MUMJ

A PEER-REVIEWED, STUDENT-RUN PUBLICATION

McMASTER UNIVERSITY
MEDICAL JOURNAL

VOLUME 19, ISSUE 1 | 2022

Commentary
MANAGING THE INFLUX: A PEER-LED SESSION ON COMMUNICATION AND PROFESSIONALISM IN MEDICINE

Case Report
IMMEDIATE BREAST RECONSTRUCTION POST-MASTECTOMY IN A PATIENT WITH PRIOR BREAST AUGMENTATION, MASTOPLEXY, AND LUMPECTOMY WITH RADIATION

Original Research
EVALUATION OF A PRE-CLERKSHIP FAMILY MEDICINE PLACEMENT: DOES IT INFLUENCE CANADIAN MEDICAL STUDENTS' INTEREST IN PERSUING FAMILY MEDICINE?

McMaster University

From shins to twins | *De la luxation à la conception*

Family physicians specialize in the whole person. See why family medicine is the right specialty for you.

Choosefamilymedicine.ca

Médecins de famille : spécialistes de la personne dans sa globalité. Vois pourquoi cette spécialité est pour toi!

Choisirlamedecinedefamille.ca

THE COLLEGE OF FAMILY PHYSICIANS OF CANADA

LE COLLÈGE DES MÉDECINS DE FAMILLE DU CANADA

18_0332_CFPC_Students_7_5x10_Print_Ad.indd 1 2020-02-19 2:38 PM

McMaster University Medical Journal

Editorial Board 2021-22

Editors-in-Chief

LAURA LOCKAU AND ALI ZHANG

Executive Editors

LAUREN LIN AND KEVIN KIM

Submission Editors

MUNEEB AHMED
ANGELA DONG
CEZARA ENE
EVAN FANG
ANNE-SOPHIE FORTIER
NIKHIL HARIHARAN
SHAHZAIB KHATTAK
CHRISTOPHER LI
CINDY NGUYEN
DEVIKA SINGH
MURALIE VIGNARAJAH
REBECCA WONG
JIM XIE
FAYE YU
JAMIE ZHEN

Reviewers

ZAHRA ABDALLAH
DOROTA BOROVSKY
COLE BOWERMAN
MIKE D'AGOSTINO
TAHA ELGHAMUDI
ANNE-SOPHIE FORTIER
NIKHIL HARIHARAN
CAMERON HARPER
ELAINE JIN
GEORGE KACHKOVSKI
KEVIN KIM
PHILIPP KOLB
LYNAEA KOROL-FILBEY
CHRISTOPHER LI
VINCENT LI
EVA LIU
LAURA LOCKAU
KATE MIYASAKI
IBRAHIM NADEEM
JANHAVI PATEL
JONAH RAKOFF
JIAN ROUSHANI
ZARWA SAQIB
MICHELLE SCHNEEWEISS
ERIN SMITH
VITHUSHAN SURENDRAN
COLIN WHALEY
REBECCA WONG
JIM XIE
ALI ZHANG
KEVIN ZHAO

Cover Art

LYNETTE PETERS

TABLE OF CONTENTS

LETTER FROM THE EDITORS……..…vi
ALI ZHANG AND LAURA LOCKAU

COVER ARTIST STATEMENT……..…vii
LYNETTE PETERS

ORIGINAL RESEARCH ARTICLES

DATA MINING PROCEDURAL REPORTS OF PERCUTANEOUS INTERVENTIONS IN DIALYSIS ACCESS FOR QUALITY ASSURANCE PROGRAMS.....1

IBRAHIM MOHAMMED NADEEM, ABHAY ISSAR, AND ANDREW DALE BROWN

ISCHEMIC STROKE AND PERIPROCEDURAL DISCONTINUATION OF ANTITHROMBOTIC AGENTS: A SINGLE CENTER RETROSPECTIVE CHART REVIEW……...…….11

RUGGIYAH RANA, LEON LI, ANDREW CAO, HANNAH ELAINE SNYDER, FARAZ MASOOD

THE ASSESSMENT OF FRAX-BASED OSTEOPOROTIC FRACTURE RISK PROBABILITY AMONG NURSES AGED 40 AND ABOVE IN A TERTIARY CARE HOSPITAL IN SRI LANKA.....23

DILUKSHA PRASAD JAYAWARDANA HETTIARACHCHIGE

A RETROSPECTIVE EXAMINATION OF THE MANAGEMENT OF PEDIATRIC BLUNT SPLEEN AND LIVER INJURIES……...……..…….34

ADRIANA DEKIRMENDJIAN, HENRIETTA BLINDER, BETHANY EASTERBROOK, AND KAREN BAILEY

NAVIGATING PEDIATRIC UNDERGRADUATE MEDICAL EDUCATION: CURRICULUM MAPPING OF PROBLEM-BASED LEARNING AND CASE-BASED LEARNING IN THE PEDIATRIC CURRICULUM.....46

DEVIKA SINGH, NINA MAZZE, AND VICKY BREAKEY

IDENTIFYING GAPS IN CHRONIC PAIN-CENTERED MEDICAL EDUCATION THROUGH AN ANALYSIS OF STUDENT PERSPECTIVES…..……...54

MYLES BENAYON, LEKHINI LATCHUPATULA, AND SHAWNEE AMAR

EVALUATION OF A PRE-CLERKSHIP FAMILY MEDICINE PLACEMENT: DOES IT INFLUENCE CANADIAN MEDICAL STUDENTS' INTEREST IN PURSUING FAMILY MEDICINE?.....74

AJAY SHAH, ADI GASNER, AND ALESSANDRA PALOMBO

FACTORS AFFECTING MENTAL WELL-BEING AMONG PROLONGED HOSPITALIZED PATIENTS IN A TERTIARY CARE TEACHING HOSPITAL IN SRI LANKA…..…..…..…93

HETTIARACHCHIGE DILUKSHA PRASAD JAYAWARDANA

CASE REPORTS

IMMEDIATE BREAST RECONSTRUCTION POST-MASTECTOMY IN A PATIENT WITH PRIOR BREAST AUGMENTATION MASTOPEXY AND LUMPECTOMY WITH RADIATION: A CASE REPORT …….....105

KIM PHAN, MURALIE VIGNARAJAH, CHLOE WONG, ANNA KOBYLECKY, AND PETER YOUNG

KNEE PAIN: A DIAGNOSTIC DILEMMA ……..……...111

DILUKSHA PRASAD JAYAWARDANA HETTIARACHCHIGE

COMMENTARIES

MANAGING THE INFLUX: A PEER-LED SESSION ON COMMUNICATION AND PROFESSIONALISM IN MEDICINE…….....121

COLIN WHALEY, BRADLEY MURPHY, CONNIE LI, AND AMANDA BELL

CERVICAL CANCER SCREENING IN TRANSGENDER MEN AND NON-BINARY PEOPLE WITH A CERVIX 126

TESSA ANZAI, AMANDA SELK, AND JULIE MY VAN NGUYEN

From the Editors

McMaster University Medical Journal, Volume 19

Laura Lockau, MD, PhD, and Ali Zhang, PhD Candidate, MD Candidate

Editors-in-Chief
Michael G. DeGroote School of Medicine

The McMaster University Medical Journal is proud to present its 19th annual issue, which continues to highlight research undertaken by medical and graduate students from McMaster University and other institutions around the world. Our mandate is to disseminate recent advances in medical knowledge relevant to our readers in the form of original research, commentaries, case reports, and review articles. Through this endeavor, we hope to augment our understanding of issues impacting medical education, as well as individual and population health.

The 19th volume highlights a wide array of articles prepared by medical and graduate students across the world. In the area of medical education, our authors evaluate the effectiveness of a pre-clerkship family medicine placement, explore how to better incorporate pediatrics and chronic pain in medical curricula, and describe a student-led session to bolster professional development. Our authors also share case reports describing difficulties in correctly diagnosing chronic knee pain, and the intricacies of the approach to immediate breast reconstruction. You will find articles describing new perspectives on cervical cancer screening, and quality outcome measurements in interventional radiology. Our authors also share retrospective analyses describing the relationship between the incidence of ischemic stroke and discontinuation of antithrombotics, as well as compliance and management of pediatric blunt spleen and liver injuries.

We are extremely grateful for the tireless efforts from the administrative staff and the MUMJ editorial team, including our executive editors, submission editors, and reviewers who have graciously contributed their time, expertise, and hard work to make this issue of MUMJ possible. We are as proud as ever of our team, who have witnessed significant disruptions to their lives and education in this continuing pandemic. Your efforts truly reflect a culture that has remained consistent and true across the young life of this journal. We would also like to thank the authors for their scientific efforts and the opportunity to showcase and publish their work. This issue of MUMJ would not be possible without you, and we hope that you are as proud of your work as we are.

Finally, we would like to thank you, dear reader, as it is only with your support that this journal can continue to thrive. We hope that you enjoy this issue of MUMJ as much as we enjoyed preparing it.

Sincerely,

Ali Zhang and Laura Lockau

Cover Art

"Serving the Uncertain"

Lynette Peters, PhD Candidate
Dalhousie University

Artist Statement

"Serving the Uncertain" is a multi-form presenting both hidden and visible meanings of human experience as I understand and interpret. In the uncertainty of the current pandemic, a new variant of COVID-19 has washed ashore in Canada. The institution of healthcare and its "servants" are required to serve the interests of others, sometimes consistent with personal moral fibre, and sometimes against. The period is fodder to moral injury. Healthcare as a collective resource is heavily strained in NS, while morale among many healthcare professionals is low. The gilded-platter acknowledges this experience. The serving surface glaze reflects public sentiment.

COVID-19 spike proteins are represented by 19 shot glasses; these are to hold libations for substantial loss: the loss of human life, the loss of time, the loss due to necessary restrictions. They are sanguine red. The central shot glass has a triad-flute, it is red except for its centre. I chose yellow, however blended flux to mar its consistency. It represents natural mutation, its variants, and hope for future co-existence. The spike proteins also hold candles; when lit, these memorialize millions of lives extinguished due to its spike protein virulence. The flaming spikes are key to its success and to us, power and control.

Artist Bio

Lynette A. Peters is a Doctoral Candidate in Health at Dalhousie University, Nova Scotia. She is the artist and founder of Cerberus Pottery. While her research interests include pottery and CAF Veterans who transition from service, her artistic innovations continue to place clay in novel spaces in order to challenge others to uncover meaning.

Original Research Article

Data mining procedural reports of percutaneous interventions in dialysis access for quality assurance programs

Ibrahim Mohammad Nadeem[1], Abhay Issar[1], Andrew Dale Brown[2]

[1]Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Canada
[2]Department of Medical and Diagnostic Imaging, St. Michael's Hospital, Toronto, Canada

Abstract

Purpose: Ongoing quality assessment of dialysis access interventions is critical in the care of hemodialysis-dependent patients. The objective of this study was to mine data from interventional radiology (IR) reports of dialysis access interventions to determine if these reports contain the data necessary to retrospectively calculate quality outcome metrics required to support quality assurance (QA) programs.

Methods: A retrospective analysis was conducted of IR reports created at the institution between May 28, 2019 and October 16, 2020. Radiology reports pertaining to percutaneous image-guided management of thrombosed or dysfunctional hemodialysis circuits were included. Reports that only described diagnostic intervention(s) were excluded. Relevant reports were manually annotated according to a checklist of items derived from published reporting standards to determine whether reports contained the data necessary to retrospectively calculate quality outcome metrics, such as postintervention primary patency (PiPP) and postintervention lesion patency (PiLP).

Results: A total of 130 reports describing 78 patients were included in the analysis. Documentation of items derived from published reporting standards for dialysis fistulogram and interventions ranged from 28.5% to 100%. Only 18.5% and 15.4% of radiology reports were independently sufficient to calculate PiPP and PiLP, respectively.

Conclusion: Few reports were independently sufficient to retrospectively calculate quality outcome metrics, PiPP and PiLP. Results of this study suggest the need for greater standardization in reporting practices. Standardized reporting has the potential to improve communication, promote adherence to guidelines, and provide data for quality improvement projects to optimize patient care.

Keywords: Diagnostic imaging; patient safety; health information technology; quality improvement; hemodialysis

Corresponding author: andrew.brown@unityhealth.to

Introduction

Since 1991, the Standards of Practice Committee of the Society of Interventional Radiology (SIR) has published numerous practice guidelines for image-guided procedures (1-5). This work not only highlights the importance of standardizing technical aspects of interventional procedures but also emphasizes the critical role of quality improvement in ensuring continued competence. Steele et al. described a systematic approach to quality improvement programs in interventional radiology (IR) consisting of both quality assurance (QA) and continuous quality improvement (CQI) activities (6). QA activities focus on quantifying the frequency of low-quality events, such as complications, compared to an agreed-upon quality threshold or metric; CQI activities seek to decrease waste and limit variation in the provision of care (6,7). In medicine, there are two types of waste: 1) quality waste, which refers to when resources are expended and the effort fails to produce the desired outcome, and 2) productivity waste, which refers to when more resources than necessary are used to achieve an outcome (6).

The overall objective of QA activities is to provide feedback mechanisms to improve the delivery of healthcare at an institutional level. If a department or individual falls below an acceptable minimal standard of performance, corrective steps, such as continuing medical education or a CQI project, can be taken. However, the most challenging part of most QA programs is access to data (8). Compared to most modern industries, healthcare severely lacks an adequate data infrastructure that enables the efficient retrospective evaluation of quality metrics. This means much of the data collection and analysis must be performed manually from procedural reports which often consist of unstructured prose. This inability to easily access the necessary data to support evaluation is exacerbated by the reality that many IR-groups, with the exception of large academic programs, lack the administrative support for robust QA activities, making the issue of capturing quality metrics even more challenging. The recent focus on structured reporting within IR may provide an opportunity for quality improvement programs to leverage the data contained in reports to generate quality metrics. Standardized reports have been shown to have several advantages in facilitating communication and documentation of procedural indications, clinical histories, techniques, equipment, and important findings (9).

One area of IR in which ongoing quality assessment and improvement practices are critical is in caring for hemodialysis-dependent patients. Well-functioning vascular access is vital in providing care to these patients. International quality improvement guidelines for percutaneous image-guided management of thrombosed or dysfunctional hemodialysis circuits, published by the SIR Standards of Practice Committee, suggest that outcome measurement thresholds should be used in ongoing quality improvement programs (1). The SIR Standards of Practice Committee defines a threshold as “a specific level of an indicator that, when reached or crossed, should prompt a review of departmental policies and procedures” (1). One example of an outcome metric is postintervention primary patency (PiPP), defined as the interval of uninterrupted patency between two consecutive vascular access interventions at any site within a dialysis circuit (1,10). In considering the management of an arteriovenous fistula with angioplasty, guidelines suggest PiPP

threshold rates of 74%, 54%, and 32% at three months, six months, and 12 months, respectively (1). Another example of an outcome metric is postintervention lesion patency (PiLP), defined as the interval of uninterrupted patency between two consecutive vascular access interventions at or adjacent to a lesion site (10). If a cohort of patients does not meet guideline thresholds, a multidisciplinary review of vascular access management should be undertaken to understand the root causes and propose solutions.

The objective of this study was to mine data from IR reports of dialysis access interventions to determine whether radiology reports are independently sufficient for the calculation of outcome measure thresholds, such as PiPP and PiLP rates. To the authors' knowledge, this is the first study of its kind.

Methods

Setting and population

This retrospective study was approved by the Hamilton Integrated Research Ethics Board (HiREB), and the requirement for informed consent was waived. A retrospective analysis of radiology reports created from May 28, 2019 to October 16, 2020 was conducted at the tertiary care centre. Reports pertaining to percutaneous image-guided management of thrombosed or dysfunctional hemodialysis circuits were included. Radiology reports that only described diagnostic intervention(s) were excluded.

Cohort identification

All radiology reports were identified and extracted from Picture Archiving and Communication System (PACS). All examinations were anonymized in a HiREB compliant manner. The initial data set was filtered by relevant IR procedure codes and billing codes; this data set was then manually screened to exclude reports that did not describe management of a thrombosed or dysfunctional hemodialysis circuit. Screening was performed in duplicate by two independent reviewers (I.M.N. and A.I.). Discrepancies were resolved by consensus between the two reviewers. If a consensus could not be reached, the input of a third, senior reviewer (A.D.B.) was used to determine the final eligibility of the study.

Assessment of procedural reports

To assess the content of radiology reports, we created a checklist of items derived from published reporting standards for percutaneous interventions in dialysis access and the SIR template for dialysis fistulogram and interventions (11,12). The checklist was created by a fellowship-trained interventional radiologist with five years of experience (A.D.B). Categories and elements from

published reporting standards that were included in the checklist were: referral indications, access description, prior interventions (date, type, lesion location), anatomic measures of disease severity (technique for lumen visualization, qualitative or quantitative measure of preprocedural stenosis, lesion location, central vein patency), treatment description, posttreatment evaluation, and complications. Elements from published reporting standards that were not included in the checklist were: comorbidities/risk factors, clinical (return to dialysis, continuous thrill, resolution of clinical abnormalities), device success, compliance, and procedure time. Although important, inclusion of these specific elements was not needed for the calculation of quality metrics, PiPP and PiLP. Relevant radiology reports were manually annotated according to the checklist. Annotation was performed in duplicate by two independent reviewers (I.M.N. and A.I.). Discrepancies were resolved by consensus between the two reviewers. If a consensus could not be reached, the input of a third, senior reviewer (A.D.B.) was used.

Assessment of self-sufficiency of reports

Following manual annotation, radiology reports were assessed to determine whether they were independently sufficient in providing the data required to calculate the selected outcomes. PiPP and PiLP were specifically chosen because, based on the experience of the authors, these metrics are the simplest to calculate, require inclusion of basic clinical/procedural histories, and are most clinically relevant, as they are associated with reintervention rates. Other outcome metrics that were considered include clinical success, hemodynamic success, postintervention assisted primary patency, postintervention secondary patency, and cumulative patency. These metrics were not pursued as they required inclusion of information that was not likely for an interventional radiologist to include in their reports, given that the institution, like most others in Canada, has not adopted the standard use of reporting templates.

The criteria for a report to be classified as “independently sufficient” was determined based on the definitions of PiPP and PiLP according to quality improvement guidelines (1,10). A report was classified as “independently sufficient” to calculate PiPP if it included the date, access description, type of prior intervention, and procedural information of the current intervention. A report was classified as “independently sufficient” to calculate PiLP if it included the location of prior intervention in addition to the criteria required to calculate PiPP.

Results

A total of 379,508 radiology reports were extracted for the period of May 28, 2019 to October 16, 2020. After filtering this initial data set for reports tagged with relevant procedure codes, we identified 140 reports. Following a final manual screening to exclude reports that did not describe management of a thrombosed or dysfunctional hemodialysis circuit, a total of 130 radiology reports describing 78 patients were included**.** All finalized radiology reports were produced and

signed by attending radiologists in the health system. In total, seven interventional radiologists performed these studies.

Patient demographic characteristics are detailed in Table 1. The mean age of the 78 patients included was 68.2 years (standard deviation: 13.3 years; range: 23 to 87 years) and 80.8% were male. Almost all patients had a fistula (96.2%), with more than half the patients having a radiocephalic access (56.4%). Just over three-quarters of the patients had a left-sided dialysis access (75.6%).

Table 1. Patient demographic characteristics (n=78)

Characteristic		**n (%)**
Age (mean [years] ± standard deviation (range))		68.2 ± 13.3 (23 – 87)
Gender, male		63 (80.8)
Dialysis access type	Graft	75 (96.2
	Fistula	3 (3.8)
Dialysis access location	Radiocephalic	44 (56.4)
	Brachiocephalic	31 (39.7)
	Brachiobasilic	2 (2.6)
	Brachiocubital	1 (1.3)
Dialysis access side, left		59 (75.6%)

Table 2 outlines the content of the procedural reports within the sample. All reports detailed techniques for lumen visualization and contained treatment descriptions. The least frequently included data elements were prior interventions (date, type, or location) (28.5%), access type (45.4%), and referral indications (63.9%). Only 3.9% (n=5) of reports contained all data elements included in the checklist. Of the 130 radiology reports included, 18.5% were independently sufficient in providing the information required to calculate PiPP (n=24), and 15.4% were independently sufficient to calculate PiLP (n=20).

Discussion

Determining whether an institution's IR practice is meeting guideline thresholds is a challenge, especially in the Canadian context. Although various QA systems exist, they are not widely implemented in Canadian institutions (13). As such, manual extraction of data from radiology reports from PACS and/or clinical histories from electronic medical records (EMR) are required to compare an IR program's performance with guideline thresholds. In most Canadian hospitals, EMR data are usually managed and regulated by the hospital system's information technology staff, whereas PACS is usually managed by the radiology department's IT staff. As a result, radiology reports are often more accessible to interventional radiologists for data mining and conducting QA activities.

In Canada, the retrospective collection of quality metrics can be time consuming. Due to challenges of accessing reports retrospectively and the fact that most institutions have not

Table 2. Completeness of radiology reports (n=130). Checklist criteria derived from the Society of Interventional Radiology template for dialysis fistulogram and interventions.

Checklist criteria	**n (%)**
Referral indications (either screening method or access failure indication)	83 (63.9)
Access type (e.g., brachiocephalic, radiocephalic, etc)	59 (45.4)
Prior Interventions (any data)	37 (28.5)
Date of intervention	31 (23.9)
Type of intervention	30 (23.1)
Lesion location	22 (16.9)
Anatomic measures of disease severity	
Technique for lumen visualization (ex. fistulogram, ultrasound, venogram, etc.)	130 (100)
Qualitative or quantitative measure of preprocedural stenosis (<30%)	83 (63.9)
Lesion location	128 (98.5)
Central vein patency	94 (72.3)
Treatment description	130 (100)
Posttreatment qualitative or quantitative measure of postprocedural stenosis (<30%)	127 (97.7)
Complications	112 (86.1)

adopted the standard use of reporting templates, calculating PiPP and PiLP would require administrators to first identify relevant procedure codes, filter reports accordingly, exclude those that do not describe a percutaneous image-guided intervention, sort the remaining reports by patient, manually annotate for date, type, and location of lesion (assuming that this information is contained), and, finally, calculate the time difference between consecutive interventions. These results would then need to be tabulated to compare the IR practice's reintervention rate(s) with quality guideline thresholds. This workflow assumes the necessary data are contained within the report.

Although the literature describes the importance of patient-centered outcomes measure in radiology, this study is the first of its kind to assess inclusion of certain elements in radiology reports to enable the retrospective calculation of quality metrics. This study found that documentation of items derived from published reporting standards for percutaneous interventions in dialysis access was low, with only 3.9% of reports containing all the elements in the checklist. Additionally, only 18.5% and 15.4% of radiology reports were independently sufficient to calculate PiPP and PiLP, respectively. Furthermore, reports were not explicitly categorized as structured (itemized or tabular) versus unstructured (prose) because most reports used a mix of the two approaches, containing headings to enumerate specific categories while the descriptions associated with them were largely prose. This is not a criticism of the reports or the interventionists in this sample, as no standard reporting requirements currently exist at the institution, nor are there any government reporting mandates in place. The findings of this study suggest that non-implementation of published reporting standards may hinder the retrospective quality assessments required in quality improvement programs.

The literature encourages the adoption of standardized reporting templates (9,14-20). McWilliams et al. reported that, among the 10 IR practices that deployed standardized reporting templates, the mean report usage rate was 57% (9). Additionally, they found that each of the sites observed in their study modified the original report template, and on average reduced the length by 26%, the word count by 18%, and the number of compulsory fields by 60% (9). Further statistical analysis found that reducing the number of compulsory fields was significantly correlated with increased rates of use [R2=0.444; P=0.05], suggesting that simple, customizable templates are better implemented (9). Similarly, Boseman et al. formed a focus group of 11 attending radiologists representing eight countries to identify barriers to the adoption of standardized reporting by radiology departments (17). The study found that radiologists judged reporting within a rigid frame as "unacceptable." Additionally, participants expressed that other healthcare stakeholders imposed standardized reporting without considering the perspectives of practicing radiologists. However, radiologists agreed that, given their acceptance of the advantages of reporting, they would be more likely to engage positively if templates were provided, especially where such tools did not compromise accuracy of reporting and workflows (17).

