strategy used in this study and other contributing factors that are required to implement changes in clinical practice, such as education and leadership. Finally, this QI project was primarily intended to improve local care and the findings may not be generalizable to other settings and populations. Adherence to the surgical safety checklist in this population was already low and the same magnitude of benefit may not be seen in settings with higher checklist completion rates. The current project demonstrated improvements in checklist compliance, but other aspects of success should be considered in future projects, including whether user satisfaction is perceived to be improved and if clinically important outcomes, such as rates of preventable adverse events, can be reduced by this type of intervention.

CONCLUSIONS

A multicomponent strategy with distributed responsibility in surgical safety checklist completion (through allocation of questions and responses among team members and use of a memory aid) was associated with significant improvements in checklist item completion, both for individual checklist sections and the overall checklist. These findings suggest that this is a feasible approach for improving surgical safety checklist completion when compliance is low.

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Appel à l'œuvre

Avec la sortie prochaine de UOJM 10.2, nous recherchons des illustrations créatives qui figureront sur la couverture de notre édition! Les soumissions d'œuvres d'art ne seront pas non plus limitées à un thème spécifique et peuvent être dessinées à la main ou numériquement. Les fichiers PDF sont préférés mais non obligatoires. Les soumissions d'œuvres d'art peuvent être envoyées par courriel à *contact@uojm.ca* d'ici le 1er octobre 2020!

Melissa Phuong & Hao Wang
Co-rédacteurs en chef
Journal de Médecine de l'Université d'Ottawa


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