The most robust standardized reporting template for IR procedures are SIR templates (21). In 2021, SIR launched a new data registry, VIRTEX, designed to enable IR practices to compile standard sets of data to benchmark and improve patient care outcomes (21). The primary objective of VIRTEX is to establish data-driven, evidence-based patient care (21). VIRTEX encourages the use of SIR's standardized reporting templates, as the templates offer a structured and automated way to submit data to the registry (21). This study supports the need for greater standardization as advocated for by the creators of VIRTEX registry and the importance of reporting certain elements, particularly details of prior interventions, a data element not explicitly required in the current SIR standardized template (11,12). Our findings suggest that including the date, access description, type, and lesion location of prior and current interventions in reports would facilitate data mining in the care of patients with dysfunctional hemodialysis circuits. The suggestions above would enable reports to provide the data necessary to support QA programs, particularly in the calculation of PiPP and PiLP, and they align with the objectives of VIRTEX (21).

This study has some limitations. First, the report data set was mined from a single institution. Local factors, such as case mix and implicit preferences of radiologists and referring clinicians, may limit generalizability. Second, the selection of relevant reports was based on PACS procedure codes; it is possible that other relevant reports indexed with an incorrect procedure code may not have been captured in the final data set. Additionally, this study assumed that all relevant information for quality improvement assessments was contained within the radiology reports. EMR were not accessed, cross-referenced, or validated in this study. By utilizing additional records, it may have been possible to obtain the information necessary to calculate the outcome metrics of interest (PiPP and PiLP). However, the objective of this study was to assess the content of radiology reports independent of other data sources, as this may be more representative of QA data mining in a real-world setting.

Conclusion

Data mining from procedural reports of percutaneous interventions in dialysis access may provide the data to support QA activities in an IR practice. However, few reports in the dataset were independently sufficient to calculate the quality outcome metrics suggested by international guidelines. Standardized reporting has the potential to improve communication, promote adherence to guidelines, and provide data for quality improvement projects to optimize patient care. This study supports the need for greater standardization as advocated for by the creators of VIRTEX registry.

References

1. Dariushnia SR, Walker TG, Silberzweig JE, Annamalai G, Krishnamurthy V, Mitchell JW, et al. Quality improvement guidelines for percutaneous image-guided management of the thrombosed or dysfunctional dialysis circuit. J Vasc Interv Radiol. 2016;27(10):1518-1530.

2. Spies JB, Bakal CW, Burke DR, Husted JW, McLean G, Palestrant AM, et al. Standards for interventional radiology. J Vasc Interv Radiol. 1991;2(1):59-65.

3. Gupta S, Wallace MJ, Cardella JF, Kundu S, Miller DL, Rose SC. Quality improvement guidelines for percutaneous needle biopsy. J Vasc Interv Radiol. 2010;21(7):969-975.

4. Haskal ZJ, Martin L, Cardella JF, Cole PE, Drooz A, Grassi CJ, et al. Quality improvement guidelines for transjugular intrahepatic portosystemic shunts. J Vasc Interv Radiol. 2001;12(2):131-136.

5. Hovsepian DM, Siskin GP, Bonn J, Cardella JF, Clark TWI, Lampmann LE, et al. Quality improvement guidelines for uterine artery embolization for symptomatic leiomyomata. Cardiovasc Intervent Radiol. 2004;27(4):307-313.

6. Steele JR, Wallace MJ, Hovsepian DM, James BC, Kundu S, Miller DL, et al. Guidelines for establishing a quality improvement program in interventional radiology. J Vasc Interv Radiol. 2010;21(5):617-625.

7. Society of Interventional Radiology Standards of Practice Committee. Guidelines for establishing a quality assurance program in vascular and interventional radiology. J Vasc Interv Radiol. 2003;14(9 PART 2):S203-7.

8. McGlynn EA. Measuring clinical quality and appropriateness. In: Smith P, Mossialos E, Papanicolas I, Leatherman S, eds. Performance measurement for health system improvement: Experiences, challenges and prospects. Cambridge: Cambridge University Press; 2010:87-113.

9. McWilliams JP, Shah RP, Quirk M, White SB, Dybul SL, Ahrar J, et al. Standardized reporting in IR: A prospective multi-institutional pilot study. J Vasc Interv Radiol. 2016;27(12):1779-1785.

10. The American College of Radiology. ACR-SIR practice parameter for endovascular management of the thrombosed or dysfunctional dialysis access [Internet]. Reston; 2017 [cited 2020 Nov 1]. Available from: https://www.acr.org/-/media/ACR/Files/Practice-Parameters/Dysfunc-DialysisMgmt.pdf

11. Society of Interventional Radiology (SIR) and SIR Foundation. Standardized report – Dialysis fistula interventions [Internet]. Fairfax; 2019 [cited 2020 Nov 1]. Available from: https://sir.personifycloud.com/PersonifyEbusiness/IR-Store/Product-Details/productId/107725790

12. Gray RJ, Sacks D, Martin LG, Trerotola SO. Reporting standards for percutaneous interventions in dialysis access. J Vasc Interv Radiol. 2003;14(9 PART 2).

13. Weiner BJ, Alexander JA, Shortell SM, Baker LC, Becker M, Geppert JJ. Quality improvement implementation and hospital performance on quality indicators. Health Serv Res. 2006;41(2):307-334.

14. Corwin MT, Lee AY, Fananapazir G, Loehfelm TW, Sarkar S, Sirlin CB. Nonstandardized terminology to describe focal liver lesions in patients at risk for hepatocellular carcinoma: Implications regarding clinical communication. Am J Roentgenol. 2018;210(1):85-90.

15. Nörenberg D, Sommer WH, Thasler W, D'Haese J, Rentsch M, Kolben T, et al. Structured reporting of rectal magnetic resonance imaging in suspected primary rectal cancer: Potential benefits for surgical planning and interdisciplinary communication. Invest Radiol. 2017;52(4):232-239.

16. Flusberg M, Ganeles J, Ekinci T, Goldberg-Stein S, Paroder V, Kobi M, et al. Impact of a structured report template on the quality of CT and MRI reports for hepatocellular carcinoma diagnosis. J Am Coll Radiol. 2017;14(9):1206-1211.

17. Boseman JML, Peremans L, Menni M, de Schepper AM, Duyck PO, Parizel PM. Structured reporting: If, why, when, how-and at what expense? Results of a focus group meeting of radiology professionals from eight countries. Insights Imaging. 2012;3(3):295-302.

18. Durack JC. The value proposition of structured reporting in interventional radiology. Am J Roentgenol. 2014;203(4):734-738.

19. Nguyen Q, Sarwar A, Luo M, Berkowitz S, Ahmed M, Brook OR. Structured reporting of IR procedures: Effect on report compliance, accuracy, and satisfaction. J Vasc Interv Radiol. 2018;29(3):345-352.

20. The American College of Radiology. ACR–SIR–SPR practice parameter for the reporting and archiving of international radiology procedures [Internet]. Reston; 2019 [cited 2020 Nov 1]. Available from: https://www.acr.org/-/media/ACR/Files/Practice-Parameters/Reporting-Archiv.pdf

21. Society of Interventional Radiology. VIRTEX: SIR data registry [Internet]. Fairfax; [cited 2021 June 21]. Available from: https://www.sirweb.org/virtex

Original Research Article

Ischemic stroke and periprocedural discontinuation of antithrombotic agents: A single center retrospective chart review

Ruqqiyah Rana[1], Leon Li BHSc, MScPT[1], Andrew Cao[2], Hannah Elaine Snyder MD[3], Faraz Masood MD[4]

[1]McMaster University, Michael G. Degroote School of Medicine
[2]Department of Medicine, University of Toronto
[3]Department of Pediatrics, McMaster University
[4]Department of Medicine, Niagara Health, McMaster University

Abstract

Objective: To investigate the relationship between periprocedural discontinuation of antithrombotics and the occurrence of ischemic stroke in a regional stroke center.
Methods: This is a retrospective chart review that examined 517 patients presenting to a regional stroke center with radiographically and/or clinically confirmed ischemic stroke. Prescription of oral antithrombotics at time of stroke and discontinuation for any cause were recorded.
Results: Of the 36 patients who had their antithrombotic therapy interrupted, six patients with periprocedural discontinuation and subsequent ischemic stroke (within 30 days) were identified. These patients received anticoagulation therapy with factor Xa inhibitors, direct thrombin inhibitors, or warfarin prior to discontinuation. Adverse bleeding events were identified as the most common reason for discontinuation, followed by non-adherence to medication regimen.
Conclusion: Although the quantity of patients presenting with ischemic stroke following periprocedural anticoagulation interruption was significantly lower than hypothesized, this project nonetheless identifies the need for greater examination into clinician adherence with anticoagulation guidelines and reasons for patient non-compliance.

Keywords: Perioperative; periprocedural; antithrombotic; ischemic stroke

Corresponding author: ruqqiyah.rana@medportal.ca

Introduction and literature review

Antithrombotics are important for primary and secondary stroke prevention

In patients diagnosed with their first ischemic stroke, longitudinal studies have identified an increased risk of recurrent ischemic stroke, particularly in the subsequent years following the initial incident (1,2). In Ontario, Edwards et al. observed an approximate five-fold increase in incidence of ischemic stroke in the five years following the first transient ischemic attack (TIA) or ischemic stroke, when compared with matched controls (3). Together, these studies underscore the importance of secondary prevention in ischemic stroke.

Indeed, the necessity for secondary prophylactic medical therapy in such scenarios is reflected in the most recent Canadian Stroke Best Practice Recommendations for the Secondary Prevention of Stroke and the American Heart Association/American Stroke Association guidelines for secondary prevention of stroke (4,5). Antithrombotic medications are first-line therapy in these patients and are used to great clinical effect. A meta-analysis of over 15,000 randomized patients demonstrated a significantly decreased incidence of recurrent ischemic stroke at 12 weeks following the initial ischemic insult when treated with aspirin, an antiplatelet therapy (6). Clopidogrel, also an antiplatelet therapy, has been shown to provide a further reduction in incidence of ischemic stroke; however, the clot-reduction benefits of clopidogrel come at the cost of a higher risk of major hemorrhage (7). Anticoagulants, such as factor X inhibitors (e.g., apixaban or rivaroxaban), direct thrombin inhibitors (e.g., argatroban or dabigatran), or vitamin K antagonists (e.g., warfarin) are used in the primary prevention of stroke in high-risk patients with atrial fibrillation, as determined by validated evaluation tools (8,9). More recently, the COMPASS trial demonstrated an additional role for rivaroxaban in the secondary prevention of ischemic stroke (10). Overall, the benefits of antithrombotic therapy cannot be understated; however, it should be noted that antithrombotic therapies carry a non-negligible risk of increased bleeding events that must be weighed in careful consideration with each individual patient.

Adherence to periprocedural management of antiplatelet and anticoagulant guidelines can be unpredictable

Thrombosis Canada provides extensive clinical guides which outline appropriate management of antiplatelets and anticoagulants in the periprocedural period. Within these guides, surgical procedures are stratified as either low, moderate, or high risk, depending on the probability of associated adverse bleeding. These stratifications assist in determining the length of time for which an antithrombotic agent should be held pre- and post-operatively, and are based on current best evidence (11). To highlight the incorporation of the most up to date literature within the guidelines, one can examine the nuances of direct oral anticoagulant (DOAC) discontinuation in the perioperative period. The guidelines partly base this information on a sub-study of the RE-LY trial,

which showed that the use of bridging anticoagulation during interruption of dabigatran or warfarin increased major bleeding events, but had no significant effect in decreasing stroke or thromboembolism (12). Moreover, a study by Douketis et al. found very low rates of perioperative arterial thromboembolism, ranging from 0.16-0.60% depending on the specific DOAC, when standardized management measures were appropriately followed (13).

Despite the availability of these evidence-based guidelines, perioperative management of antithrombotic medications can vary based on practitioner and healthcare site. These variations appear to be present during both the pre- and post-operative periods, theoretically increasing the risk of procedural bleeds as well as thromboembolic events (1-5). This lack of adherence may be partially attributed to an inadequacy in the guidelines themselves in providing clear direction for clinical gray areas, a concept which is especially true in the periprocedural setting. To highlight the nuance and the complex nature of the guidelines—which can increase the rates of non-adherence or misinterpretation—one can take the example of the perioperative management of aspirin. Thrombosis Canada outlines the management for low and high-risk patients, and the guidelines suggest discontinuing the medication seven to 10 days prior to the procedure if there is a high risk of bleeding (11). However, in addition to these two classifications, patients with coronary stents are classified and managed differently, and often require both hematology and cardiology specialist consultation in order to manage their perioperative anticoagulant dosages (11). Other disciplines within which this heterogeneity exists includes dermatology and interventional pain management (14,15).

This lack of adherence may also be due to suboptimal understanding of treatment guidelines or adverse consequences by the patient population. While not specifically studying periprocedural outcomes, Borne et al. examined adherence patterns in a population of patients treated with preventative anticoagulation due to atrial fibrillation. They found that more than 25% of their sample displayed suboptimal adherence and that this was associated with an increased risk of ischemic stroke (16). Overall, these studies demonstrate a need for further investigations into guideline adherence and interventions at the level of the clinician and the patient to minimize both cerebrovascular accidents and major bleeds.

Discontinuation of antithrombotics may increase risk for cerebrovascular accident (CVA)

While there is robust evidence to prove that inadequate interruption of anticoagulants puts patients at risk of adverse bleeding outcomes, it is also important to consider whether there is an increased risk of ischemic stroke with prolonged interruption. For instance, one group of researchers studied the incidence of anticoagulant interruption amongst patients with atrial fibrillation undergoing secondary stroke prevention. In a sample of over 3,000 patients, they found that stroke recurrence occurred in four percent of patients whose dosing schedule was interrupted, with the most common reason for interruption being patient non-compliance (17). When specifically considering perioperative management of oral anticoagulation, subsequent CVA risk may be related to higher-

risk procedures, as defined by Thrombosis Canada, due to the lengthier interruption that these entail. In the BRUISE CONTROL-2 study of over 600 anticoagulated patients undergoing cardiac device implantation, a low-risk procedure, researchers found that ischemic stroke was a very uncommon complication and that there was no difference between continuous versus interrupted groups (18). In contrast, Kaatz et al. studied risk of post-operative stroke in patients treated for chronic atrial fibrillation undergoing high-risk surgeries, such as abdominal, lung, neurologic, orthopedic, and urologic operations. They found that the 30-day risk of stroke was two times higher than that of individuals without underlying atrial fibrillation who were not anticoagulated (19).

Overall, there is evidence in the literature to support the idea that periprocedural withdrawal of anticoagulant and antiplatelet medications is associated with an increased risk of subsequent ischemic stroke. Broderick et al. studied all patients presenting at a single hospital system with acute ischemic stroke and found that 5.2% of these patients had associated interruption of antithrombotic agents, including warfarin, low molecular weight heparin, aspirin, and clopidogrel (22). While this does represent a considerable proportion of strokes, it is important to recognize that these results are representative of a single geographic region and must be studied further. Currently, there is more emphasis, both academically and clinically, placed on risk of adverse bleeding associated with anticoagulation and surgery; the risk of ischemic stroke with interruption of anticoagulation is another important factor that must be seriously considered.

Why is this study needed now?

While there has been considerable improvement in the prevention and treatment of stroke over the years, CVAs remain the third leading cause of death in Canada (20). Moreover, the Economic Burden of Ischemic Stroke study examined a cohort of 232 ischemic stroke patients across 12 Canadian stroke centres and estimated an average annual cost of $74,353 CAD per ischemic stroke (21). Given the substantial morbidity, mortality, and financial burden of ischemic stroke, preventative measures should be emphasized and optimized. One avenue for optimization lies in the often-inconsistent perioperative management of antithrombotics. This study seeks to identify the proportion of ischemic strokes associated with antithrombotic discontinuation, whether due to preprocedural discontinuation or patient non-adherence, in a Canadian mixed community/academic stroke center. To the authors' knowledge, this question has not been explored previously in this setting. The information gathered from this study can also be used to guide future quality improvement projects as needed.

Purpose

The primary purpose of this study is to examine the incidence of CVAs associated with periprocedural discontinuation of antithrombotic medications; this will be accomplished by performing a chart review of all patients with ischemic strokes who presented to the Greater Niagara General Hospital (GNGH), the centralized stroke centre within the Niagara Health

System, in 2019. We will assess the severity of these strokes as determined by the initial National Institute of Health Stroke Scale (NIHSS) score and modified Rankin Score at 90 days post-infarct.

This study aims to address the following clinical research question: in adult patients diagnosed with ischemic stroke, is there an association between recent cessation of antithrombotic therapy and ischemic stroke occurrence? The primary outcome of interest is to identify the proportion of ischemic strokes occurring within 30 days of antithrombotic agent discontinuation within a larger cohort of ischemic stroke patients. A secondary objective would be to identify and categorize the reasons for antithrombotic agent discontinuation in these patients.

In all patients, the following baseline characteristics will be recorded: age and sex; history of previous stroke, atrial fibrillation, current smoking status, dyslipidemia, hypertension, and diabetes mellitus; initial NIHSS score and pre/post-stroke Modified Rankin score; investigations including initial INR and the presence of CT findings for ischemic stroke; and, if relevant, the date and type of procedure and the date and time of oral antithrombotic interruption and reinstatement.

Methods

This study will be a single-centre retrospective chart review examining all strokes presenting to the GNGH in 2019. To be included in the current study, patients must have presented to GNGH with a discharge diagnosis of acute ischemic stroke. Hemorrhagic strokes were excluded from the study, but patients with hemorrhagic transformation of an acute ischemic infarct were still considered. TIAs were also excluded from this study, as determined by negative CT head and resolving focal neurologic deficits without intervention within 24 hours of presentation.

Data extraction procedures

Hamilton Integrated Research Ethics Board approval was obtained to access patient charts for the cohort admitted to the GNGH during 2019. Meditech electronic medical records were used to access patient data primarily extracted from consult notes for inpatient visits provided by the internal medicine and neurology services. Discharge notes were also checked to confirm the discharge diagnosis of ischemic stroke confirmed radiographically. NIHSS scores were calculated for the initial presentation by reviewers trained and certified in NIHSS scoring. Relevant data were extracted by four independent reviewers. Analysis was primarily performed by deriving descriptive statistics using excel functions, to mimic the design and procedures employed by previous studies in the field (22).

Results

Descriptive statistics and baseline characteristics

The total patient sample (n) of individuals presenting with ischemic stroke to the GNGH in 2019 included 517 patients; the mean age of the sample was 74 years with a median of 77 years (range 33 - 98 years). The sample consisted of 282 (55% of the total sample size) males and 235 (45%) females. Baseline characteristics and comorbidities are recorded in Table 1.

Less than half of the patients (n=218, 42%) were on antithrombotic therapy prior to their stroke, including antiplatelets (n=134, 26%) and anticoagulants (n=84, 16%). Thirty-six (7%) patients had their antithrombotic therapy interrupted, and, of these, only 10 (1.9%) experienced ischemic stroke within 30 days of discontinuation.

Table 1. Baseline characteristics and comorbidities of adults before ischemic stroke

Patient Characteristics		**N (%)**	
Sex	Male	282 (55%)	
	Female	235 (45%)	
Comorbidities	Previous CVA	209 (40%)	
	Atrial fibrillation	142 (27%)	
	Dyslipidemia	248 (48%)	
	Hypertension	383 (74%)	
	Diabetes mellitus	145 (28%)	
	Chronic kidney disease	43 (8%)	
	Smoking history	179 (35%)	
Neuroimaging confirmed	Yes	414 (80%)	
	No	103 (20%)	Median age = 77 years
	TOTAL SAMPLE	517	Median initial NIHSS = 4

Reasons for antithrombotic therapy interruption

Of the 36 patients who had their antithrombotic therapy interrupted, only six (1.2%) were interrupted for periprocedural reasons. In order of decreasing proportion, the reasons cited for discontinuation included adverse bleeding event (n=15, 2.9%), non-adherence to medication regimen (n=13, 2.5%), perioperative/periprocedural (n=6, 1.2%), and the presence of contraindications (n=2, 0.4%).

The patients for whom antithrombotics were discontinued due to adverse bleeding events were categorized by whether they suffered a major or minor bleeding event; major bleeding events included internal bleeding events, including intracerebral hemorrhage and gastrointestinal

bleeding, subdural hemorrhage resulting from fall or trauma, as well as bleeding from varicose veins requiring transfusion. Minor events included bruising, hematuria and rectal bleeds, and minor post-op bleeding complications.

Non-adherence was the second largest reason for discontinuation, affecting 13 patients; the medications that were not adhered to included apixaban (n=5), clopidogrel (n=1), aspirin (n=5), and dabigatran (n=2). Patients with contraindications included patients with worsening renal function and pelvic fracture with high risk of bleeding events on antithrombotics.

Perioperative / periprocedural discontinuation

There were six (1.2%) patients who had their therapy interrupted due to perioperative or periprocedural guidelines. Table 2 outlines the surgical procedures and agents interrupted.

Table 2. Periprocedural/perioperative discontinuation of antithrombotics in adults before ischemic stroke

Patient	Surgery	Associated risk	Antithrombotic	Number of days between interruption and ischemic event
1	Lipoma removal	Moderate	Dabigatran	1-5
2	Open reduction internal fixation of radius	Moderate	Apixaban	1-5
3	Circumcision	Low	Apixaban	1-5
4	Colonoscopy	Low	Rivaroxaban	6-10
5	Tooth extraction	Low	Apixaban	6-10
6	Cardiac catheterization	Low	Warfarin	6-10

Antithrombotic interruption and temporal relation to ischemic stroke

Of the 36 patients for whom antithrombotic therapy was discontinued, only 10 (1.9%) experienced ischemic stroke within 30 days. Data on the respective time intervals corresponding to the reason for discontinuation for these 10 patients are included in Table 3. Patients discontinued from DOACs and vitamin K antagonists experienced ischemic stroke within the first half of the 30-day periprocedural time frame (one to 14 days). One patient discontinued from antiplatelets experienced stroke within the second half of the periprocedural period (15-30 days).

Table 3. Reasons for discontinuation and antithrombotic agents for ischemic stroke in 30 days

Timing of stroke	Reason for discontinuation	Antithrombotic agent	Number of patients
Within 1-5 days	Perioperative or periprocedural	Dabigatran	1
		Apixaban	2
	GI bleed	Dabigatran	1
Within 6-10 days	Perioperative or periprocedural	Rivaroxaban	1
		Apixaban	1
		Warfarin	1
Within 11-14 days	GI bleed	Apixaban	1
Within 15-30 days	Bruising	Aspirin	1
	Contraindication	Aspirin	1

Discussion

The use of antithrombotics is critical to primary and secondary stroke prevention; however, adherence to appropriate antithrombotic guidelines can be unpredictable due to several factors. Identifying these variables can provide avenues for quality improvement interventions to better optimize adherence to clinical guidelines and avoid unnecessary antithrombotic discontinuation which increases risk for CVA.

In this study, we retrospectively reviewed patient charts to describe the incidence of ischemic strokes associated with periprocedural antithrombotic discontinuation in a Canadian community stroke center. From our sample cohort, we found six patients (1.2%) with periprocedural antithrombotic discontinuation, a significantly lower incidence than was found in a similar previous study of 5.2% (22). This difference in findings can potentially be accounted for due to our significantly lower sample size as well as possible geographical differences of medical profiles and presence of risk factors in the sample population. Our results revealed non-operative adverse bleeding events as the primary reason for patient antithrombotic discontinuation, with patient non-adherence being the second most common; both are well-established reasons for discontinuation consistent with previous literature (16,17).

There are some limitations within the methodological design of the study, including the previously cited low sample size, resulting in a significantly lower incidence of patients with perioperative and all-cause discontinuation of antithrombotics than was hypothesized. The small sample size can likely be attributed to the largely community-based nature of the hospital from which patients were recruited and the lack of collaboration with other stroke centers in the region, as has been done in previous studies. The team also encountered many obstacles in gathering patient charts and evaluating them for inclusion in the study, including erroneous medical identification numbers, identification numbers which either did not match to an existing file or led to a duplicated file, and unclear/inadequate reporting around the timelines of discontinuation; these

unfortunate instances resulted in approximately 30 otherwise valid charts being excluded from the study, further limiting the sample size.

The results of this study establish a preliminary foundation of knowledge around antithrombotic management in patients presenting with risk factors for ischemic stroke within the local region for future research studies to build upon. Some additional avenues of exploration can include: investigating the rationale behind different types of adverse bleeding events (e.g., major / minor) associated with antithrombotic discontinuation, expanding the study population time frame to better visualize the population of patients with perioperative antithrombotic discontinuation, and, finally, analyzing barriers behind patient non-adherence to antithrombotic therapy for the potential implementation of quality improvement interventions. Further areas of analysis which could be considered for this patient population include examining instances where clinician decisions regarding periprocedural and perioperative management do not adhere with the established guidelines and delving into the reasons for these non-adherences.

Conclusion

This single-center retrospective chart review examined the association between periprocedural antithrombotic discontinuation and the development of ischemic stroke within a 30-day time frame. The study was based upon the findings of previous literature citing significant association between periprocedural discontinuation and ischemic stroke, with 5.2% of all ischemic strokes studied having been attributed to peri-procedural interruption (22). Our study revealed a much lower rate of 1.2%; an inadequate sample size and the small-scale community nature of the setting were identified as contributing factors. Nevertheless, the study identified a notable number of patients who experienced ischemic stroke after discontinuation of their antithrombotics for a wider variety of factors than have previously been identified, including adverse bleeding events, patient non-adherence to therapy, and contraindications. These findings indicate the need for further study into clinician adherence to antithrombotic guidelines, and understanding patterns of inappropriate discontinuation in patients on primary or secondary prophylactic therapy.

Conflict of interest

There are no conflicts of interest to disclose.

References

1. Amarenco P, Lavallée PC, Monteiro Tavares L, Labreuche J, Albers GW, et al. Five-year risk of stroke after TIA or minor ischemic stroke. New England Journal of Medicine. 2018 Jun 7;378(23):2182-90.

2. Burn J, Dennis M, Bamford J, Sandercock P, Wade D, Warlow C. Long-term risk of recurrent stroke after a first-ever stroke. The Oxfordshire Community Stroke Project. Stroke. 1994 Feb;25(2):333-7.

3. Edwards JD, Kapral MK, Fang J, Swartz RH. Long-term morbidity and mortality in patients without early complications after stroke or transient ischemic attack. CMAJ. 2017 Jul 24;189(29):E954-61.

4. Wein T, Lindsay MP, Côté R, Foley N, Berlingieri J, Bhogal S, et al. Canadian stroke best practice recommendations: Secondary prevention of stroke, practice guidelines, update 2017. International Journal of Stroke. 2018 Jun;13(4):420-43.

5. Kernan WN, Ovbiagele B, Black HR, Bravata DM, Chimowitz MI, Ezekowitz MD, et al. Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014 Jul;45(7):2160-236.

6. Rothwell PM, Algra A, Chen Z, Diener HC, Norrving B, Mehta Z. Effects of aspirin on risk and severity of early recurrent stroke after transient ischaemic attack and ischaemic stroke: time-course analysis of randomised trials. The Lancet. 2016 Jul 23;388(10042):365-75.

7. Johnston SC, Easton JD, Farrant M, Barsan W, Conwit RA, Elm JJ, et al. Clopidogrel and aspirin in acute ischemic stroke and high-risk TIA. New England Journal of Medicine. 2018 Jul 19;379(3):215-25.

8. Gage BF, Waterman AD, Shannon W, Boechler M, Rich MW, Radford MJ. Validation of clinical classification schemes for predicting stroke: results from the National Registry of Atrial Fibrillation. Jama. 2001 Jun 13;285(22):2864-70.

9. Hart RG, Pearce LA, Aguilar MI. Meta-analysis: antithrombotic therapy to prevent stroke in patients who have nonvalvular atrial fibrillation. Annals of internal medicine. 2007 Jun 19;146(12):857-67.

10. Sharma M, Hart RG, Connolly SJ, Bosch J, Shestakovska O, Ng KK, et al. Stroke outcomes in the COMPASS trial. Circulation. 2019 Feb 26;139(9):1134-45.

11. Thrombosis Canada. Clinical Guides | Thrombosis Canada - Thrombose Canada [Internet]. [Place unknown]. Available from: https://thrombosiscanada.ca/clinicalguides/

12. Douketis, J. D., Healey, J. S., Bruekmann, M., Eikelboom, J. W., Ezekowitz, M.D., Fraessdorf, M, et al. Perioperative bridging anticoagulation during dabigatran or warfarin interruption among patients who had an elective surgery or procedure. Substudy of the RE-LY trial. ThrombHaemost. 2015; 113(3):625-32.

13. Douketis, J. D., Spyropoulos, A. C., Duncan, J., Carrier, M., Le Gal, G., Tafur, A. J., et al. Perioperative management of patients with atrial fibrillation receiving a direct oral anticoagulant. JAMA Intern Med. 2019; 179(11):1469-1478.

14. Gaskins M, Dittmann M, Eisert L, Werner RN, Dressler C, Löser C, et al. Management of antithrombotic agents in dermatologic surgery before and after publication of the corresponding German evidence-based guideline. JDDG: Journal der Deutschen Dermatologischen Gesellschaft. 2018 Mar;16(3):297-305.

15. Western DO, Arkansas FS, Manchikanti L. Assessment of practice patterns of perioperative management of antiplatelet and anticoagulant therapy in interventional pain management. Pain Physician. 2012 Nov;15:E955-68.

16. Borne, R. T., O'Donnell, C., Turakhia, M. P., Varosy, P. D., Jackevicius, C. A., Marzec, et al. Adherence and outcomes to direct oral anticoagulants among patients with atrial fibrillation: Findings from the veterans health administration. BMC Cardiovascular Disorders. 2017;17(1):236.

17. Kim, J. M., Park, K. Y., Yu, I. W., Song, T. J., Kim, Y. J., Heo, S. H., et al. Incidence of oral anticoagulant interruption among stroke patients with atrial fibrillation and subsequent stroke. European Journal of Neurology. 2020;27(5):900-902.

18. Birnie, D. H., Healey, J. S., Wells, G. A., Ayala-Paredes, F., Coutu, B., Sumner, G. L., et al. Continued vs. interrupted direct oral anticoagulants at the time of device surgery, in patients with moderate to high risk of arterial thrombo-embolic events (BRUISE CONTROL-2). European Heart Journal. 2018; 39(44):3973-3979.

19. Kaats, S., Douketis, J. D., Zhou, H., Gage, B. F., & White, R. H. Risk of stroke after surgery in patients with and without chronic atrial fibrillation. J Thromb Haemost. 2010; 8(5):884-890.

20. Statistics Canada. Leading causes of death by age group. [Internet]. Available from: <https://open.canada.ca/data/en/dataset/3bec33c7-ab4a-4018-92a4-9a696f97173d>

21. Mittmann N, Seung SJ, Hill MD, Phillips SJ, Hachinski V, Coté R, et al. Impact of disability status on ischemic stroke costs in Canada in the first year. Canadian journal of neurological sciences. 2012 Nov;39(6):793-800.

22. Broderick JP, Bonomo JB, Kissela BM, Khoury JC, Moomaw CJ, Alwell K, et al. Withdrawal of antithrombotic agents and its impact on ischemic stroke occurrence. Stroke. 2011 Sep;42(9):2509-14.

Original Research Article

The assessment of FRAX-based osteoporotic fracture risk probability among nurses aged 40 and above in a tertiary care hospital in Sri Lanka

Diluksha Prasad Jayawardana Hettiarachchige

Sri Jayewardenepura General Hospital, University of Sri Jayewardenepura, Sri Lanka

Abstract

Data related to the probability of osteoporotic fracture risk among nurses are not available in Sri Lanka. FRAX (Fracture Risk Assessment Tool) can assess fracture risk without bone mineral density (BMD) values when Dual energy x-ray absorptiometry is not available. This study analyzes the FRAX-based 10-year major osteoporotic fracture probability (MOFP) and the hip osteoporotic fracture probability (HOFP) among nurses aged 40 years and above in a tertiary care hospital in Sri Lanka. A standard questionnaire was administered to collect data on socio-demographic characteristics and clinical risk factors for osteoporosis. Partial correlation analysis was used to analyze the association between fracture risk probability and body mass index (BMI) or duration of menopause. Of the 200 study subjects, Sinhalese constituted the majority (98.5%, n=197) with a mean age of 48.5±5.5 years. Menopause was significantly correlated with FRAX-based 10-year MOFP and HOFP estimated without consideration of BMD ($p<0.001$). The FRAX-based 10-year MOFP and HOFP estimated without consideration of BMD were 1.82% and 0.27%, respectively. A significant positive association was observed between menopausal duration and FRAX-based fracture probability after adjustment for age and BMI, while a significant negative association between BMI and FRAX-based fracture probability after adjustment for age was also identified. Further, a statistically significant association was observed between menopausal duration and FRAX-based 10-year MOFP ($p=0.03$) and between BMI and FRAX-based 10-year HOFP ($p=0.001$), without consideration of BMD. In conclusion, MOFP and HOFP estimated without consideration of BMD among Sri Lankan nurses aged 40-years and above were very low and were below the FRAX-based treatment thresholds. Further studies involving several healthcare institutions and BMD values are encouraged to confirm our results.

Keywords: FRAX; bone mineral density; osteoporosis; fracture; nurses

Corresponding author: dilukshaprasad@gmail.com

Introduction

Osteoporotic fractures are common among postmenopausal women, with high morbidity and mortality (1,2). Spine and hip fractures are the two most serious fracture types. Osteoporosis is a silent disease that is difficult to detect at an early stage as bone loss occurs without symptoms and signs. It also entails a significant cost to society by causing hospitalizations, necessitating advanced investigations, increasing nursing home stays, and diminishing patient performance in social responsibilities (3-5). It has been estimated that more than 50% of all osteoporotic hip fractures in the world will occur in Asia by the year 2050 (6). Furthermore, several studies have demonstrated that there were 5-30% treatment rates for osteoporosis following hip fractures (7,8). Therefore, it is critical to identify those who are at risk for an osteoporotic fracture early and to prevent future fractures once a fragility fracture has been diagnosed.

The Fracture Risk Assessment Tool (FRAX) is a computer-based algorithm developed in 2008 by the World Health Organization Collaborating Centre for Metabolic Bone Disease (9,10). FRAX is currently available online at http://www.shef.ac.uk/FRAX. The tool calculates the 10-year probability of a major osteoporotic fracture in the hip, spine, humerus, or wrist (11). This probability is calculated by considering the age, sex, body mass index (BMI), history of fragility fracture, parental history of hip fracture, current tobacco smoking, use of long-term oral glucocorticoids, rheumatoid arthritis, causes of secondary osteoporosis, and consumption of alcohol. In addition, femoral neck bone mineral density (BMD) is an optional measure that can be included to enhance fracture risk prediction (10). Previous research has shown that estimated probability of FRAX-based 10-year osteoporotic fracture risk was lower than the actual fracture rate among women with low BMD (12,13).

Dual-energy x-ray absorptiometry (DXA) is considered the gold standard for assessing BMD (14-16). However, affordability and availability of DXA are the two major barriers that arise with BMD measurement. Even though quantitative ultrasound (QUS) is cheap, portable, and free of ionizing radiation, the utility of QUS is limited in the field of osteoporosis (17-20).

Caregivers may be particularly vulnerable to bone and muscle diseases due to laborious work in taking care of patients, inadequate exposure to sunlight, and indoor work environment. Moreover, most of them are in middle age or older, making them highly vulnerable to osteoporosis. Chen et al. have shown that 46.8% of public health nurses falsely considered osteoporosis to be easy to treat and diagnose (21). Further, nursing students of various grade levels, as well as nursing practitioners, have been shown to have inadequate knowledge of risk factors, detection, treatment, and prevention of osteoporosis (22-26). Inadequate knowledge and inherent occupational responsibilities together make nurses more vulnerable to osteoporosis.

Some countries like Sri Lanka used data of a surrogate population to estimate 10-year osteoporotic fracture probabilities. To date, there is no study assessing FRAX-based osteoporotic fracture risk among nurses (27). This study aims to assess the FRAX-based 10-year osteoporotic fracture risk probability among nurses aged 40 years and above at a tertiary care hospital in Sri Lanka. Thereby, early recognition and identification of at-risk candidates will help take

appropriate preventive measures and therapeutic interventions to reduce the burden on individuals as well as on the healthcare system as a whole.

Materials and methods

This cross-sectional study was conducted between January and May 2021. The study population included 200 female nurses aged 40 years or older without a diagnosis of osteoporosis, selected from a tertiary care hospital in Sri Lanka. A simple random sampling method was used to recruit eligible subjects. All study participants provided written informed consent, and the study was approved by the medical ethics committee of the institution. A questionnaire was used to collect information on age, level of education, marital status, ethnicity, last regular menstrual period, hormone replacement therapy, and clinical risk factors for osteoporosis.

The BMI was calculated from weight and height, measured by a standard weighing machine and stadiometer, respectively. The same questionnaire was used to gather data to assess the 10-year major osteoporotic fracture probability (MOFP) and the 10-year hip osteoporotic fracture probability (HOFP) by the Sri Lankan FRAX tool. Fracture risk was calculated based on age, BMI, and clinical risk factors without consideration of BMD. BMD was not taken into consideration as DXA facilities are not readily available in all hospitals in Sri Lanka.

Statistical analysis was performed using Statistical Package for Social Science (SPSS, version 26.0) software. Quantitative data are presented as the mean ± standard deviation (SD) and range. Qualitative data are presented as frequencies (percentages). To analyze the association between 10-year fracture risk probability and various categorical variables, the Chi-squared test was utilized. Partial correlation analysis was used to analyze the association between fracture risk probability and BMI or duration of menopause. *P*-values <.05 were considered statistically significant.

Results

In the present study, out of the total study subjects (n=200), Sinhalese constituted the majority (98.5%, n=197). The mean age of the subjects was 48.5 years ± 5.5 years. 99.5% of the nurses (n=199) had diplomas at the time of enrolment in the study. A majority of the study participants did not use hormone replacement therapy (95.5%, n=191) (Table 1). Descriptive data on basic characteristics and FRAX-based 10-year osteoporotic fracture probabilities of the study sample are shown in Table 2. Upon analyzing demographic data and osteoporotic fracture probability, there was a statistically significant correlation between FRAX-based 10-year MOFP and HOFP ((p<0.001; Table 3).

Analysis of BMI among the study participants revealed that 30.5% (n=61) were obese with a BMI greater than or equal to 27, 25% (n=50) were overweight with a BMI between 24 to 26.9, 41.5% (n=83) were within the normal range with a BMI between 18.5 to 23.9, and 3% (n=6) were underweight with a BMI less than 18.5. Significant negative associations were observed between BMI and FRAX-based fracture probability after adjustment for age among the

Table 1. Socio-demographic characteristics of the study sample

Variable		**Frequency, number (%)**
Age (years)	40-50	129 (64.5)
	51-60	68 (34)
	61-70	3 (1.5)
Marital status	Married	182 (91)
	Unmarried	17 (8.5)
	Divorced	1 (0.5)
Ethnicity	Sinhala	197 (98.5)
	Tamil	2 (1)
	Muslim	1 (0.5)
Education level	Diploma	199 (99.5)
	Postgraduate degree	1 (0.5)
Menopause	Yes	83 (41.5)
	No	117 (58.5)
Hormone replacement therapy	No	191 (95.5)
	Used for some time	8 (4)
	Continuous usage	1 (0.5)

overall study subjects. There were statistically significant positive associations between BMI and FRAX-based 10-year HOFP (p=0.001; Table 4). Among the study participants, 41.5% (n=83) of female subjects were postmenopausal females. The duration of menopause ranged from one year to 19 years (mean 5.2 ± 4.0 years). There were significant positive associations between menopausal duration and FRAX-based fracture probability after adjustment for age and BMI among menopausal females. Therefore, a statistically significant association was observed between menopausal duration and FRAX-based 10-year MOFP (p=0.032) (Table 4). However, this study did not show an association between hormone replacement therapy and FRAX-based osteoporotic fracture probability among nurses.

Table 2. Descriptive characteristics and FRAX-based 10-year osteoporotic fracture probabilities

Variable	Mean (SD) / n (%)	Range
Age (Years)	48.5± 5.5	40-67
BMI (kg/m^2)	25.07±4.05	12.8-41.4
Previous fracture	15 (7.5%)	
Parental history of fracture	13 (6.5%)	
Current smoking	0	
History of steroid use	14 (7%)	
Rheumatoid arthritis	6 (3%)	
Secondary osteoporosis	38 (19%)	
Alcohol 3 or more units/day	0	
MOFP without BMD	1.82±1.40	0-9.5
HOFP without BMD	0.27±0.40	0-2.7

Abbreviations: BMD, bone mineral density; BMI, body mass index; HOFP, FRAX-based 10-year hip osteoporotic fracture probability; MOFP, FRAX-based 10-year major osteoporotic fracture probability

Table 3. Comparison of FRAX-based 10-year osteoporotic fracture probabilities according to socio-demographic characteristics

Variable	X^2		P	
	Without BMD		Without BMD	
	MOFP	HOFP	MOFP	HOFP
Age	251.793	163.415	<0.001	<0.001
Marital status	41.752	14.84	1.000	0.991
Ethnicity	41.859	9.374	1.000	1.000
Menopause	85.099	59.904	<0.001	<0.001
Hormone replacement therapy	52.395	13.283	0.997	0.986

Abbreviations: BMD, bone mineral density; HOFP, FRAX-based 10-year hip osteoporotic fracture probability; MOFP, FRAX-based 10-year major osteoporotic fracture probability.

Table 4. Associations between BMI and duration of menopause with FRAX-based 10-year osteoporotic fracture probabilities

Variable		Without BMD	
		MOFP	HOFP
BMI	r	-0.112	-0.226
	p	0.115	0.001
Duration of menopause	r	0.153	0.103
	p	0.032	0.147

Abbreviations: BMD, bone mineral density; BMI, body mass index; HOFP, FRAX-based 10-year hip osteoporotic fracture probability; MOFP, FRAX-based 10-year major osteoporotic fracture probability.

Discussion

Osteoporosis screening and evaluation of risk factors allow clinicians to determine which groups require follow-up interventions that reduce their risk for osteoporosis. The FRAX model plays an important role in estimating risk of an osteoporotic fracture within the next 10 years. Many countries have developed their FRAX models using national data, assuming country-specific algorithms suit the local population best.

In this study, we assessed the Sri Lankan FRAX-based 10-year MOFP and HOFP among nurses in a tertiary care hospital. The FRAX-based fracture probabilities (MOFP: 1.82% and HOFP: 0.27%) identified in this study were lower than the fracture probabilities reported in postmenopausal women in Taiwan (MOFP:13.8%, HOFP:2.2%) and Hong Kong (MOFP:6.9%, HOFP: 2.3%) (28,29). Previous studies have shown that non-inclusion of BMD leads to inaccurate estimation of fracture risk (30-32). Gadam et al. found 84% identical fracture risk prediction by FRAX with and without BMD in a multiethnic study sample (33). A similar study showed that the Canadian FRAX tool without BMD is a good predictor of estimating fracture risk among men and women (34). Similarly, Subasinghe et al. demonstrated that Sri Lankan FRAX without BMD input can be an alternative on the clinical ground when there is no access to DXA facility (35). However, to date, there is a range of 76% to 90% agreement between FRAX score estimation with and without BMD (36). Therefore, we estimated the fracture risk probability without BMD, owing to the lack of accessibility to the DXA facility.

Notably, there was a significant negative association between BMI and FRAX-based 10-year fracture probability. Similar to this study, previous studies have shown that there is a nonlinear relationship between BMI and FRAX-based fracture probability and that BMI<18.5 kg/m^2 might be a risk factor for fragility fractures (37-38). The present study shows a statistically significant correlation between menopause and FRAX-based fracture probability. The increased rate of bone resorption after menopause indicates a hormonal influence on bone density in women, probably due to the drop in ovarian estrogen production (39). Moreover, this study shows a statistically significant association between menopausal duration and FRAX-based 10-year MOFP estimated without consideration of BMD. Similar to our results, Demir et al. stated

that osteoporosis is related to the duration of menopause at the time of BMD measurement rather than the age at menopause among postmenopausal women (40). Further, Keramat et al. showed that a postmenopausal period of more than five years is a risk factor for osteoporosis (41). However, this study does not show a statistically significant association between hormone replacement therapy and FRAX-based osteoporotic risk probability. This is likely due to most of the study participants not using hormone replacement therapy (95.5%, *n*=191).

Even though treatment thresholds for osteoporosis based on FRAX were MOFP of ≥20% or HOFP of ≥3%, this study noted that almost all the study subjects have low FRAX-based 10-year MOFP and HOFP (42). This is likely due to the effect of education on lifestyle, healthcare, personal hygiene, nutrition, and economic status.

One limitation of this study was that it was conducted in a single healthcare institution. Therefore, the extrapolation of the results to the entire Sri Lankan nursing community should be performed with caution. Since there is no electronic medical record system in Sri Lanka, we had to rely on the information provided by the study subjects about clinical risk factors to calculate FRAX. However, we verified the information from their health records. Another limitation is that we assessed the 10-year osteoporotic fracture probability without BMD values. Therefore, we encourage future studies including randomized control trials to include multiple healthcare institutions and BMD values to confirm our observations.

Conclusion

This study provides data on FRAX-based 10-year MOFP and HOFP among nurses aged 40 years and above in a tertiary care hospital in Sri Lanka. It showed a statistically significant association between BMI and FRAX-based 10-year HOFP estimated without consideration of BMD. Furthermore, a statistically significant association was observed between menopausal duration and FRAX-based 10-year MOFP estimated without consideration of BMD. However, this study did not show an association between hormone replacement therapy and FRAX-based osteoporotic fracture probability among nurses. After the calculations with the FRAX algorithm without consideration of BMD, MOFP and HOFP among Sri Lankan nurses aged 40 years and above are low and are below the FRAX-based treatment thresholds. Moreover, this study may add substantial value to identifying those with a high risk of osteoporotic fractures in medical facilities where DXA facilities are not available.

Conflicts of Interest

The author has no conflict of interest to disclose

References

1. U.S. Department of Health and Human Services. Bone health and osteoporosis: A report of the Surgeon General. Rockville MD, U.S. Department of Health and Human Services, Office of the Surgeon General; 2004.

2. Sözen T, Özışık L, Başaran NÇ. An overview and management of osteoporosis. Eur J Rheumatol. 2017;4(1):46-56.

3. Ray NF, Chan JK, Thamer M, Melton LJ 3rd. Medical expenditures for the treatment of osteoporotic fractures in the United States in 1995: report from the National Osteoporosis Foundation. J Bone Miner Res. 1997;12(1):24-35.

4. Lippuner K, Golder M, Greiner R. Epidemiology and direct medical costs of osteoporotic fractures in men and women in Switzerland. Osteoporos Int. 2005;16(Suppl 2):S8-S17.

5. Maravic M, Bihan CL, Landais P, Fardellone P. Incidence and cost of osteoporotic fractures in France during 2001. A methodological approach by the national hospital database. Osteoporos Int. 2005;16(12):1475-80.

6. Action Plan Osteoporosis: Consensus Statement of an Expert Group, Osteoporosis Society of India, New Delhi; 2003.

7. Gardner MJ, Brophy RH, Demetrakopoulos D, Koob J, Hong R, Rana A, Lin JT, Lane JM. Interventions to improve osteoporosis treatment following hip fracture. A prospective, randomized trial. J Bone Joint Surg Am. 2005;87:3-7.

8. Bahl S, Coates PS, Greenspan SL. The management of osteoporosis following hip fracture: have we improved our care? Osteoporos Int. 2003;14:884-8.

9. Kanis JA, Johnell O, Oden A, Johansson H, McCloskey E. FRAX and the assessment of fracture probability in men and women from the UK. Osteoporos Int. 2008;19:385-97.

10. Kanis JA, Oden A, Johnell O, et al. The use of clinical risk factors enhances the performance of BMD in the prediction of hip and osteoporotic fractures in men and women. Osteoporos Int. 2007;18:1033-46.

11. Kanis JA, Oden A, Johansson H, Borgstrom F, Strom O, McCloskey E. FRAX and its applications to clinical practice. Bone. 2009;44(5):734-43.

12. Sornay-Rendu E, Munoz F, Delmas PD, Chapurlat RD. The FRAX tool in French women: how well does it describe the real incidence of fracture in the OFELY cohort? J Bone Miner Res. 2010;25(10):2101-7.

13. Gonzalez-Macias J, Marin F, Vila J, Diez-Perez A. Probability of fractures predicted by FRAXs and observed incidence in the Spanish ECOSAP Study cohort. Bone. 2012;50(1):373-7.

14. Alquaiz AM, Kazi A, Tayel S, et al. Prevalence and factors associated with low bone mineral density in Saudi women: A community based survey. BMC Musculoskelet Disord. 2014;15(5).

15. Kanis JA, McCloskey EV, Johansson H, Oden A, Melton LJ, Khaltaev N. A reference standard for the description of osteoporosis. Bone. 2008;42:467-75.

16. Naves M, Díaz-López JB, Gómez C, Rodríguez-Rebollar A, Serrano-Arias M, Cannata-Andía JB. Prevalence of osteoporosis in men and determinants of changes in bone mass in a non-selected Spanish population. Osteoporos Int. 2005;16:603-9.

17. Williams JE, Wilson CM, Biassoni L, Suri R, Fewtrell MS. Dual energy x-ray absorptiometry and quantitative ultrasound are not interchangeable in diagnosing abnormal bones. Arch Dis Child. 2012;97:822-4.

18. Hashmi FR, Elfandi KO. Heel ultrasound scan in detecting osteoporosis in low trauma fracture patients. Orthop Rev. 2016;8:61-3.

19. Nayak S, Olkin I, Liu H, Grabe M, Gould MK, Allen IE. Annals of Internal Medicine Review Meta-Analysis?: Accuracy of Quantitative Ultrasound for Identifying Patients with Osteoporosis. Ann Intern Med. 2006;144:832-41.

20. Siribaddana SH, Kovas Y, Fernando DJS. Quantitative ultrasound of bone and calcium intake in suburban males in Sri Lanka. Int J Rheum Dis. 2008;11:407-13.

21. Chen IJ, Yu S, Wang TF, Cheng SP, Huang LH. Knowledge about osteoporosis and its related factors among public health nurses in Taiwan. Osteoporos Int. 2005;16:2124–28.

22. Berarducci A. Senior nursing students' knowledge of osteoporosis. Orthop Nurs. 2004;23:121-7.

23. Amre H, Safadi R, Jarrah S, Al-Amer R, Froelicher ES. Jordanian nursing students' knowledge of osteoporosis. Int J Nurs Pract. 2008;14:228-36.

24. Nguyen VH, Z. Wang Z.Osteoporosis knowledge of students in relevant academic programs. J Osteoporos. 2012;2012:1-4.

25. Vered I,Werner P, Shemy G, Stone O.Nurses' knowledge and perceptions about osteoporosis: a questionnaire survey. Int J Nurs Stud. 2008;45:847-54.

26. Zhang RF, Chandran M.Knowledge of osteoporosis and its related risk factors among nursing professionals. Singap Med J. 2011;52:158-62.

27. Lin LP, Lai WJ, Hsu SW, Lin JD.Early Osteoporosis risks and associated factors among caregivers working in disability institutions: IOF one-minute osteoporosis risk check. Int J Environ Res Public Health. 2020;17(9):3319.

28. Cheung E, Cheung CL, Kung AW, Tan KC. Possible FRAX-based intervention thresholds for a cohort of Chinese postmenopausal women. Osteoporos Int. 2014;25(3):1017-23.

29. Li YM, Liu SH. Estimation of the 10-year probability of osteoporotic fracture in postmenopausal Taiwanese women with FRAX@. Tzu Chi Med J. 2010;22:29-35.

30. Azagra R, Roca G, Encabo G, et al. FRAX® tool, the WHO algorithm to predict osteoporotic fractures: The first analysis of its discriminative and predictive ability in the Spanish FRIDEX cohort. BMC Musculoskelet Disord. 2012;13:204.

31. Egsmose EL, Birkvig M, Buhl T, Madsen OR. FRAX fracture risk in women with a recent fracture of the distal forearm: Agreement between assessments with and without bone mineral density and impact of measurement side in the individual patient. Clin Rheumatol. 2015;34:1265-72.

32. Klop C, Vries FD, Bijlsma JWJ, Leufkens HGM, Welsing PMJ. Predicting the 10-year risk of hip and major osteoporotic fracture in rheumatoid arthritis and in the general population: An independent validation and update of UK FRAX without bone mineral density. Ann Rheum Dis. 2016;75:2095-100.

33. Gadam RK, Schlauch K, Izuora KE. Frax Prediction without BMD for Assessment of Osteoporotic Fracture Risk. Endocr Pract. 2013;19:780-4.

34. Fraser LA, Langsetmo L, Berger C, et al. Fracture prediction and calibration of a Canadian FRAX® tool: A population based report from CaMos. Osteoporos Int. 2011; 22:829-37.

35. Subasinghe HWAS,Lekamwasam S,Ball P,Morrissey H,Waidyaratne ET. Performance of Sri Lankan FRAX algorithm without bone mineral density and with quantitative ultrasound data input. Ceylon Med J. 2019;64(1):17-24.

36. Sarikaya NO, Yavasi SK, Tan G, et al. Agreement between FRAX scores calculated with and without bone mineral density in women with osteopenia in Turkey. Clin Rheumatol. 2014;33:1785-9.

37. Gao G, Zhang ZL, Zhang H, et al. Hip axis length changes in 10,554 males and females and the association with femoral neck fracture. J Clin Densitom. 2008;11(3):360-6.

38. Armstrong ME, Spencer EA, Cairns BJ, et al. Body mass index and physical activity in relation to the incidence of hip fracture in postmenopausal women. J Bone Miner Res. 2011;26(6):1330-8.

39. Suhas A, Satyavaishnavi T, Sana T, Zansi K, Sushma K, AdityaS. Postmenopausal osteoporosis- an updated review. Int J Pharm Sci Res. 2012;3(2):320-28.

40. Demir B, Haberal A, Geyik P, Baskan B, Ozturkoglu E, Karacay O, Deveci S. Identification of the risk factors for osteoporosis among postmenopausal women. Maturitas. 2008; 60(3):253-56.

41. Keramat A, Patwardhan B, Larijani B, Chopra A, Mithal A, Chakravarty D, Adibi H, Khosravi A. The assessment of osteoporosis risk factors in Iranian women compared with Indian women. BMC Musculoskelet Disord. 2008;9:28.

42. Dawson-Hughes B, Tosteson AN, Melton LJ 3rd, Baim S,Favus MJ, Khosla S, Lindsay RL. National Osteoporosis Foundation Guide Committee. Implications of absolute fracture risk assessment for osteoporosis practice guidelines in the USA. Osteoporos Int. 2008;19:449-58.

Original Research Article

A retrospective examination of the management of pediatric blunt spleen and liver injuries

Adriana Dekirmendjian BHSc, MD[1,2], [1]Henrietta Blinder MSc[1], Bethany Easterbrook MSc, PhD[1], Karen Bailey MD, FRCSC[1,3,4]

[1]McMaster Pediatric Surgery Research Collaborative, Department of Surgery, McMaster University, Hamilton, Ontario, Canada.
[2]University of Toronto Faculty of Medicine, University of Toronto, Toronto, Canada
[3]Division of Pediatric Surgery, Department of Surgery, McMaster Children's Hospital, Hamilton Ontario, Canada.
[4]MacTrauma Research Group, Department of Surgery, Hamilton Health Sciences, Hamilton, Ontario, Canada.

Abstract

Introduction: The American Pediatric Surgical Association (APSA) has published validated guidelines regarding non-operative management of pediatric blunt spleen and liver injuries (BSLI) based on injury grade. Although these guidelines exist, few studies have examined guideline implementation and adherence in a clinical setting. This study sought to examine current clinical treatment of BSLI and assess practitioner adherence to guidelines at a single pediatric tertiary care center.
Methods: A retrospective review was performed of all pediatric patients (<18 years) in the local Trauma Registry who received non-operative management of BSLI between January 1st, 2004 and November 31st, 2014. Collected data included demographic information, guideline compliance and radiology grade reporting. Statistical analyses with chi square tests were conducted to assess differences between spleen/liver injuries and organ injury grades.
Results: Sixty-five (92%) abstracted cases were analyzed. Guideline compliance for intensive care unit (ICU) admission, length of hospitalization, pre-/post-discharge imaging, and physical activity restriction were 29%, 21%, 75%, 75%, and 40%, respectively. Radiologists reported injury grades in 22% of spleen cases and 15% of liver cases (p=0.46). Additionally, 8% of spleen and 33% of liver injuries (p=0.01) did not have a reported grade of organ injury.
Discussion: At this center, a substantial number of BSLI cases had no reported grade, and APSA guideline adherence was low for ICU admission, activity restriction, and length of hospitalization. In order to emphasize the importance of guideline compliance, future directions include the creation of clinician and patient educational handouts to increase adherence rates.

Keywords: Non-operative injury; guidelines; pediatric; blunt; spleen; liver

Corresponding Author: Dr. Karen Bailey, 1200 Main Street West, Room 4E4, Hamilton, Ontario, L8N 3Z5
Phone: 905-521-2100 ext. 73550, Fax: 905-521-9992, Email: kbailey@mcmaster.ca

Introduction

Traumatic injuries account for an estimated 500,000 hospitalizations and 20,000 paediatric deaths annually (1). Within this category, abdominal injuries are frequently cited as the second most common cause of trauma-related death and are reportedly found in 10-15% of pediatric trauma patients (2,3). More specifically, amongst all cases of traumatic paediatric abdominal injuries, approximately 30% involve blunt spleen and liver injuries (4). Within the pediatric population, non-operative management of blunt spleen and liver injuries (BSLI) is the standard method of treatment for hemodynamically stable patients. This method has been associated with reduced hospital costs, earlier discharge, and improved mortality rates (5,6). Non-operative management is dictated by various protocols, such as the American Pediatric Surgical Association (APSA) evidence-based guidelines, the abbreviated APSA protocol, and the Arizona Texas Oklahoma Memphis Arkansas Consortium (ATOMAC) Protocol (7-9).

Currently, the majority of paediatric centers utilize the APSA protocol, which was published by Dr. Stylianos and the APSA Trauma Committee in 2000 based on evidence from a retrospective review of 856 children (8). These guidelines recommend the appropriate length of hospital stay, intensive care unit (ICU) admission, pre-discharge imaging, post-discharge imaging, and interval of physical activity restriction based on the computerized tomography (CT) determined grade of the injury (7). Adherence to these guidelines is integral to treatment success, as they have been shown to improve resource utilization, increase conformity of treatment, and safely and effectively treat patients (7,8,10,11). This protocol was prospectively validated by Stylianos and the APSA Liver/Spleen Trauma study group in 2002 and again in 2004 by Leinwand et al. (10,11). In comparison to historical controls, these prospective studies reported a significant reduction in ICU stay, length of hospital stay, follow up imaging, and interval of activity restriction. In both studies, no patients required operation for BSLI, providing further evidence of the effectiveness of these guidelines (10,11). Despite the demonstrated safety and efficacy of the APSA guidelines for non-operative management of BSLI, few studies have sought to examine compliance and clinician adherence to these guidelines (7,8,10,11). Furthermore, the implementation of such guidelines, as well as their documentation, can prove to be challenging, as many sites do not adequately report such data. Additionally, certain components lack standardization, such as the restriction of activity, which requires patient self-reporting (12). Lastly, it is not always possible to adhere to strict criteria on the basis of clinical judgement (13). The aim of this study was to examine current clinical practice at a single tertiary healthcare center in the treatment of BSLI, and to assess local compliance and practitioner adherence to the standardized APSA guidelines over the last ten years.

Methods

Following ethics approval by the local Research Ethics Board (REB Approval #14-890-C), a retrospective chart review was performed. De-identified medical records of patients at a single

paediatric tertiary healthcare center in Southern Ontario were obtained through the Institutional Trauma Registry. Patient records were included for analysis if the patient was <18 years of age, had been treated between January 1st, 2004 and November 31st, 2014, and had received non-operative management for a blunt spleen and/or liver injury. This timeframe was chosen as it was believed to be representative of the time at which the APSA guidelines were implemented locally. Records were excluded if patients had sustained a grade V injury, or were treated for penetrating, rather than blunt, spleen and/or liver injuries, as treatment of such injuries is outside the scope of the APSA guidelines. Hospital admissions data were collected from patient records and included patient demographics, Injury Severity Score (ISS), admission hemoglobin levels, mechanism of injury, grade of organ injury and by whom it was determined (e.g., physician, radiologist, other), method of diagnosis (e.g., operation, ultrasound, CT), transfusion status, additional injuries, and outcome (e.g., death, hospital readmission).

Guideline adherence was assessed using the guidelines established by the APSA Trauma Committee in 2000, which focus on the following primary outcomes: ICU admission, length of hospitalization, pre-discharge imaging, post-discharge imaging, and activity restrictions (Table 1). These guidelines are based on the CT-determined grade of organ injury and exclude recommendations for patients with grade V injuries, as they are rare and require treatment beyond the scope of the guidelines. The guidelines suggest that length of hospitalization (in days) should be determined by the grade of organ injury plus one, and only patients with a grade IV injury should be admitted to the ICU for one day of observation. The guidelines also propose that physical activity restriction (in weeks) is to be determined by the grade of injury plus two, and that pre-discharge, as well as post-discharge, imaging should not be routinely ordered for any grade of injury (7). Overall compliance to the guidelines was assessed by analyzing cases for ICU admission, length of hospitalization, pre-/post- discharge imaging and activity restrictions, and by comparing the values to those recommended by the APSA guidelines. Each medical record was examined by a single reviewer and assigned a categorical value of 1= adherent vs. 0=non-adherent for each domain outlined by the guidelines. In the event of uncertainty regarding adherence, a second independent reviewer was consulted. Based on the data and the retrospective nature of the study, blinding to the outcome of interest was not possible.

Data were collected and recorded using secure, encrypted Research Electronic Data Capture (REDCap) online data collection forms. Statistical analyses were performed using IBM SPSS V21.0 software. Descriptive statistics were calculated to estimate overall adherence to guidelines. Chi square tests were conducted to assess for subgroup differences in reporting and guideline compliance between grades (I-IV) and organ of injury (spleen vs. liver), with a cut-off of $p<0.05$ considered significant.

Table 1. APSA evidence-based guidelines

	CT Grade*			
	I	II	III	IV
ICU Stay (days)	NR	NR	NR	I
Hospital Stay (days)	2	3	4	5
Pre-discharge imaging	NR	NR	NR	NR
Post-discharge imaging	NR	NR	NR	NR
Activity restriction (weeks)	3	4	5	6

*Grade of solid organ injury based on AAST organ injury scale; NR, not required

Results

Of the 71 patient records obtained from the Trauma Registry, 65 cases were included in the final analysis (Table 2). Six cases were excluded; two cases involved penetrating injuries, two cases were not treated for BSLI (wrongfully included), and two cases were unavailable for data abstraction.

Grade IV injuries (n=29) were found to be most prevalent, comprising 45% of all included cases. Organ injuries were diagnosed almost exclusively by CT scan (n=63); only two patients were diagnosed by ultrasound or operation. Ten (15%) patients developed complications (Table 3) during their initial treatment and eight (12%) patients were readmitted to the hospital following discharge, the majority of which were treated for grade IV injuries (n=5). Only one (1.5%) patient died while receiving treatment at this institution due to uncontrolled bleeding during exploratory surgery. No patients required surgery to treat BSLI injuries; therefore, no deviation from non-operative management occurred.

Although 52 (80%) cases were given a grade of I-IV, 13 (20%) cases had no reported organ injury grade. Of the cases that were given a grade, grading of injuries was reported by attending physicians, radiologists, or was indicated in the Trauma Registry and thus denoted as “other” (Figure 1a and 1b). For both spleen and liver injuries, attending physicians reported the largest proportion of grades, 50% and 52%, respectively (p=1.00). In comparison, radiologists graded only 22% and 15% of spleen and liver injuries, respectively (p=0.46). The proportion of cases with no reported grade was significantly larger for liver injuries (33%) in comparison to splenic injuries (8%) (p=0.01).

Table 2. Patient demographics

	Grade I n=3(%)	**Grade II n=10(%)**	**Grade III n=10(%)**	**Grade IV n=29(%)**	**Not Reported n=13(%)**
Age (mean years ± SD)	12.3±5.5	10.5±5.2	10.4±3.9	11.3±4.1	12.2±3.1
Sex					
Male	2 (67%)	6 (60%)	5 (50%)	22 (76%)	6 (46%)
Female	1 (33%)	4 (40%)	5 (50%)	7 (24%)	7 (54%)
ISS 90 (mean ± SD)	13.0±0	18.0±5.9	19.0±10.6	19.7±6.0	19.8±9.6
Length of Hospitalization (days) (median)	1.0 (1-5)	4.5 (2-16)	5.0 (3-49)	6.0 (2-67)	4.0 (1-18)
Method of Diagnosis					
CT	3 (100%)	9 (90%)	10 (100%)	29 (100%)	12 (92%)
Ultrasound	-	1 (10%)	-	-	-
Operative	-	-	-	-	1 (8%)
Mechanism of Injury					
MVC	3 (100%)	4 (40%)	3 (30%)	6 (20%)	8 (62%)
Pedestrian Accident	-	1 (10%)	1 (10%)	4 (15%)	2 (15%)
Fall	-	1 (10%)	2 (20%)	6 (20%)	2 (15%)
Bicycle Accident	-	2 (20%)	1 (10%)	8 (28%)	-
Other	-	2 (20%)	3 (30%)	5 (17%)	1 (8%)
Transfused	-	1 (10%)	2 (20%)	5 (17%)	3 (23%)
Hospital Readmission	1 (33%)	-	1 (10%)	5 (17%)	1 (8%)
Death	-	-	-	-	1 (8%)

Table 3. Patient complications

Complication	Organ Injured	Grade of Injury	Length of Hospitalization (days)
Left lower effusion	Spleen	4	8
Nosocomial pneumonia	Liver	4	6
Left pleural effusion	Spleen	4	8
Prolonged ileus	Spleen	3	11
Paralytic ileus, right hepatic artery aneurysm requiring embolization, right antecubital thrombophlebitis, SIADH	Liver	4	21
Urinary tract infection	Liver	Not Reported	5
Left pleural effusion	Spleen	4	7
Hepatic artery pseudo aneurysm rupture; pleural effusion, nosocomial bacterial infection, abdominal infection	Liver	4	67
Extensive bleeding during abdominal surgery	Liver	Not Reported	1*
Bacterial infection due to multiple exposed wounds	Liver	3	49

* Patient died during surgery

Forty-four (68%) cases were treated for additional injuries in conjunction with BSLI, with 32 (63%) cases given a documented organ injury grade (Table 4). Median length of hospitalization increased as the grade of injury increased; grade I, II, III and IV injuries had a median length of hospitalization of 1.0 (1-5), 4.5 (2-16), 5 (3-49) and 6 (2-67) days, respectively. The longest hospital stay was 67 days and involved a grade IV isolated liver injury.

Table 4. Additional injuries and length of hospitalization by grade of organ

Grade of Organ Injury	Median Length of Stay (days) (range)	APSA Guidelines Length of Stay (days)	Additional Injuries
Grade I (n=3)	1.0 (1-5)	2.0	3 (100%)
Grade II (n=10)	4.5 (2-16)	3.0	10 (100%)
Grade III (n=10)	5.0 (3-49)	4.0	8 (80%)
Grade IV (n=29)	6.0 (2-67)	5.0	11 (38%)

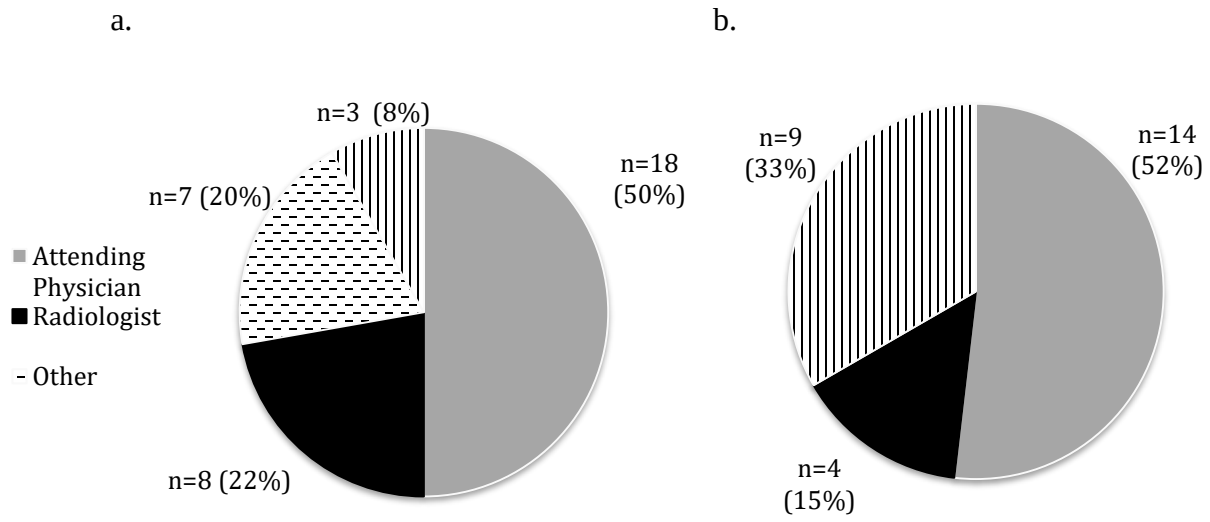

Figure 1. Breakdown of reporting of grade by specialty. a) Spleen injuries; b) Liver injuries

Only cases with a reported grade (n=52) were analyzed for compliance. Overall ICU compliance was 29%, length of hospital stay compliance was 21%, pre-discharge imaging compliance was 75%, post-discharge imaging compliance was 75%, and activity restriction compliance was 40% (Table 5). APSA guideline compliance was further assessed through stratification of cases by organ injury (Table 5). Chi square tests were conducted in order to assess statistically significant differences in compliance between spleen and liver injuries, and between grades. Although non-significant, a substantial difference in length of hospital stay guideline compliance between spleen and liver injuries was noted (30% vs. 6%, p=0.072).

Discussion

The APSA guidelines published in 2000 were initially adopted by many centers as the standard protocol for non-operative management of BSLI (2,7,11). These guidelines were validated and proven to be safe and effective in reducing hospital resource utilization and standardizing non-operative management of hemodynamically stable BSLI patients (2,6,8,10). However, few studies have assessed clinician compliance and adherence to the validated APSA guidelines (6,10,11). We therefore sought to retrospectively examine clinical practice and adherence to the guidelines at our institution over a ten-year period.

These guidelines recommend length of hospitalization, activity restriction, ICU admission, and pre-discharge, as well as post-discharge, imaging based on CT determined grades.(7,11) As a result, radiologists are the suggested professionals for reporting organ injury grades. Our results suggest that there may be a lack of formal reporting by radiologists at this center, with attending professionals reporting the majority of organ injury grades for both spleen

Table 5. Compliance with APSA guidelines

	Percent Compliance (%)				
	ICU	Length of Hospitalization	Pre-discharge Imaging	Post-discharge Imaging	Activity Restrictions
Overall Compliance (n=52)	29 (15)	21 (11)	75 (39)	39 (75%)	21 (40%)
Spleen (n=33)	27 (9)	30 (10)	78 (26)	25 (75%)	14 (42%)
Liver (n= 18)	28 (5)	6 (1)	50 (12)	13 (72%)	7 (39%)
Liver & Spleen (n=1)	100 (1)	0	100 (1)	100 (1)	0

and liver injuries. Furthermore, a substantial proportion of cases in this study population did not have a reported grade of organ injury. The disparity in reporting of grades is concerning, as previously conducted studies suggest that the grading of splenic and liver injuries is crucial for effective non-operative management and is most accurate when reported by radiologists using standardized scales (7,10,11,14).

Homann et al. found that increased use of the validated American Association for the Surgery of Trauma's (AAST) organ injury scale by radiologists was correlated with an increase in precision and ability to properly diagnose the severity of BSLI (14). Proper diagnosis of injury grade has substantial implications for non-operative treatment, as recommendations for management differ by grade of injury. It is possible that this lack of radiologist involvement at our site is due to a lack of promotion of the APSA guidelines, as management of BSLI has long been delegated to the domain of the surgeons, and there are few studies examining the guidelines at Canadian centers (15).

Length of hospitalization at this institution consistently exceeded the recommended length of stay according to APSA guidelines for grade II-IV injuries, which was exemplified by the subsequent low compliance rate. Compliance with ICU admission guidelines was also low, demonstrating that many individuals were either admitted to the ICU without indication or exceeded the recommended length of ICU stay. Unnecessitated ICU admission and length of hospitalization, as dictated by APSA guidelines, results in an over-expenditure of hospital resources. It must be noted, however, that the APSA guidelines dictate management of isolated spleen and liver injuries. In order to increase generalizability of results, this study also included multiply injured individuals. Inclusion of all cases treated for BSLI may be responsible for the observed increased median length of hospital stay.

Similar to previous studies examining guideline compliance, our findings demonstrated that compliance was highest for pre-discharge and post-discharge imaging guidelines. Stylianos et al. found that practitioners were most compliant with guidelines for follow-up imaging (87%) (11). Literature suggests that follow-up imaging is unnecessary and costly for patients undergoing non-operative management of BSLI (16). Contrastingly, compliance with proposed intervals for activity restriction was considerably lower in comparison to previous studies. In their prospective examination, Stylianos et al. found that 78% of cases were managed in compliance with proposed activity restriction, and compliance was higher for less severe injuries (87% for grades I and II vs. 72% in grades III and IV) (11). Our study found that less than half of all cases were compliant with proposed intervals of activity restriction, and compliance rates were similar between spleen and liver injuries. Low compliance with the proposed interval of activity restriction may be due to the guidelines themselves. The APSA guidelines state that the proposed interval of activity restriction is for return to unrestricted "normal" age-appropriate activities, but that return to full-contact activities is left to the discretion of the individual pediatric trauma surgeon (7,11). A lack of consensus around what comprises "normal" age-appropriate activities may lead to confusion regarding how long a child must wait to return to activities and may contribute to the low rate of guideline compliance. Assessing activity restriction compliance is also challenging, as many physicians fail to state the prescribed interval of activity restriction at discharge, and, when they do, few explicitly state which activities the patient must abstain from.

Although the APSA guidelines have served as the standard for non-operative management at many institutions since their initial publication, less "conservative" recommendations, such as the abbreviated bedrest protocol and the ATOMAC guidelines, are gaining increasing attention and implementation (2,8,9). The recently validated ATOMAC guidelines dictate treatment based upon hemodynamic stability rather than organ injury grade. These guidelines have been proposed in order to further standardize care and improve resource utilization, as the benchmarks set by the APSA guidelines were rarely met in many clinical settings (9). Our findings support this assertion, as compliance with guidelines for hospital stay, activity restriction, and ICU admission remained low. Prior to adopting a new protocol, we felt it necessary to assess current practice and compliance with institutional guidelines in order to identify disparities in clinical practice. Implementation of the ATOMAC protocol at our institution may be warranted; however, education with regards to the practice management pathway is crucial in order to adhere to this newly proposed guideline for non-operative management of pediatric BSLI patients.

There are several important limitations of this study, including its retrospective nature and small sample size. Our analysis was also limited by missing data, particularly for reported grade. Since a substantial proportion of cases had no reported grade in the medical charts or the Trauma Registry, compliance to guidelines could not be measured for all included cases; this may have introduced selection bias if reporting was associated with grade of organ injury. In addition, this study's small sample size resulted in low power to detect differences, which may have resulted in missed differences across organs and injury grades. Despite these limitations, literature is sparse

on this topic, so these findings provide valuable insight into current clinical treatment of paediatric BSLI and local APSA guideline compliance.

Conclusion

The findings of this study have provided valuable insight regarding compliance rates and the grading of organ injuries at this institution. These findings suggest that the reporting of organ injury grades by radiologists is lacking and compliance with interval of activity restriction, ICU admission, and length of hospital stay remains low. In order to improve compliance and the ability to assess practitioner adherence to APSA guidelines, there must be an increased reporting of grades. We suggest that a standard organ injury scale be adopted and that grade of BSLI be documented consistently in CT reports.

The findings of this study also indicate the need for increased compliance with proposed interval of activity restriction and consensus on what be recommended as “normal age-appropriate activities.” Subsequently, patient handouts, which specify the details of activity restriction duration, as well as what activities to avoid, should be distributed to increase patient compliance. A future prospective study is warranted to ensure standardized radiology reporting and adherence to clinical practice guidelines to enhance the quality of patient care at this institution.

References

1. Sivit CJ. Imaging children with abdominal trauma. AJR Am J Roentgenol. 2009;192(5):1179-1189.

2. Dodgion CM, Gosain A, Rogers A, St Peter SD, Nichol PF, Ostlie DJ. National trends in pediatric blunt spleen and liver injury management and potential benefits of an abbreviated bed rest protocol. J Pediatr Surg. 2014;49(6):1004-1008; discussion 1008.

3. Ludwig S. Pediatric abdominal trauma. Topics in Emergency Medicine. 1993;15(2):40-47.

4. Coburn MC, Pfeifer J, DeLuca FG. Nonoperative management of splenic and hepatic trauma in the multiply injured pediatric and adolescent patient. Arch Surg. 1995;130(3):332-338.

5. Stassen NA, Bhullar I, Cheng JD, et al. Selective nonoperative management of blunt splenic injury: an Eastern Association for the Surgery of Trauma practice management guideline. J Trauma Acute Care Surg. 2012;73(5 Suppl 4):S294-300.

6. Stylianos S. Outcomes from pediatric solid organ injury: role of standardized care guidelines. Curr Opin Pediatr. 2005;17(3):402-406.

7. Stylianos S. Evidence-based guidelines for resource utilization in children with isolated spleen or liver injury. The APSA Trauma Committee. J Pediatr Surg. 2000;35(2):164-167; discussion 167-169.

8. St Peter SD, Sharp SW, Snyder CL, et al. Prospective validation of an abbreviated bedrest protocol in the management of blunt spleen and liver injury in children. J Pediatr Surg. 2011;46(1):173-177.

9. Notrica DM, Eubanks JW, 3rd, Tuggle DW, et al. Nonoperative management of blunt liver and spleen injury in children: Evaluation of the ATOMAC guideline using GRADE. J Trauma Acute Care Surg. 2015;79(4):683-693.

10. Leinwand MJ, Atkinson CC, Mooney DP. Application of the APSA evidence-based guidelines for isolated liver or spleen injuries: a single institution experience. J Pediatr Surg. 2004;39(3):487-490; discussion 487-490.

11. Stylianos S. Compliance with evidence-based guidelines in children with isolated spleen or liver injury: a prospective study. J Pediatr Surg. 2002;37(3):453-456.

12. Notrica DM, Sayrs LW, Krishna N, et al. Adherence to APSA activity restriction guidelines and 60-day clinical outcomes for pediatric blunt liver and splenic injuries (BLSI). J Pediatr Surg. 2019;54(2):335-339.

13. Linnaus ME, Langlais CS, Garcia NM, et al. Failure of nonoperative management of pediatric blunt liver and spleen injuries: A prospective Arizona-Texas-Oklahoma-Memphis-Arkansas Consortium study. J Trauma Acute Care Surg. 2017;82(4):672-679.

14. Homann G, Toschke C, Gassmann P, Vieth V. Accuracy of the AAST organ injury scale for CT evaluation of traumatic liver and spleen injuries. Chin J Traumatol. 2014;17(1):25-30.

15. Li D, Yanchar N. Management of pediatric blunt splenic injuries in Canada--practices and opinions. J Pediatr Surg. 2009;44(5):997-1004.

16. Thaemert BC, Cogbill TH, Lambert PJ. Nonoperative management of splenic injury: are follow-up computed tomographic scans of any value? J Trauma. 1997;43(5):748-751.

Original Research Article

Navigating pediatric undergraduate medical education: Curriculum mapping of problem-based learning and case-based learning in the pediatric curriculum

Devika Singh[1], Nina Mazze[2], Vicky Breakey[2]

[1]Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Canada
[2]McMaster Children's Hospital, McMaster University, Hamilton, Canada

Abstract

Background: The pre-clerkship curriculum at McMaster University uses problem-based learning (PBL) as the main teaching method and includes patients of all ages. However, informal data collected through surveys sent to McMaster medical students demonstrated that our students do not feel adequately prepared for their pediatric clerkship rotation. The purpose of this study was to map the McMaster pediatric pre-clerkship PBL curriculum and online Aquifer cases to the National Canuc-Paeds clinical presentations (https://www.pupdoc.ca/en/canuc-paeds/) to determine the comprehensiveness of our current pediatrics curriculum.
Methods: All 150 undergraduate problem-based learning cases were reviewed for pediatric content. In addition, the 32 pediatric Aquifer cases were reviewed to determine which Canuc-Paeds clinical presentations are addressed.
Results: Thirty-six out of 150 PBL cases included pediatric content, in which 15/29 of the required clinical presentations were covered, and many were addressed more than once. The majority of the objectives (25/29) were covered by at least one Aquifer case, while four objectives were not addressed by any case.
Conclusion: Mapping pre-clerkship PBL cases and Aquifer cases onto the Canuc-Paeds curriculum provides valuable insight into the pediatrics content in the pre-clerkship and clerkship curriculum and demonstrates areas where additional training is required. A similar methodology can also be used in other programs to evaluate their curriculum.

Keywords: Pediatrics; medical education; Aquifer; problem-based learning; McMaster

Corresponding author: breakev@mcmaster.ca

Introduction

Curriculum mapping is an established process in the literature and has been proven to efficiently manage the curriculum and help to fulfill academic requirements (1). This method of evaluating the curriculum is essential in reviewing, developing, and improving any curriculum (1). The method for mapping can include three steps: 1) a mapping template prefilled with standardized data; 2) a curriculum mapping system; and 3) a curriculum review process (1). The Royal College of Physicians and Surgeons of Canada's (RCPSC) program directors' handbook chapter on how to develop a meaningful curriculum map demonstrates the need for a continuously evolving curriculum map and mapping to national objectives (2). The handbook suggests that a curriculum map can be created for different aspects of the curriculum, including objectives, teaching methods, resources, assessment methods, and faculty development (2). Factors that can lead to successful curriculum mapping include support of the institution, sufficient time, leadership, and being user-friendly (3). A recent German initiative mapped an entire undergraduate medical curriculum to their national learning objectives, including roles of the physician, knowledge, skills, attitudes, and patient-centered care (4). They demonstrate the importance of rigorous curriculum mapping to national objectives and reporting of these results. While our medical school has a robust curriculum map, it was difficult to practically capture how pediatrics is covered in the pre-clerkship curriculum (5).

Problem-based learning (PBL) is a well-established teaching method in undergraduate medical education. Evidence has shown that pediatric-focused PBL is associated with increased problem-solving and clinical reasoning in medical students (6). In fact, pediatric-focused PBL has been shown to be more effective than traditional didactic learning and continues to be effective during clerkship years (7-8). Our local pre-clerkship learning is built on PBL and includes 150 cases, covered in tutorials over the first 15 pre-clinical months, and includes patients of all ages. There are no formal pediatrics learning objectives in the pre-clerkship clinical skills student handbook (9).

To supplement PBL learning, virtual case-based learning (CBL) can be used to help fulfill pediatric learning objectives (10). CBL has also been proven to be more effective than didactic learning by improving students' competence in knowledge and clinical skill acquisition (10). A series of 32 pediatric cases widely used across North America is available to medical students online to supplement the curriculum through Aquifer, a non-profit organization that develops clinical teaching and learning methods (https://aquifer.org/courses/aquifer-pediatrics).

Canada has a national pediatrics curriculum for undergraduate medical education, developed by the Paediatric Undergraduate and Clerkship Directors of Canada (PUPDOC). The "Canuc-Paeds" curriculum, updated in 2021, contains 29 clinical presentations, with their corresponding "Key Conditions" providing more detailed core conditions (11). The purpose of this study was to map the pre-clerkship PBL curriculum and the Aquifer cases to the national Canuc-Paeds curriculum to identify gaps that can be supplemented with additional teaching. Mapping the pediatric curriculum will help identify both the topic areas that are addressed and those that are currently lacking to allow for the introduction of new cases or the modification of existing cases

to address these gaps. This study can provide an approach to evaluating the undergraduate pediatric curriculum at many medical schools, along with valuable information on the Aquifer pediatric cases.

Methods

A manual pre-screen identified that 36/150 pre-clerkship PBL cases contained pediatric content. One key objective is typically provided to students for each case, with more detailed enabling objectives provided to tutors who facilitate the PBL sessions. These mandatory learning objectives were reviewed to identify pediatric-specific learning objectives. These were then mapped to the Canuc-Paeds clinical presentations by numbering them. Other aspects of the curriculum such as didactic lectures, clinical skills classes, and professional competencies sessions were not mapped, since our aim was to focus on PBL as this is the main teaching method at McMaster University. Each objective that was pediatric-focused was identified (i.e., cases with patients up to age 18), and, out of those objectives, the ones that mapped to a Canuc-Paeds clinical presentation were recorded.

The main topics for each of the 32 pediatric Aquifer cases were also identified based on the case stem provided to students. Each case was similarly assessed to determine which Canuc-Paeds clinical presentations were addressed. A summary table of each Canuc-Paeds clinical presentation created with the total number of cases, or lack thereof, was recorded.

Results

There were 15/29 Canuc-Paeds objectives included in the pre-clerkship PBL curriculum, which include a number of core pediatric topics, as listed in Table 1. The majority of the objectives (25/29) were covered by at least one Aquifer case (Table 1). There were four objectives that were not addressed by any Aquifer case, while many objectives were covered by the Aquifer curriculum more than once. The clinical presentation(s) that each Aquifer case addressed was also recorded (Table 2).

Discussion

The Canuc-Paeds clinical presentations outline fundamental learning objectives in pediatrics for Canadian undergraduate medical students. This study mapped the PBL learning objectives at McMaster University as well as the Aquifer CBL cases to this curriculum. While the main form of learning at McMaster University is through PBL, the cases only covered 15/29 of the Canuc-Paeds clinical presentations. As a result, in order to learn all of the clinical presentations by graduation, students would need to master the rest of the clinical presentations during clerkship. This is challenging, as there is great variability with regard to students' experience during their

Table 1. The number of PBL tutorial cases and Aquifer cases that covered each Canuc-Paeds clinical presentation

	Canuc-Paeds Clinical Presentation	Tutorial Cases	Aquifer Cases
1	Describe differences between the medical management of paediatric patients versus adult patients.	2	0
2	Recognize an acutely ill child.	0	4
3	Abdominal pain and abdominal mass	0	4
4	Adolescent Health Issues	7	3
5	Altered Level of Consciousness	0	2
6	Bruising / Bleeding	2	5
7	Dehydration	0	2
8	Development / Behavioural / Learning Problems	9	4
9	Diarrhea	0	0
10	Edema	1	1
11	Eye Issues	1	0
12	Fever	0	2
13	Genitourinary Complaints	3	2
14	Growth Problems	3	3
15	Headache	0	1
16	Inadequately explained injury	0	2
17	Limp / Extremity Pain	2	1
18	Lymphadenopathy	0	1
19	Mental Health Concerns	1	1
20	Murmur	0	2
21	Neonatal Jaundice	0	1
22	Newborn	4	3
23	Pallor / Anemia	1	2
24	Rash	0	5
25	Respiratory distress / Cough	2	4
26	Seizure / Paroxysmal event	2	1
27	Sore Ear	0	1
28	Sore Throat / Sore Mouth	0	0
29	Vomiting	1	1

Table 2: Pediatric Aquifer cases and the corresponding Canuc-Paeds clinical presentation numbers (corresponds to Table 1).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Newborn male infant evaluation and care																						x							
Infant female well-child visits (2, 6, and 9 months)			x					x						x															
3-year-old male well-child visit						x																	x	x					
8-year-old male well-child check								x						x															
16-year-old female health maintenance visit				x		x													x										
16-year-old male preparticipation evaluation				x																									
2-hour-old male newborn with respiratory distress																						x			x				
6-day-old female with jaundice																					x								
2-week-old female with lethargy																						x							
6-month-old female infant with a fever												x																	
4-year-old male with fever and adenopathy												x						x						x					
10-month-old female with a cough																									x				
6-year-old female with chronic cough																									x				
18-month-old female with congestion																											x		
Two siblings: 4-year-old male and 8-week-old male with vomiting							x																						x
7-year-old female with abdominal pain and vomiting							x																						
4-year-old female refusing to walk																	x												
2-week-old male with poor feeding																				x									
16-month-old male with first seizure		x													x									x		x			
7-year-old male with a headache															x														
6-year-old male with bruising			x			x										x								x					
16-year-old female with abdominal pain			x	x									x																
15-year-old female with lethargy and fever		x			x	x																							
2-year-old female with altered mental status		x			x																								
2-month-old male with apnea																x									x				
9-week-old male not gaining weight														x															
8-year-old female with abdominal pain			x			x																							
18-month-old male with developmental delay								x												x									
9-week-old male Infant with hypotonia								x																					
2-year-old male with sickle cell disease		x																					x						
5-year-old female with puffy eyes										x																			
5-year-old female with Rash																								x					

pediatric core rotations in terms of setting, patient population, preceptors, and additional informal learning experiences.

Furthermore, there is currently no available overview of undergraduate pediatrics learning objectives across all three years of training at our medical school. Our results provide valuable information that can be used to enhance the undergraduate pediatric curriculum in accordance with the Canuc-Paeds clinical presentations. Specifically, important clinical presentations that were not covered by any PBL case included core pediatric topics, such as neonatal jaundice, rash, fever, abdominal pain, and acute care topics such as altered level of consciousness and recognizing an acutely ill child. Additional PBL cases, resources, or objectives can be created to ensure that these clinical presentations are covered. Other schools that use PBL can also evaluate their pediatrics curriculum using similar methods to determine clinical presentations that are not currently taught and to develop new resources or learning materials for medical students. Additionally, schools who teach using traditional didactic approaches can also use a similar mapping process for their curriculum by applying the same concepts to their main form of teaching (i.e., lectures).

The current pediatrics clerkship curriculum focuses on clinical rotations, which may be inadequate to address all pediatric learning objectives, and learning around patient encounters rather than a fixed, case-based learning curriculum. Mapping the Aquifer online cases is helpful

in determining which of the Canuc-Paeds objectives are not covered and could use additional resources. Specifically, elements of our curriculum not covered by Aquifer included describing differences between the medical management of pediatric patients versus adult patients, diarrhea, eye issues, and sore throat/sore mouth. These gaps can be addressed with additional teaching in these areas in order to ensure students are learning these important clinical issues during their medical education.

Despite the practical benefits of curriculum mapping, there is little published to support the best approach. There is no pediatrics-specific literature that looks at mapping the pre-clerkship or clerkship curriculum to the Canuc-Paeds clinical presentations. However, one study extracted demographic data and chronic versus acute presentations from PBL cases (12). Another study used a similar methodology by analyzing Aquifer teaching cases with a 20-item case review spreadsheet, as opposed to national curriculum guidelines. They used this information to evaluate the effectiveness of Aquifer cases in addressing race and culture (13). Lastly, Sehgal et al. mapped the Aquifer Geriatric cases to the AAMC/JAHF Minimum Geriatrics Competencies for Medical Students to evaluate and determine which clerkship specialties each case can be used to supplement and found that Aquifer cases were an efficient way to teach geriatrics to medical students (14). While mapping of the undergraduate medical curriculum has been done using alternative methods, as demonstrated above, mapping the PBL and pediatric Aquifer cases to the Canuc-Paeds curriculum provides clear information on which clinical presentations need further teaching to provide a solid foundational pediatrics knowledge base for all McMaster medical students. Curriculum mapping can be used by other medical programs to evaluate their pediatrics curriculum and where core learning objectives are and are not being met to ensure optimization of pediatrics undergraduate medical education. This mapping can help to ensure that there is an improvement in students' pre-clerkship pediatrics exposure and optimize their knowledge and skill attainment during their clinical time in pediatrics.

Conclusion

Curriculum mapping helps educators to understand the current state of the curriculum and to see gaps. Mapping our pre-clerkship PBL and Aquifer cases to the national pediatric objectives in the Canuc-Paeds clinical presentations provided valuable insight into the current state of our pre-clerkship and clerkship curriculum and revealed areas where new cases need to be developed or where additional training is required to optimize content. These data can also be used when modifying the clerkship curriculum to ensure objectives that are not covered in pre-clerkship are covered in clerkship. This approach is applicable to other medical programs and specialties, including programs that use PBL and other teaching methods.

References

1. Al-Eyd G, Achike F, Agarwal M, Atamna H, Atapattu DN, Castro L, et al. Curriculum mapping as a tool to facilitate curriculum development: A new School of Medicine experience. BMC Med Educ [Internet]. 2018 Dec [cited 2021 Oct 19];18(1):185. Available from: https://bmcmededuc.biomedcentral.com/articles/10.1186/s12909-018-1289-9

2. Ladhani M, Writer, Hilary. Developing a meaningful curriculum map. In: The Royal College program directors handbook: A practical guide for leading an exceptional program.

3. Harden RM. AMEE Guide No. 21: Curriculum mapping: a tool for transparent and authentic teaching and learning. Med Teach [Internet]. 2001 Jan [cited 2021 Oct 19];23(2):123–37. Available from: http://www.tandfonline.com/doi/full/10.1080/01421590120036547

4. Gulbis K, Krüger T, Dittmar M, Peters H. Approaches to mapping an undergraduate medical curriculum to a national competency-based catalogue of learning outcomes. Med Teach [Internet]. 2021 Apr 3;43(4):439–47. Available from: https://doi.org/10.1080/0142159X.2020.1854704

5. MedPortal Curriculum Database. In: MedPortal [Internet]. Available from: https://cdb.medportal.ca/

6. Joseph N, Rai S, Madi D, Bhat K, Kotian SM, Kantharaju S. Problem-Based Learning as an Effective Learning Tool in Community Medicine: Initiative in a Private Medical College of a Developing Country. Indian J Community Med Off Publ Indian Assoc Prev Soc Med [Internet]. 2016;41(2):133–40. Available from: https://pubmed.ncbi.nlm.nih.gov/27051088

7. Ma Y, Lu X. The effectiveness of problem-based learning in pediatric medical education in China: A meta-analysis of randomized controlled trials. Medicine (Baltimore) [Internet]. 2019;98(2). Available from: https://journals.lww.com/md-journal/Fulltext/2019/01110/The_effectiveness_of_problem_based_learning_in.55.aspx

8. Curtis J, Indyk D, Taylor B. Successful Use of Problem-Based Learning in a Third-Year Pediatric Clerkship. Ambul Pediatr Off J Ambul Pediatr Assoc. 2001 May 1;1:132–5.

9. Profetto J, McCarthy J. McMaster Clinical Skills Guide, 5e. 5th ed. 2017. 315 p.

10. Chen J, Li Y, Tang Y, Zeng F, Wu X, Liang F-R. Case-based learning in education of Traditional Chinese Medicine: a systematic review. J Tradit Chin Med Chung Tsa Chih Ying Wen Pan Spons -China Assoc Tradit Chin Med Acad Tradit Chin Med. 2013 Oct 1;33:692–

7.

11. Bannister SL, Forbes KL, Moddemann DM, Lewis MA. From vision to implementation: Building a national undergraduate paediatric curriculum. Paediatr Child Health [Internet]. 2021 Sep 13 [cited 2021 Nov 9];pxab066. Available from: https://academic.oup.com/pch/advance-article/doi/10.1093/pch/pxab066/6369246

12. Finucane P, Nair B. Is there a problem with the problems in problem-based learning? Med Educ. 2002 Mar;36(3):279–81.

13. Krishnan A, Rabinowitz M, Ziminsky A, Scott SM, Chretien KC. Addressing Race, Culture, and Structural Inequality in Medical Education: A Guide for Revising Teaching Cases. Acad Med J Assoc Am Med Coll. 2019 Apr;94(4):550–5.

14. Sehgal M, Syed Q, Callahan KE, Powers BB, Eleazer GP, Gleason LL, et al. Introducing Aquifer Geriatrics, the American Geriatrics Society National Online Curriculum. J Am Geriatr Soc. 2019 Apr;67(4):811–7.

Original Research Article

Identifying gaps in chronic pain-centered medical education through an analysis of student perspectives

Myles Benayon[1], Lekhini Latchupatula[1], Shawnee Amar[2]

[1] Michael G. DeGroote School of Medicine, McMaster University
[2] Western University

Abstract

Chronic pain (CP) is one of the most common reasons for seeking medical care in Canada and the United States, yet the Canadian Pain Task Force reports there are still insufficiencies in health care pain curricula. Given that one in five Canadians suffer from CP and 40-80% of CP patients are misdiagnosed, a voluntary survey was conducted on McMaster undergraduate medical students to gain insight into how these students perceive CP-specific curricula and their confidence in managing CP patients. A total of 168 students completed the survey. Results demonstrated that, on average, participants had low confidence in their CP-related skills. Students generally supported additional education in this area through CP workshops (54%), pain-focused tutorial objectives (52%), and more CP-dedicated lecture time (51%). Given the results of this study, we recommend that additional CP-related lecture time, online teaching modules, and virtual workshops be incorporated into McMaster's undergraduate medical education to improve medical students' ability to confidently assess, diagnose, and manage CP patients.

Keywords: Chronic pain; curricula; UGME; McMaster; education

Corresponding author: myles.benayon@medportal.ca

Introduction

Chronic pain (CP) is one of the most common reasons for seeking professional health care in Canada and the United States, yet it remains frequently misdiagnosed and dismissed (1). CP is defined as pain lasting longer than six months, typically continuing long after the underlying source of the pain has healed (2). Approximately 20% of Canadians live with CP, with two-thirds of this population describing their pain as moderate to severe (1). Furthermore, 50% of Canadians with CP have experienced it for more than 10 years, posing a significant barrier to daily life (1). While CP affects individuals of all ages, races/ethnicities, and classes, there is increased risk and worsening severity in Indigenous peoples, women, and those living in poverty (1). In Canada, up to 38% of children and adolescents and 33% of adults 65 and older have CP (1). Experiencing CP at a young age may cause developmental delays and increase risk of substance abuse and psychological disorders. In such populations, individuals tend to suffer longer without proper diagnosis and treatment due to a lack of available resources (1).

CP often impacts the lives of a patient's friends and family by incurring extreme financial costs and placing strain on familial and social relationships (1). Additionally, CP can be a major source of psychological distress. Those with CP have an increased likelihood of experiencing anxiety, even when pain is not present or at its worst, and they are three times more likely to develop depression (3). Although the nature of the relationship between psychological distress, substance abuse, and CP is not fully understood, there is compelling evidence that psychiatric effects are strongly linked to CP. Psychological distress can exacerbate one's pain levels and impair the treatment and healing process (4).

At the Michael G. DeGroote School of Medicine, the McMaster Undergraduate Medical Education (UGME) program provides students with a three-year general medical education (5). In the preclinical phase, which takes place during the first 15 months of the program, students learn the fundamentals of medicine and patient care. Once a week during Professional Competencies sessions (three hours/week), they gather in small and large groups to discuss social and ethical issues of medicine. In Clinical Skills sessions (three hours/week), students learn to perform physical exams in small groups. In tutorials, students learn medical topics through small-group, case-based learning (six hours/week). Lastly, in large-group sessions (four hours/week), students further their knowledge of various medical topics via primarily didactic learning. In their preclinical phase, the Class of 2022 spent two three-hour tutorial sessions, one Clinical Skills session, and two large-group sessions focusing on CP throughout their 15 months in preclinical education, totaling approximately 21 hours of CP education. The approximate total hours of education during the 54 preclinical weeks is 864 (6).

The Canadian Pain Task Force reports the need for pain curricula implementation for pre-licensure and post-licensure health care professionals in a format that allows application of their CP education in real world situations (7). Additional research highlights that only one-third of prelicensure students in medicine, nursing, dentistry, occupational therapy, and physical therapy could identify the amount of time dedicated to learning CP-related content (8). Numerous students

expressed their desire for more CP-related curriculum resources (cases, modules, presentation content, and directories of experienced pain health professionals), emphasizing the need for improvement in prelicensure pain curricula across Canada (8).

The objectives of this study were (i) to identify how McMaster medical students, across all three years of training, perceive CP learning opportunities, and (ii) to determine students' confidence in managing CP patients. This study hopes to identify gaps in McMaster's chronic pain education in order to improve students' confidence in managing CP patients and ultimately benefit patient care.

Methods

A survey was created in Google Forms to collect primary data about CP education in the McMaster UGME program. A link to the survey was posted in Facebook groups which are accessible to all McMaster UGME students and are a primary means of advertising research projects. A link to the survey was also sent by email to UGME students who were personally known to the study authors. To be included in the survey, participants must have received the email sent to them or have access to the McMaster UGME Facebook groups, implying active enrollment. There are approximately 203 students in each year of study (9). Given that this study focused on current UGME students, participants were excluded if their self-declared anticipated graduation date was not in the Classes of 2021, 2022, or 2023, since students in other cohort years could still have had access to the Facebook groups. No students outside of these class years responded to the survey.

The survey consisted of 26 items pertaining to CP-related personal experiences, knowledge, confidence in management, education, and career goals (Appendix 1). Eleven items were multiple-choice, including one item which also included an "Other" free-text field where participants could type a response for suggestions to improve the CP curriculum. Thirteen items used a five-point Likert scale. Two items used a seven-point Likert scale to assess, with greater granularity, participants' confidence in various CP-related skills and knowledge of different CP pathologies. Five items were specific to clerks, who practice medicine under supervision and have direct experience with patients. In the McMaster UGME program, clerkship typically begins during the second year of study. Descriptive statistics for the survey data were reported.

Results

The survey was voluntarily completed by 168 McMaster UGME student participants between October 29th, 2020, and November 4th, 2020. The participant pool comprised of first-year (n=53, 26% of the class), second-year (n=62, 31% of the class), and third-year (n=53, 26% of the class) undergraduate medical students. Participants were representative of all three sites, with students from the Hamilton (n=111), Niagara Regional (n=23) and Waterloo Regional (n=34) campuses.

Over 6% of the participants identified as having been diagnosed with a form of CP. More than one-third (36%) reported having lived with someone who had CP, and more than half reported

knowing a family member or friend who currently or previously had CP. Furthermore, two-thirds (67%) of participants reported having encountered a CP patient, including all (100%) third-year medical students who completed the survey.

There was an average rating of 1.9 (on a five-point scale) for knowledge of CP prior to entering medical school. When asked to rate their knowledge of CP at the time of survey completion the average response was 2.9 (on a five-point scale) for all medical students across all three years, comprising of 3.1, 3.2 and 2.4, for third-year, second-year and first-year students, respectively (Figure 1).

On average, medical students reported low confidence in specific CP-related skills (Table 1). Among final-year medical students, the lowest rating was for confidence in pain diagnoses, an average of 2.7 (on a seven-point scale).

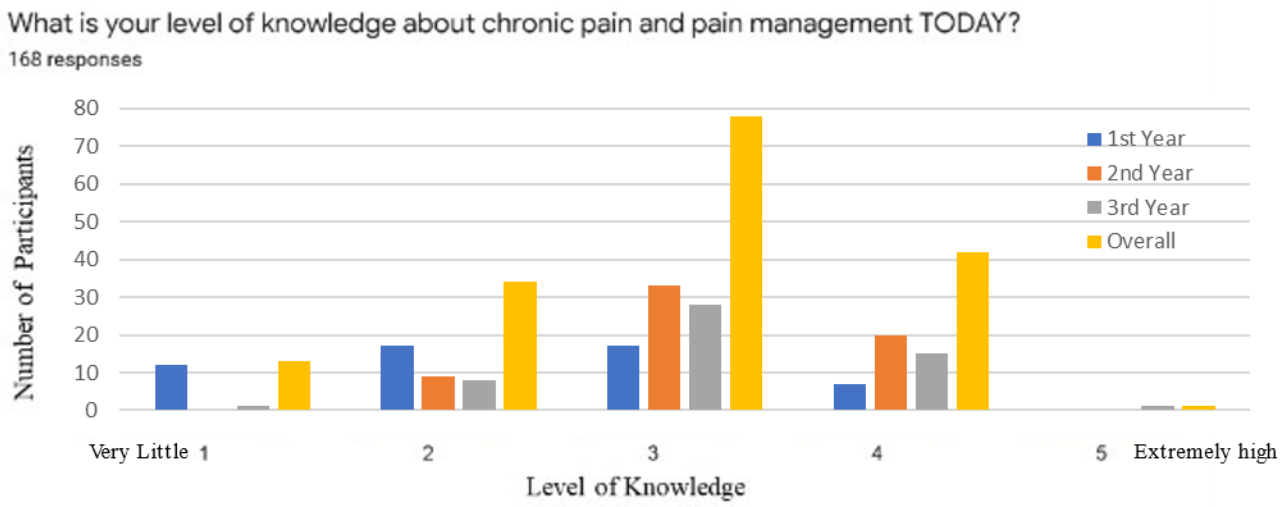

Figure 1: Survey results on level of knowledge about chronic pain and pain management at time of survey for each year of study and overall

Table 1. Average reported level of confidence in specific CP-related skills for each year of study and overall, on a seven-point scale

Skill	First Year	Second Year	Third Year	Overall
Pain mechanisms	1.4	2.7	2.9	2.4
Pain diagnoses	0.9	2.3	2.7	2.0
Pain assessment	1.2	2.5	3.2	2.3
Approach to pharmacological pain management	1.4	2.7	3.1	2.4
Approach to physical and psychological pain management	1.3	2.8	2.9	2.3
Addressing psychosocial aspects of chronic pain such as depression, anxiety, etc.	1.8	3.4	3.0	2.8
Having a difficult conversation with a patient with chronic pain regardless of their disease course	1.4	2.7	2.9	2.4
Working respectfully and appropriately in an interprofessional and multidisciplinary setting	2.6	3.8	4.1	3.5
Identifying barriers to treating chronic pain patients (i.e. gaps in access to care, underfunded research, etc.)	1.7	3.1	3.1	2.7

Overall, clerks rated their preparedness to manage CP patients following pre-clerkship as 2.6 (on a five-point scale). When asked how content in each type of learning session prepared them to manage CP patients (using five-point scales), the average response from clerks was 2.5 for case-based tutorials (Figure 2), 2.5 for Professional Competencies sessions (Figure 3), and 2.1 for Clinical Skills sessions.

When asked to rate satisfaction with their pre-clerkship CP curriculum, the average response from all survey participants was 2.7 (on a five-point scale) (Figure 4). Furthermore, participants supported additional learning opportunities in the field of CP and pain management, with an overall rating of 3.7 (on a five-point scale).

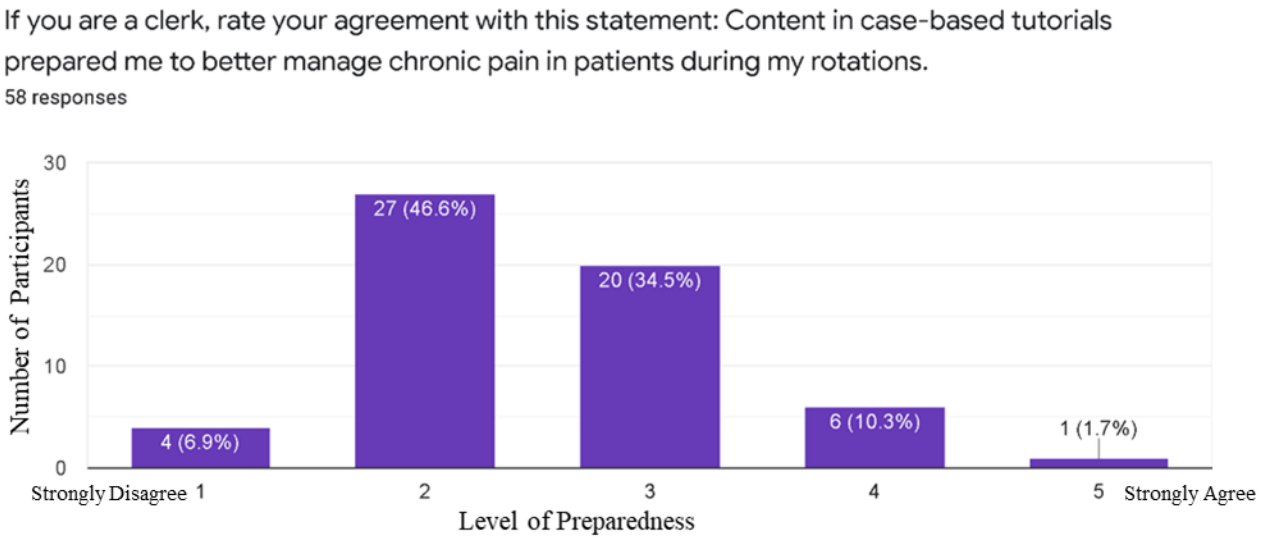

Figure 2: Clerks' survey results on preparedness from case-based tutorials to better manage chronic pain patients

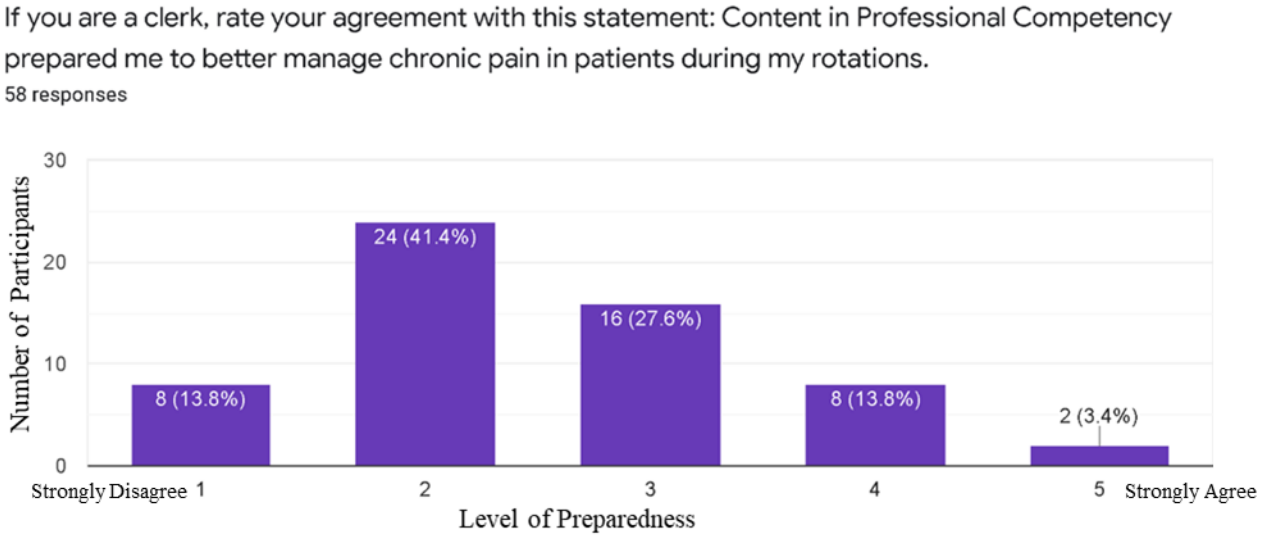

Figure 3: Clerks' survey results on preparedness from Professional Competency content to better manage chronic pain patients

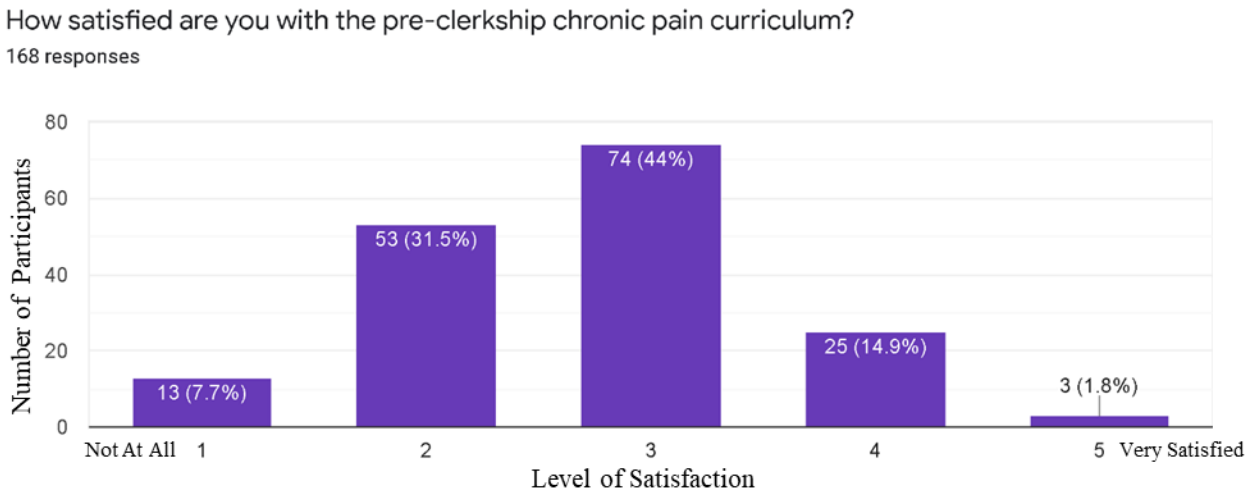

Figure 4: Survey results on satisfaction with pre-clerkship chronic pain curriculum

When asked the specialties in which respondents were interested from a pre-selected list, 59% endorsed family medicine, 51% endorsed internal medicine, 27% endorsed emergency medicine, 21% endorsed pediatrics, 21% endorsed psychiatry, and 15% endorsed anesthesiology. Additionally, 28% endorsed having an interest in completing a fellowship or further training in CP. Furthermore, 96% of participants foresaw their medical practice involving patients who experience CP.

Based on the survey results, clerks identified a need for more learning opportunities to mitigate their CP skill gaps (Figure 5). Using seven pre-selected options and one "Other" free form text field, the majority of survey participants confirmed that CP education could be improved (Figure 6) through CP workshops (n=91), having more pain focused tutorial objectives (n=88), and having more CP-dedicated lecture time (n=86). Furthermore, most third-year medical students participating (34 out of 53), agreed that more pain focused tutorial subjects would help improve CP education.

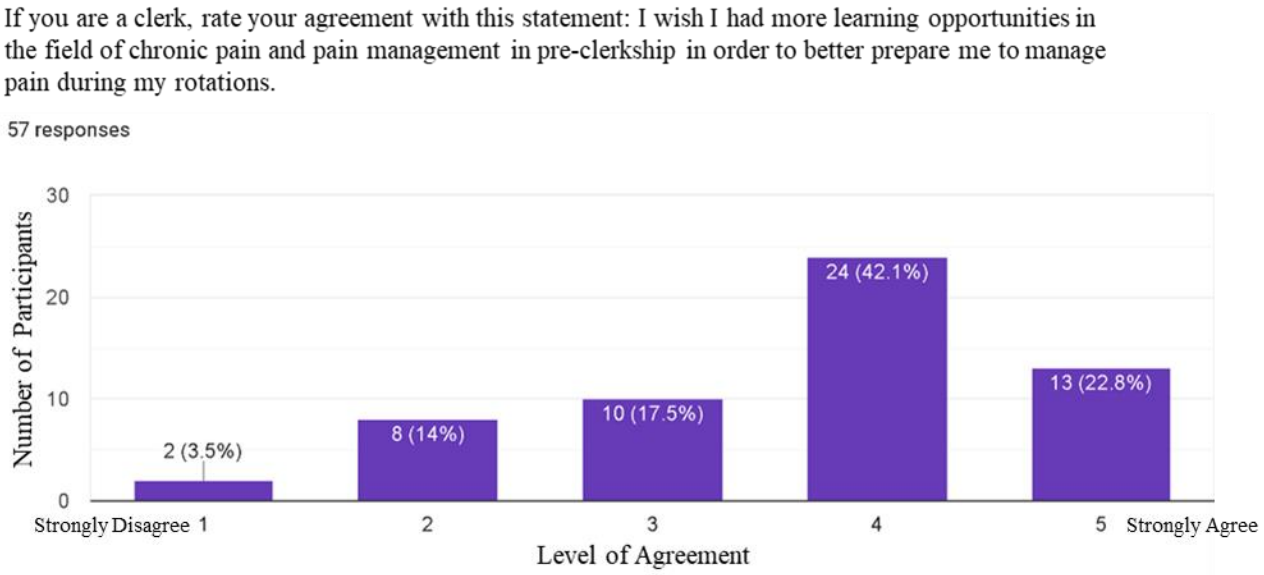

Figure 5: Clerks' responses on desire for additional pre-clerkship chronic pain learning experiences

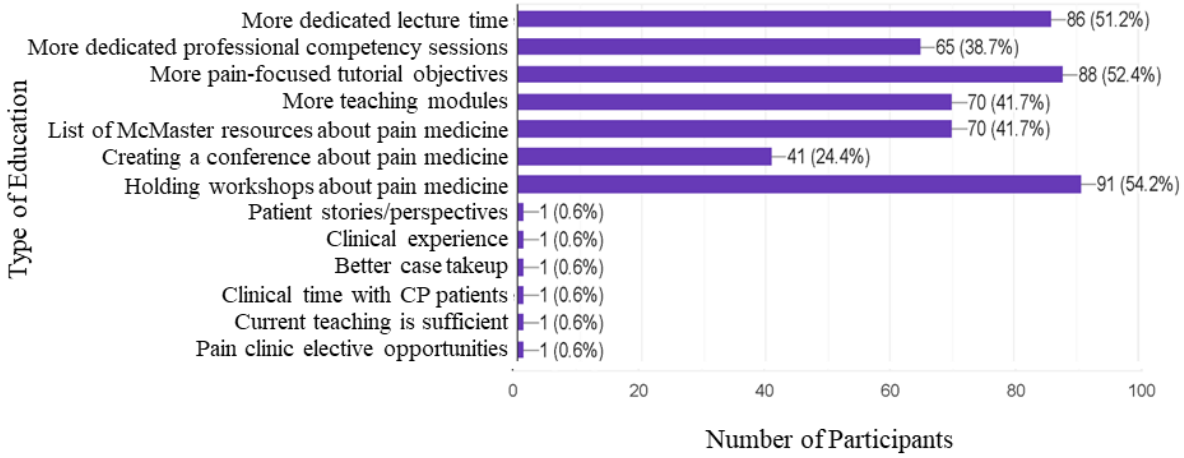

Figure 6: Participant responses for how chronic pain education can be improved

Discussion

Our survey results found that two-thirds of participants had encountered CP patients, including all final-year students who completed the survey. Generally low satisfaction ratings with the current pre-clerkship CP curriculum, especially for final year students, demonstrate that greater CP-related learning opportunities and education are warranted. Participants also indicated that there is a gap

in CP knowledge and a low level of confidence in pain diagnosis, including those in their final year of medical school.

Our findings demonstrate the importance of greater exposure to CP knowledge in pre-clerkship and the need to improve the CP curriculum to prepare students to proficiently manage such patients. The Canadian Pain Task Force declares that, to prevent pain from becoming chronic, primary health care workers need to receive specialized training and education that the system is currently lacking (7). CP patients will likely be prevalent in the professional future of medical students, and it is essential for these students to receive ample opportunities to develop their CP-related skills.

When pain is not taken as a legitimate health issue, it can often lead to misdiagnosis or complete dismissal, leading to stigmatization (1). Up to 40-80% of CP patients are misdiagnosed or over-diagnosed, and, without proper patient analysis, disease entities such as Complex Regional Pain Syndrome may be over-diagnosed up to 71-91% of the time (10). The absence of an in-depth medical history of the patient and the incorrect use of medical tests and imaging are the leading causes of CP misdiagnoses (10).

This study is limited by its inclusion of participants only from the McMaster UGME program, which is a unique three-year condensed curriculum in Ontario and may lack applicability to other medical school populations in the rest of Canada. Furthermore, given that not all students responded, and the risk of response bias, our findings may not be representative of the entire McMaster UGME student body. Namely, it could be that only participants that felt compelled to express their views about the pain curriculum and those who monitor the McMaster UGME Facebook groups completed the survey. Additionally, this survey was cross-sectional in nature; given that it was conducted approximately three months into any given student's respective year of training, it may not capture perspectives at the precise start and end dates of the program. Therefore, the risk of recall bias may have affected the accuracy of self-reported survey input.

Conclusion

Overall, our survey results demonstrate that, on average, students had low ratings in their confidence in CP-related skills. They generally supported improving the McMaster UGME curriculum by incorporating additional CP-related lecture time, online teaching modules, and virtual workshops. These findings suggest a potential gap in the medical curriculum that could be explored at other Canadian medical schools. Distributing a survey to other Canadian medical school students could reinforce our findings and contribute to improvement of the UGME CP curriculum on a national level, as well as improve medical students' ability to confidently assess, diagnose, and manage CP patients to provide better clinical outcomes.

References

1. The Canadian Pain Task Force. Chronic pain in Canada: Laying a foundation for action [Internet]. Ottawa: Health Canada; 2019 [cited 2021 Dec 13]. 50 p. Available from: https://www.canada.ca/en/health-canada/corporate/about-health-canada/public-engagement/external-advisory-bodies/canadian-pain-task-force/report-2019.html#a1.4

2. Cleveland Clinic [Internet]. Cleveland: Cleveland Clinic; c2020. Acute pain vs. chronic pain: Differences & causes; 2020 Dec 8 [cited 2021 Dec 13]; [about 1 screen]. Available from: https://my.clevelandclinic.org/health/articles/12051-acute-vs-chronic-pain

3. Augusta Pain Center [Internet]. Augusta: The APC; c2019. Do it for your mind – if not for your body: The psychological effects of chronic pain. 2019 Jun 10 [cited 2021 Dec 13]; [about 2 screens]. Available from: https://augustapaincenter.com/mind-not-body-psychological-effects-chronic-pain

4. Osterweis M, Kleinman A, Mechanic D. Pain and disability: Clinical, behavioral, and public policy perspectives [Internet]. Washington: Institute of Medicine; 1992 [cited 2021 Dec 13]. Available from: https://doi.org/10.17226/991

5. Michael G. DeGroote School of Medicine [Internet]. Hamilton: McMaster University; c2015. Our Curriculum; 2015 [cited 2021 Dec 13]; [about 2 screens]. Available from: https://mdprogram.mcmaster.ca/md-program/our-curriculum

6. Michael G. DeGroote School of Medicine [Internet]. Hamilton: McMaster University; c2019. The medical foundations; 2019 [cited 2022 May 1]; [about 2 screens]. Available from: https://mdprogram.mcmaster.ca/md-program/our-curriculum/pre-clinical/the-medical-foundations

7. The Canadian Pain Task Force. Working together to better understand, prevent, and manage chronic pain: What we heard [Internet]. Ottawa: Health Canada; 2020 [cited 2021 Dec 13]. 75 p. Available from: https://www.canada.ca/content/dam/hc-sc/documents/corporate/about-health-canada/public-engagement/external-advisory-bodies/canadian-pain-task-force/report-2020-rapport/report-2020.pdf

8. Watt-Watson J, McGillion M, Hunter J, Choiniere M, Clark, AJ, Dewar A, et al. A survey of prelicensure pain curricula in health science faculties in Canadian universities. Pain Research & Management [Internet]. 2009 Nov-Dec [cited 2021 Dec 13];14(6):439–444. Available from: https://doi.org/10.1155/2009/307932

9. Ontario Universities' Application Centre [Internet]. Guelph: Ontario Universities' Application Centre; c2022. OMSAS – Michael G. DeGroote School of Medicine (McMaster University); 2021 [cited 2022 May 1]; [about 17 screens]. Available from: https://www.ouac.on.ca/guide/omsas-mcmaster/

10. Hendler N. Evaluating chronic pain patients using methods from Johns Hopkins Hospital physicians, 7th International Conference and Exhibition on Pain Research and Management. Journal of Pain & Relief [Internet], 2018 Oct 11 [cited 2021 Dec 13]; Available from:

https://www.omicsonline.org/proceedings/evaluating-chronic-pain-patients-using-methods-from-johns-hopkins-hospital-physicians-98640.html

Appendix 1

McMaster Chronic Pain MedEd Survey

* Required

1. What is your class year? *
   Mark only one oval.

   - c2020
   - c2021
   - c2022
   - c2023

2. What is your campus? *
   Mark only one oval.

   - Hamilton
   - NRC
   - WRC

Personal Chronic Pain History

3. Have YOU ever been diagnosed with a form of chronic pain? *
   Mark only one oval.

   - Yes
   - No

4. Have you lived with anyone who has chronic pain? *
Mark only one oval.

- Yes
- No

5. Did you ever have a family member or a friend that has/had chronic pain? *
Mark only one oval.

- Yes
- No

Medical Education & Knowledge Comfort

6. What was your level of knowledge about chronic pain and pain management PRIOR to medical school? *
Mark only one oval.

	1	2	3	4	5	
Very little						Extremely high

7. What is your level of knowledge about chronic pain and pain management TODAY? *
Mark only one oval.

	1	2	3	4	5	
Very little						Extremely high

8. How satisfied are you with the pre-clerkship chronic pain curriculum? *

Mark only one oval.

	1	2	3	4	5	
Not At All	◯	◯	◯	◯	◯	Very Satisfied

9. How best can your chronic pain education be improved? (Select all that apply) *

Check all that apply.

- ☐ More dedicated lecture time
- ☐ More dedicated professional competency sessions
- ☐ More pain-focused tutorial objectives
- ☐ More teaching modules
- ☐ List of resources about pain medicine provided by McMaster
- ☐ Creating a conference about pain medicine
- ☐ Holding workshops about pain medicine
- ☐ Other: _____

10. If an online pain education program were offered, to teach you an approach to chronic pain management and allow you to practice your communication skills with chronic pain patients, would you use it? *

Mark only one oval.

- ◯ Yes
- ◯ No

11. Have you ever encountered a patient with any form of chronic pain? *
Mark only one oval.

- Yes
- No
- Unsure

12. Rate your agreement with this statement: There are sufficient opportunities for chronic pain education in case-based tutorials. *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree						Strongly Agree

13. Rate your agreement with this statement: There are sufficient opportunities for chronic pain education in Professional Competency. *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree						Strongly Agree

14. Rate your agreement with this statement: There are sufficient opportunities for chronic pain education in Clinical Skills. *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree						Strongly Agree

15. Rate your agreement with this statement: Exposure to chronic pain management in Preclerkship is important for my medical education. *
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree						Strongly Agree

16. What is your level of confidence in the following skills? *

Mark only one oval per row.

	Poor	Fair	Somewhat Fair	Average	Somewhat Good	Good	Excellent
Pain Mechanisms							
Pain Diagnoses							
Pain Assessment							
Approach to pharmacological pain management							
Approach to physical and psychological pain management							
Addressing psychosocial aspects of chronic pain such as depression, anxiety, etc.							
Having a difficult conversation with a patient with chronic pain regardless of their disease course							
Working respectfully and appropriately in an interprofessional and multidisciplinary setting							
Identifying barriers to treating chronic pain patients (i.e. gaps in access to care, underfunded research, etc.)							

17. How would you rate your knowledge about the following pathologies of chronic pain? *

Mark only one oval per row.

	Poor	Fair	Somewhat Fair	Average	Somewhat Good	Good	Excellent
Back Pain							
Cancer Pain							
Carpal Tunnel Syndrome							
Complex Regional Pain Syndrome (CRPS/RSD)							
Diabetic Neuropathy							
Fibromyalgia							
Lupus							
Migraines and Headaches							
Osteoarthritis							
Osteoporosis							
Rheumatoid Arthritis							
Sickle Cell Disease							
Traumatic Brain Injuries							

Clerkship Section: ONLY do this session if you are a clerk (c2021)

Skip this session if you are NOT currently in clerkship

18. If you are a clerk, how well has the pre-clerk chronic pain curriculum prepared you to manage patients with chronic pain during your rotations?
Mark only one oval.

	1	2	3	4	5	
Not At All	◯	◯	◯	◯	◯	Very Well

19. If you are a clerk, rate your agreement with this statement: Content in case-based tutorials prepared me to better manage chronic pain in patients during my rotations.
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

20. If you are a clerk, rate your agreement with this statement: Content in Professional Competency prepared me to better manage chronic pain in patients during my rotations.
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

21. If you are a clerk, rate your agreement with this statement: Content in Clinical Skills prepared me to better manage chronic pain in patients during my rotations.
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

22. If you are a clerk, rate your agreement with this statement: I wish I had more learning opportunities in the field of chronic pain and pain management in pre-clerkship in order to better prepare me to manage pain during my rotations.
Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Career Goals

23. Please select all the following specialties you are interested in: *
Check all that apply.

- [ ] Anesthesiology
- [ ] Emergency medicine
- [ ] Family medicine
- [ ] Internal Medicine
- [ ] Neurology
- [ ] Pediatrics
- [ ] Physical Medicine & Rehabilitation
- [ ] Psychiatry
- [ ] Radiology
- [ ] Rheumatology
- [ ] Other

24. Do you foresee your medical practice involving patients suffering from any form of chronic pain? *
Mark only one oval.

- Yes
- No
-

25. Rate your level of interest in working with patients that have chronic pain. *
Mark only one oval.

	1	2	3	4	5	
No Interest						Very interested

26. Would you be interested in completing a fellowship or other further training in chronic pain? *
Mark only one oval.

- Yes
- No

Original Research Article

Evaluation of a pre-clerkship family medicine placement: Does it influence Canadian medical students' interest in pursuing family medicine?

Ajay Shah, Adi Gasner, Alessandra Palombo

McMaster University

Abstract

Achieving a sustainable workforce in family medicine (FM) requires 50-53% of Canadian medical students to apply. However, in 2020, only 32.4% ranked FM as their top specialty choice. Increasing FM exposure during pre-clerkship is one strategy to boost interest in the specialty. In this context, McMaster University created the Family Medicine Experience (FME) for early clinical exposure. This mixed-methods study aims to evaluate the FME's influence on students' interest in pursuing FM. Pre- and post-FME surveys and focus groups included pre-clerkship McMaster medical students as participants. The survey results were analyzed for relationships between demographic variables and change in FM ranking or likelihood for pursuing a career in FM. The focus groups were conducted after the FME and analyzed for common themes. The surveys showed that there was neither a significant difference ($p>.05$) in the proportion of students with FM as their top specialty, nor any change in the mean score for likelihood of pursuing FM as a career. The focus groups analysis revealed that although the FME improved attitudes and perceptions of FM, the students' top specialty choice did not change. The FM+1 is an increasingly popular option for students and was the intended choice for most students interested in FM. Strategies including lunchtime panel sessions and workshops were suggested for FM promotion during pre-clerkship. A pre-clerkship FM placement does not influence the proportion of students with an intent to pursue FM.

Keywords: Canadian medical students; medical education; mixed-methods study; pre-clerkship placements

Corresponding author: ajay.shah@medportal.ca

Introduction

An estimated 15.3% of Canadians (4.7 million) do not have regular access to a Family Physician (FP), as of 2017 (1). Canada ranks 29th out of 33 developed countries in patient-to-physician ratio (2). Lack of a regular FP is associated with higher in-hospital and one-year post-admission mortality (3), decreased health promotion including cancer screening (1), and increased healthcare costs (4,5).

Up to 35.1% of Canadians looking for an FP cannot find one accepting new patients (6). A 2017 Canadian Medical Association (CMA) Workforce Survey found 73.6% of practising FPs are seeing few or no new patients, and that 39.4% of FPs plan to reduce working hours or retire within the next two years (7,8). Canadian FPs are also increasingly pursuing enhanced skills training ("FM+1"). This is an opportunity for graduates of family medicine (FM) programs to gain additional training in an area of interest, and it allows for them to work in other clinical settings, rather than practicing traditional FM (9).

Approximately 50-53% of Canadian medical school graduates should apply to FM to achieve a sustainable workforce (10). In 2020, only 32.4% of Canadian medical graduates applied to FM as their top specialty choice (five-year average (5YA) from 2016-2020: 33.8%), (11), and 49 Canadian FM residency spots went unfilled after both iterations of the match (5YA: 48.8 unfilled spots). The Canadian Federation of Medical Students (CFMS) released seven recommendations in 2006 to increase the popularity of FM as a career choice, including "increased exposure to FM in the pre-clerkship years of medical school, including rural or community experience or both." (12).

McMaster University, a medical school in Southwestern Ontario, has created a mandatory first year FM placement, the Family Medicine Experience (FME). This is an 18-hour (three half- or six full-days) placement that aims to promote early clinical experience in FM. Other medical schools in Canada have recently begun pre-clerkship FM placements (Appendix A). To date, there is no published Canadian literature examining whether participation in pre-clerkship FM placements influences students' eventual specialty selection, and whether it increases interest in FM. The purpose of this study is to evaluate whether the FME affects students' interest in pursuing a career in FM.

Methods

Study design

This is a mixed-methods study utilizing a pre- and post-FME survey and focus groups. The survey measured first-year students' interest in pursuing a career in FM at two cross-sectional timepoints: before and immediately after the FME. The focus groups were conducted after the FME, before students entered their clerkship training. This study was granted a HiREB

exemption waiver from ethics review as it was classified as program evaluation as per the TCPS2 (2014) Article, 2.5.

Setting and sample

The participants were pre-clerkship medical students from McMaster University. The survey was sent to all 206 first-year medical students (class of 2022) shortly after matriculation to medical school, one day after receiving an orientation presentation on the FME. All respondents to the pre-FME survey were contacted again for the post-FME survey, within one week of their placement ending.

Focus group participants were recruited via an e-mail to all students, and through snowball recruitment of survey participants, from the classes of 2021 and 2022. Students were encouraged to participate in surveys through random selection of one student to receive a $30 Amazon gift card, and in focus groups where a complimentary meal was provided.

Survey

The survey questions were based on a literature review of studies investigating factors affecting the career interests of first-year Canadian medical students (13). The initial survey was reviewed and edited by the McMaster Education Research, Innovation, and Theory group in a thinktank session for question content, vocabulary, and potential bias.

All first-year students were sent the Part I (Pre-FME) survey. This survey had two parts: 10 multiple-response questions collecting demographic data (e.g., age, ethnicity, gender…), and eight questions on specialties of interest (arranged by a top-five rank-order list of 27 specialties available in the residency (e.g., Anaesthesiology, Cardiac Surgery, Dermatology…) and subspecialty (e.g., FM+1, IM Subspecialty…) matches), five-item Likert scale question “How likely are you to pursue an FM residency?”, with zero indicating “no interest”, and five “absolute certainty”, and free-text responses on factors most important for career selection (Appendix A).

Students who responded to the Part I survey were sent the Part II (Post-FME) survey. This survey also included the rank-order list of the top five specialties of interest, five-item Likert scale question “How likely are you to pursue an FM residency?”, and several free-text questions about the FME, such as “How did the FME influence your likelihood of pursuing FM?”.

Statistical analyses

Data regarding means, percentages, variation, and standard error were calculated using Microsoft Excel (Version 2007, Microsoft, Redmond, WA, USA). The Part I and II survey results were analyzed for relationships between independent demographic variables, number one ranked

specialty choice, and change in FM specialty ranking using Minitab ® statistical software (Version 17, Minitab Inc., State College, USA). Linear regression was performed to analyze whether independent variables accounted for significant variance in specialty choice and pre- and post- analyses of changes in FM interest. For categorical variables, chi-square testing was employed; for continuous variables, unpaired t-tests were used. For free-text survey responses, a document with all compiled answers was created and analyzed for common themes. Re-occurring themes were categorized, counted based on frequency of response, and reported quantitatively.

Focus groups

Focus groups lasting 60 to 90 minutes were carried out for participants after completion of the FME. Focus groups of students were facilitated by two trained investigators (AS, AG); neither facilitator was associated with any aspect of the medical curriculum in the medical school. Focus group questions covered two broad areas (Appendix A): first, the influences that shaped students' career interests before and during medical school, and second, how the FME influenced their perceptions of FM. Focus group sessions were recorded electronically using QuickTime Player (Apple, Cupertino, CA, USA).

Qualitative analyses

Audio recordings were initially transcribed using the Trint Audio Transcription software (2014, Florence, Italy). Two different investigators (AS, AG) reviewed these transcripts and simultaneously listened to the recordings to add qualitative details (e.g., tone, sarcasm, laughter) and make corrections for spelling and grammar. Both investigators independently read each transcript and used an open coding method of analysis, in which interesting words, phrases, or concepts in the transcripts were highlighted in Microsoft Word (Version 2007, Microsoft, Redmond, WA, USA). These codes were compiled into a master codebook, where descriptive commentary noted emerging themes or potential patterns in the data. The commentary was the basis of the primary thematic analysis. Codes were clustered under each theme, and a new theme was created where multiple codes did not fit an existing theme. Thematic analysis was completed when exhaustion of coding segments from the codebook was reported by each investigator. Both investigators then independently summarized each theme into discrete categories, with specific quotes and codes used as supporting evidence. These categories were compared between investigators, and consensus on a final summary of qualitative themes was achieved.

Results

Surveys

The Pre-FME survey (Appendix A) had 72 respondents (72/206, 35.0%), and 53 respondents completed all questions. The Post-FME survey had 43 respondents (43/72, 59.7%), and 40 respondents completed all questions. All survey respondents were in their first year of medical school; further demographic information regarding gender, campus and marital status is in Table 1.

Table 1. Demographic information of participants and comparison of interest in FM for independent variables. FM, family medicine; HRC, Hamilton campus; NRC, Niagara campus; WRC, Waterloo campus

Category	**n**	**%**	**Category for comparison**	**FM/FM+1 Rank #1**	**p**	**FM+1 only Rank #1**	**p**
Male	29	40.3%	Male	10/29	0.36	7/10	1.0
Female	43	59.7%	Female	5/24		4/5	
Age	22.9 (SD 2.7) yrs.		Age ≤ 24	10/44	0.10	9/10	.08
			Age > 24	5/9		2/5	
Hamilton Campus	52	72.2%	HRC	11/38	1.0	7/11	0.50
Niagara Campus	10	13.9%	NRC/WRC	4/15		4/4	
Waterloo Campus	10	13.9%					
Married	7	9.7%	Married/Relationship	9/24	0.23	6/9	0.60
Serious Relationship	21	29.2%	Single	6/29		5/6	
Single	43	59.7%					
No response	1	1.4%					
Hometown population <100,000	16	22.2%	Hometown <100,000	3/11	1.0	2/3	1.0
Hometown population >100,000	56	77.8%	Hometown >100,000	12/41		9/12	
Family income <$100,000	20	27.8%	Income <$100,000	6/25	0.56	4/6	1.0
Family Income $100,000-$300,000	29	40.3%	Income >$100,000	9/28		7/9	
Family Income >$300,000	6	8.3%					
Unsure/No response	4	5.6%					
Debt < $30,000	22	30.6%	Debt <$30,000	4/15	1.0	2/4	0.52
Debt > $30,000	45	62.5%	Debt >$30,000	11/38		9/11	
No response	5	6.9%					
Caucasian	28	38.9%	Caucasian	8/21	0.23	6/8	1.0
East Asian	29	40.3%	Non-Caucasian	7/32		5/7	
South Asian	13	18.1%					
Other	10	13.9%					
Has children	3	4.2%					

Part I survey

Of 53 respondents, 28.3% (15/53) ranked FM or FM+1 as their top specialty of interest. 26.7% (4/15) ranked traditional FM first, while 73.3% (11/15) ranked FM+1 first. Other popular selections were Pediatrics (11.3%, 6/53), Psychiatry (9.4%, 5/53), Internal Medicine (9.4%, 5/53) and Anaesthesiology (7.5%, 4/53) (Figure 1; Table 2). The mean Likert (1-5) score for the question: "How likely are you to pursue an FM residency?" was 3.13 (SD: 0.99, range: 1-5).

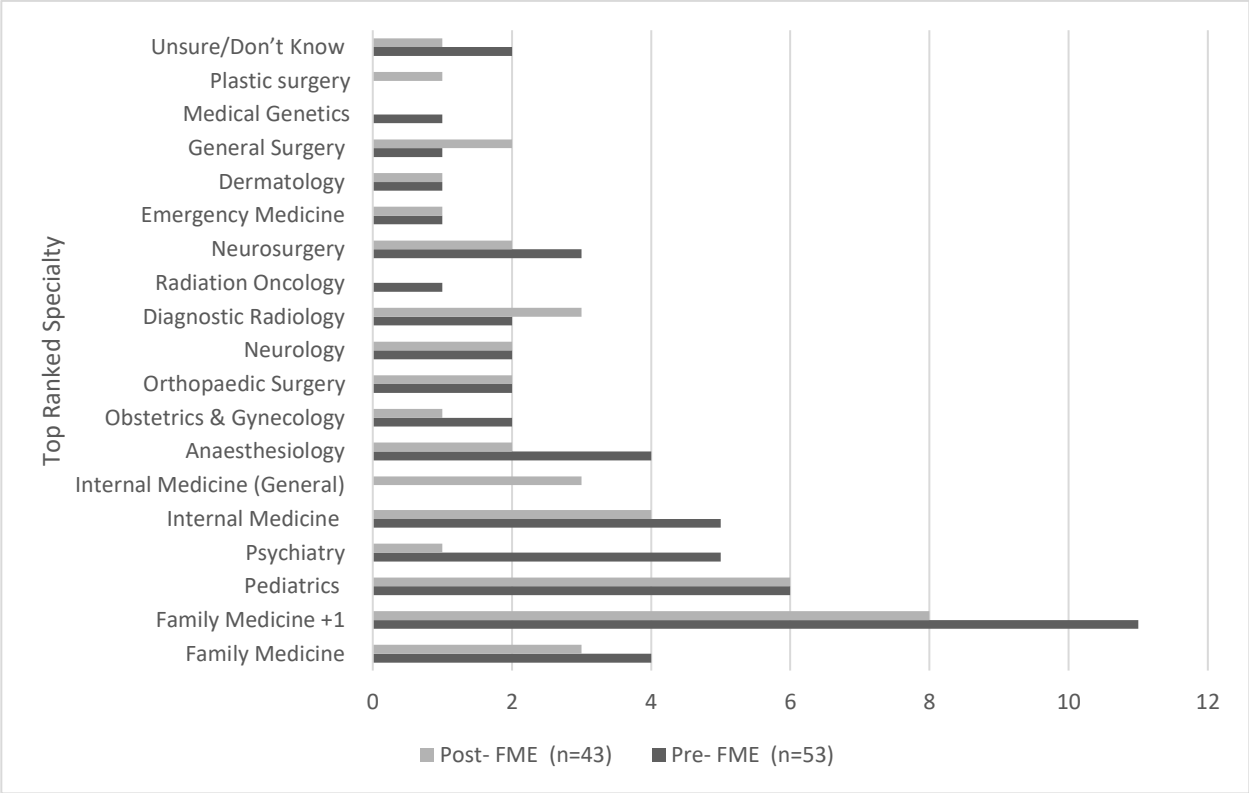

Figure 1. Top ranked specialties pre- and post-FME

Chi-squared tests of proportions revealed no statistically significant ($p>0.05$) associations between any of the demographic variables and the likelihood of ranking FM as the top specialty of interest, or FM+1 versus FM-only as the top specialty of interest (Table 1). Regression analysis failed to reveal any significant ($F>0.05$ and $p>0.05$) relationships between likelihood of pursuing FM or FM ranking and any of the demographic variables.

Factors commonly cited as most important for specialty interest were lifestyle after training (51/73), job satisfaction (45/73), personal fit in specialty (42/73) and control/predictability of schedule (40/73).

Table 2. Specialty interests of survey participants and focus group participants. FM, family medicine; FME, family medicine experience; EM, emergency medicine; ID, infectious diseases; IM, internal medicine; NR, not reported

Survey Participants			**Focus Group Participants**			
Top Ranked Specialty	Pre-FME (n=53)	Post-FME (n=43)	**ID**	**Gender**	**Current Interest (PreFME Interest)**	**Important Factors for Specialty Interest**
Family Medicine	4	3	A	Female	ID (ID)	Previous research in field, Ability to do future research
Family Medicine +1	11	8				
Pediatrics	6	6				
Psychiatry	5	1	B	Female	Pediatrics (Neurosurgery)	Ability to do medical humanities research, Lifestyle
Internal Medicine	5	4				
Internal Medicine (General)	0	3				
Anaesthesiology	4	2	C	Male	IM (IM)	Basic science research, Lifestyle, Interest in specialty
Obstetrics & Gynecology	2	1				
Orthopaedic Surgery	2	2				
Neurology	2	2	D	Female	FM (FM)	Lifestyle, Regional flexibility
Diagnostic Radiology	2	3				
Radiation Oncology	1	0	E	Female	Pediatrics (FM)	Lifestyle, Excitement, Interest in academic content (genetics)
Neurosurgery	3	2				
Emergency Medicine	1	1				
Dermatology	1	1	F	Male	Dermatology (Dermatology)	Interest in content, Lifestyle, Income
General Surgery	1	2				
Medical Genetics	1	0				
Plastic Surgery	0	1	G	Female	General Surgery/ Pediatrics (NR)	Lifestyle, Definitive management, Expertise
Unsure/Don't Know	2	1				
			H	Male	General Surgery (EM)	Interest in specialty (procedures, acuity)
			I	Female	IM (NR)	Lifestyle, Environment at work
Likelihood of ranking FM as top specialty for residency? (1 = not likely, 5 = very likely) 1	6	8				
2	17	8				
3	8	7				
4	15	8				
5	6	9				

Part II survey

After the FME, the mean score for the likelihood of pursuing an FM residency was 3.07 (STD: 1.40, range 1-5). 27.5% (11/40) listed FM or FM+1 as their top specialty, 27.3% of whom (3/11) listed FM and 72.7% of whom (8/11) listed FM+1 first. Four students switched their top rank

from another specialty to FM, and three students switched from FM to another specialty. There was neither a significant pre-/post-FME difference ($p>0.05$) in the proportion of students with FM or FM+1 as their top specialty, nor in the mean score for the likelihood of pursuing a career in FM.

Qualitative themes

The most important factors for career choices were (n=53): lifestyle and balance (n=17), personal interest in specialty (n=10), job satisfaction (n=9), patient population (n=6), and intellectual content of the specialty (n=5). In the Post-FME survey, 95.3% (41/43) of students reported a positive experience. Responses to the question, "How did the FME influence your likelihood of pursuing FM" were analyzed. Positive responses included an improved perception and appreciation of FM (n=9), dispelled negative prejudice about FM (n=2), and improved understanding of the scope of FM (n=7). For some students, the FME increased the likelihood of applying to FM (n=11), confirmed FM as the top specialty of interest (n=5), and/or influenced them towards the FM+1 (n=4). For others, the FME did not change the likelihood of applying to FM (n=8) or negatively influenced the likelihood of applying to FM (n=9).

Focus groups

Nine students participated in two focus groups. Seven students were in first year and two were in second year; six participants were female and three were male. The specialty choices of participants in the focus groups and factors that are important in the specialty selection are in Table 2.

Pre-medical school influences

Impressions of FM before medical school were generally negative due to influence from family physicians and influence from role models. Several students said their only exposure to FM before medical school was with their family physician. On finding out she got into medical school, one participant said:

> "[My family physician said] congratulations but, run! I hate my life. You should not go into this…It takes a month or two to even book an appointment and when you get to that point, you're waiting for three hours and you go, they're just (like) 'Drink water'. I was like, ok, I definitely don't want to do this." (G – Gen Sx).

Other students reported perceptions of FP as "pushing people off to see [other] specialists" and believed that FM was less intellectually demanding. Students had negative experiences at walk-in clinics and perceived incompetence among FPs. As stated by one participant about their own

family physician, "She's prescribed [me and my family] stuff that, through our own research and second opinions, [we] have [concluded] 'this is not good for us'. So that altered my perception." (B – Peds). Negative impressions of FPs from role models were pervasive:

> "[my research supervisor, an infectious diseases specialist] always kind of spoke down about FM. I was like oh, well it doesn't seem like people really respect this [profession] as much. It seems very basic, I'm not going to be able to do research, I'm not really going to be challenged." (A - IM/ID)

Focus group participants' responses also illustrated that cultural perspectives influenced their perceptions:

> "So I'm Chinese, my parents were all immigrants. When I got into medical school, my mom was like 'Great, be any doctor you want. Just not a family doctor', and I was like 'Why?', and [she] was like 'Those are the bad doctors, you know? The dumb doctors'. So that influenced me a bit." (F – Derm)

Medical school influences

Negative sentiments about FPs were also expressed to first-year students during medical school. One participant shared that, "For clinical skills, I was just talking to a patient, and the patient was like 'So are you going to be a family doctor, or *a doctor* doctor?" (G – Gen Sx). Some students said that positive impressions of FM were provided via interest group events and panel events where FPs spoke about their work. These events allowed students to meet passionate FPs and understand the special relationships that FPs can have with their patients.

FME

Students attributed positive experiences to preceptors who had strong patient-physician relationships and took an active role in student mentorship. Effective preceptors asked students to perform skills slightly above their level of expertise, with minimal consequences for failure. Students appreciated the longitudinal nature of the placement and benefitted from having senior students or residents in the environment. Negative experiences were due to logistics (travel time >45 minutes) or monotony.

The FME improved attitudes and perceptions of FM. Students viewed the ability to form longitudinal relationships with patients, the holistic nature of treatment, and the higher perceived intelligence of FPs as positives. However, some students now reported feeling intimidated by the intimacy of relationships and academic responsibility of being a primary care physician:

> "It's a full 180, like I don't think I'm smart enough to be an [FP], because they need to know everything. They play such a huge role [in] forming the link between hospitals, specialists, and general patient care." (A - IM/ID)

> "FM is what saves lives. People who want plastic surgery or general surgery…having that experience and exposing people who would not otherwise care to do electives in [FM] forces you to see that perspective." (C – IM)

> "Overall [the] FME is good for fostering a respect for the specialty within those that don't intend to pursue it and might otherwise have limited exposure to it." (E – Peds)

> "The FME gave me an experience of what a family doctor does because what me and my family [visit for] is very different from the variety of patients I was seeing." (B – Peds)

However, some negative perceptions were also reinforced by the FME:

> "As a family doc, you're not really an expert at anything unless you choose to do that plus one or centre your knowledge base in one thing, but it's impossible to be an expert in everything." (G - Gen Sx)

In general, the FME did not change students' top specialty of interest. For those not interested in FM before, it confirmed the desire to pursue alternate paths, usually due to patient population. One participant shared, "But the [FME] just made me not want to open my own clinic and have long term patients" (I – IM). Another stated, "I could really see how this would be for some people. But it's really just not for me" (C – IM). According to another participant, "The FME [helped me realize] I don't want to serve adult populations…I saw the same patients and …they're all pretty wealthy white people coming for their cholesterol. I wanted something where I would feel like I was actually impacting people's lives" (B – Peds). The student who switched from FM to Pediatrics felt "the things this person was doing weren't the things that were interesting to me" (E – Peds).

However, most students also reported more openness to a career alternative in FM because of the FME. One student expressed that, "It helped me not think FM is just people hating their lives and their jobs…I think I'd be okay to parallel plan with FM at this point" (G - Gen Sx). Another said, "I always had this sort of idea in my head about FM, that it would be cool…It didn't really push me towards or against FM. It just helped me understand what kind of FM I would want to do" (H - Gen Sx). Another participant shared, "My interest also went up as I was doing it. Originally, I didn't really know what FM was like, so I looked into ways I could run the clinic similar to Dermatology…I'm considering like parallel planning Dermatology with FM…Maybe [I] should just take it easy [and do FM]" (F – Derm).

The most common feedback to improve the FME was to place students in practices with specific foci, including women's health, at-risk/IV drug users, dermatology, or Indigenous

populations. Many students requested program standardization in the form of a curriculum with discrete learning objectives and topics for discussion (e.g., billing in FM, cardiac issues in family medicine) with preceptors. Finally, students requested closer placements for those without vehicles, and schedule changes to allow full-day experiences. To better promote FM, the clinical FME should be accompanied by panel-style presentations for FPs (e.g., generalist, +1 specialists) to interactively discuss career flexibility and their values, personal experiences and career paths. Increased observerships in FM and vlog-style videos by FPs were other methods of FM career promotion.

Specialty choices

Students who completed previous research were strongly inclined to specialize in that field. Factors important to students' career choices are in Table 2. Common themes were desire for good work-life balance, interest in the intellectual or clinical content of a specialty, and the desire to do clinical research in a specific field.

Discussion

This study found that a longitudinal 18-hour pre-clerkship placement in FM does not influence students' intentions to pursue a career in FM. In our sample, 28.3-30.0% (pre- and post-FME) of students indicated that FM was their top specialty of interest, consistent with historical averages. Of these students, 72.7-73.3% indicated that the FM+1 was their top choice. Currently, only 10.6% of FM residents pursue an additional year of training (14). These programs are controversial – while they make broad-scope FM more appealing, some consider them a back door to more competitive specialties (9). For example, most EM-trained FPs work exclusively in EM; less than 10% maintain a family practice (9). A recent poll found that 70.8% of FM residents were highly likely to have a special focus (e.g., sports medicine, EM, palliative care) (15). Indeed, FPs without fellowship training face negative stigma and are perceived as having less competence (16).

The negative stigma surrounding a career in FM is well-documented in the literature and was present in our focus groups (17–23). Strategies to mitigate this from the College of Family Physicians of Canada (CFPC) include: FM interest groups to provide information, facilitate contact with positive role models, and expose students to the diversity of FM; honours and awards to recognize students' commitment to FM; increased opportunities to experience the scope of FM; and longitudinal integrated programs (11). A recent systematic review found that "longitudinal programs are the only strategy that significantly increases the proportion of medical school graduates choosing a primary care specialty" (24). Longitudinal programs in pre-clerkship are consistently rated positively by students and preceptors (25). The FME was effective in educating students on the role of an FP, increasing positive attitudes about FM, and

dispelling negative stereotypes about primary care. This is consistent with previous qualitative research (26).

A recent meta-analysis found that pre-clerkship generalist placements were effective in increasing the proportion of students matching to FM residencies (27). Block placements of four to 11 weeks were more effective than horizontal half-day/full-day placements, which are more common in Canadian medical schools (Appendix A). The CFPC Undergraduate Education Committee suggested the implementation or improvement of longitudinal generalist placement opportunities in the first year of medical school to advance generalism (28). Having more family medicine role models early in medical school might encourage more medical students to select careers in family medicine (17).

Schools also discussed changes in admission policies to accept learners with generalist attributes (28). The Northern Ontario School of Medicine (NOSM) is a distributed medical school with admission criteria directed toward the institutional mission of producing rural generalists. These criteria include societal orientation and the desire for a varied scope of practice (29). NOSM is the only Canadian medical school with mandatory multiple block placements (three rural/remote four-week placements in years one to two) and had 47.4% of students apply to FM residencies from 2016-2020 (national average: 33.8) (30,31).

In this study, work-life balance and lifestyle were the most commonly cited factors for career choice, consistent with previous studies (32,33). Although FM is widely seen as affording a comfortable lifestyle, it is also perceived as a boring specialty that may offer inferior income (34). Specialty decision is certainly multifactorial, and many studies have attempted to previously characterize all the factors that may influence choices. We have created a model that arranges students' factors and experiences resulting in eventual FM specialty selection based on the findings in this study and a literature review on this topic over the past 20 years (2000-2020), in Figure 2.

Some FME feedback can be generalized to horizontal placements at other schools. Students felt the experience could have been optimized by reducing travel time, matching students with preceptors in a field of interest, and creating a standardized set of learning objectives. Although top specialty choice was unchanged, many students were more open to planning FM as an alternative career path. Career counselling and information sessions may augment these changes.

The present findings are important in the context of changing attitudes towards FM promotion in Canada at the pre-clerkship level. Given the increasing popularity of pre-clerkship FM programs, it is important to understand what is done well, and what can be done better for FM promotion. Discussions should be had among national education committees and with rural communities to facilitate the placement of students in longitudinal block placements with passionate FM preceptors.

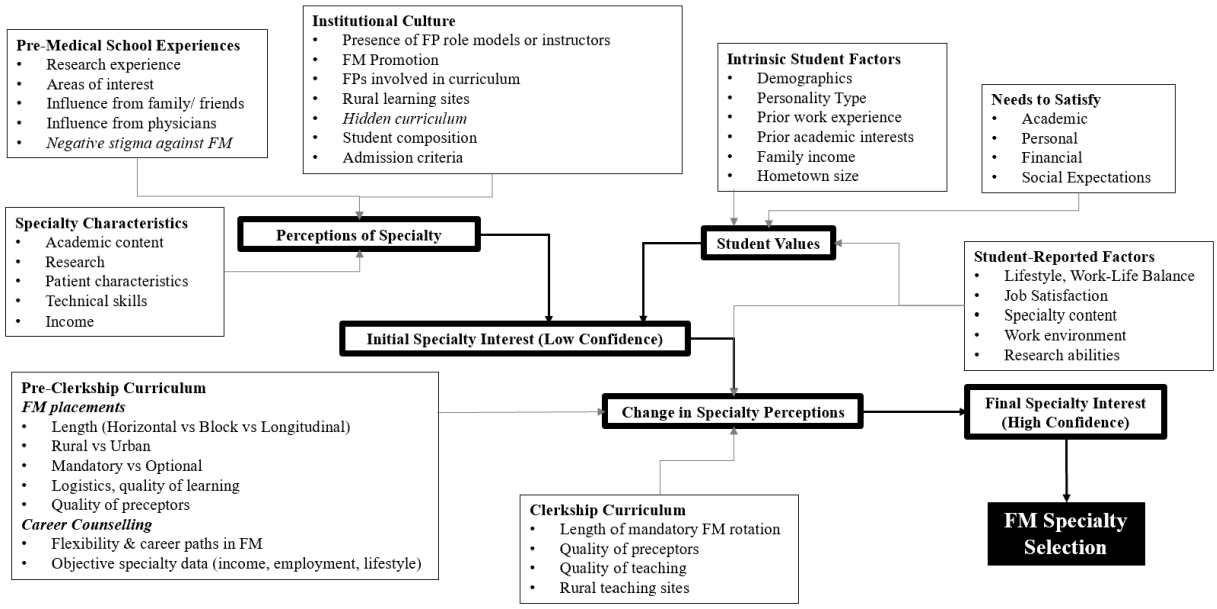

Figure 2. Factors and experiences that affect medical students' perceptions and intentions to pursue a career in family medicine (FM)

Recommendations

The following recommendations are presented for improvement of the FME and promotion of FM at the pre-clerkship level:

1. Place students in practices with specific foci, including women's health, at-risk/IV drug users, dermatology, rural medicine, or Indigenous populations for the FME.
2. FME program standardization in the form of a curriculum with discrete learning objectives and topics for discussion (e.g.: billing in FM, cardiac issues in family medicine, rural medicine) with preceptors.
3. Closer placements for those without vehicles, and schedule changes to allow full-day experiences.
4. Panel-style presentations and workshops for FPs (e.g.: generalist, +1 specialists) to interactively discuss career flexibility and their values, personal experiences and career paths.
5. Increased horizontal elective opportunities in FM and vlog-style videos by FPs.

Limitations

The main limitation of this study is the limited sample size and poor response rate (72/206 respondents, 43/206 respondents) of both surveys. The initial intention of the authors was to survey at least two cohorts of students and follow one to residency, but, due to the COVID-19

pandemic and shift to virtual learning, the FME has been suspended indefinitely. This limitation is mitigated by the inclusion of free-text responses from survey respondents about career choices and the FME, and analysis of qualitative findings of focus groups. It was not possible to validate the survey tool, but external validity was maximized by performing a literature search beforehand, and incorporating an assessment by a research methodology group.

Conclusion

The most significant finding in this study is that a longitudinal 18-hour pre-clerkship placement in FM does not influence the overall proportion of students with an intent to pursue FM in residency. This finding was determined following the immediate completion of the FME; however, this study was not repeated towards the end of medical school, when medical students would have made their choices regarding residency selection. In our sample, only 28.3% of students before the placement, and 30.0% after the placement, indicated that FM was their top specialty of interest. Of those students ranking FM first, the vast majority (73.3% pre-FME, 72.7% post-FME) indicated that FM+1 was their top choice. Both survey and focus group responses suggested increasing popularity of student desire for specialization within FM. Qualitative analysis revealed that work-life balance and lifestyle were the most commonly cited factors when considering career choice. While the FME was not significant in promoting FM as a career choice, it was effective in educating students on the role of an FP, increasing positive attitudes about FM, and dispelling negative stereotypes about primary care. Students appreciated the early clinical exposure and patient contact, but felt the experience could have been optimized by reducing travel time, allowing full-day clinic visits, and matching students with preceptors in a field of interest. Other suggestions were to create a standardized set of objectives for the FME and better advertising the flexibility of FM through panel events.

References

1. Statistics Canada. Primary health care providers, 2017 [Internet]. 2017 [cited 2021 Jul 17]. Available from: https://www150.statcan.gc.ca/n1/pub/82-625-x/2019001/article/00001eng.htm

2. Globerman S, Barua B, Hasan S. The supply of physicians in Canada: Projections and assessment. 2018.

3. Peel A, Gutmanis I, Bon T. Disparities in health outcomes among seniors without a family physician in the North West Local Health Integration Network: A retrospective cohort study. C Open. 2019 Jan;7(1):E94–100.

4. Canadian Institution for Health Information. Understanding emergency department wait times: Access to inpatient beds and patient flow. 2007.

5. Statistics Canada. Access to a regular medical doctor. 2014.

6. Statistics Canada. Access to a regular medical doctor [Internet]. Government of Canada. 2011. Available from: http://www.statcan.gc.ca/pub/82-625-x/2014001/article/14013eng.htm

7. Practice status. CMA Workforce Survey 2017. 2017. p. 17.

8. Planned changes to work hours. CMA Workforce Survey. 2017. p. 25b.

9. Vogel L. Are enhanced skills programs undermining family medicine? CMAJ. 2019 Jan;191(2):E57–8.

10. Bosco C, Oandasan I. Review of family medicine within rural and remote Canada: Education, practice, and policy. College of Family Physicians of Canada. 2016.

11. Lemire F. Cautious look at the 2017 CaRMS match results. Can Fam Physician [Internet]. 2017 [cited 2020 Oct 15];63(7):576. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5507240/

12. Avinashi V, Shouldice E. Increasing interest in family medicine. Vol. 174, CMAJ. CMAJ; 2006. p. 761–2.

13. Vo A, McLean L, McInnes MDF. Medical specialty preferences in early medical school training in Canada. Int J Med Educ. 2017;8:400–7.

14. CaRMS. 2020 Family Medicine / Emergency Medicine Match. 2020.

15. Oandasan IF, Archibald D, Authier L, Lawrence K, McEwen LA, Mackay MP, et al. Future practice of comprehensive care: Practice intentions of exiting family medicine residents in Canada. Can Fam Physician. 2018 Jul;64(7):520–8.

16. Payne L, Moaveni A, Handford C. Family medicine residents' perspectives on curricular messaging surrounding enhanced skills fellowship programs. Can Fam Physician. 2019;65(5).

17. Jordan J, Brown JB, Russell G. Choosing family medicine. What influences medical students? Can Fam Physician. 2003 Sep;49(SEPT.):1131–7.

18. Petchey R, Williams J, Baker M. "Ending up a GP": A qualitative study of junior doctors' perceptions of general practice as a career. Fam Pract. 1997 Jun;14(3):194–8.

19. Anderson DJ. The hidden curriculum. In: American Journal of Roentgenology. AJR Am J Roentgenol; 1992. p. 21–2.

20. Mattsson B, Freeman GK, Coles CR, Schmedlin J. General practice in the undergraduate curriculum: 20 interviews with Southampton final-year students. Med Educ. 1991;25(2):144–50.

21. Hafferty FW. Beyond curriculum reform: Confronting medicine's hidden curriculum. Vol. 73, Academic Medicine. Lippincott Williams and Wilkins; 1998. p. 403–7.

22. Furmedge DS. General practice stigma at medical school and beyond - Do we need to take action? Vol. 58, British Journal of General Practice. Royal College of General Practitioners; 2008. p. 581.

23. Sanfilippo A. Family Medicine and the Hidden Curriculum. 2013.

24. Pfarrwaller E, Sommer J, Chung C, Maisonneuve H, Nendaz M, Junod Perron N, et al. Impact of interventions to increase the proportion of medical students choosing a primary care career: A systematic review. J Gen Intern Med. 2015 Sep;30(9):1349–58.

25. Willoughby KA, Rodríguez C, Boillat M, Dove M, Nugus P, Steinert Y, et al. Assessing students' perceptions of the effects of a new Canadian longitudinal pre-clerkship family medicine experience. Educ Prim Care. 2016;27(3):180–7.

26. Selva Olid A, Zurro AM, Villa JJ, Hijar AM, Tuduri XM, Puime ÁO, et al. Medical students' perceptions and attitudes about family practice: A qualitative research synthesis. BMC Med Educ. 2012 Dec;12(1):81.

27. Shah A, Gasner A, Bracken K, Scott I, Kelly MA, Palombo A. Early generalist placements are associated with family medicine career choice: A systematic review and meta-analysis. Med Educ [Internet]. 2021 Jun 2 [cited 2021 Jun 18];medu.14578. Available from: https://onlinelibrary.wiley.com/doi/10.1111/medu.14578

28. The College of Family Physicians of Canada. Proceedings from the College of Family Physicians of Canada undergraduate education retreat on advancing generalism. Mississauga, ON; 2020.

29. Wright B, Scott I, Woloschuk W, Brenneis F. Career choice of new medical students at three Canadian universities: Family medicine versus specialty medicine. CMAJ. 2004 Jun;170(13):1920–4.

30. Hogenbirk JC, French MG, Timony PE, Strasser RP, Hunt D, Pong RW. Outcomes of the northern Ontario school of medicine's distributed medical education programmes: Protocol for a longitudinal comparative multicohort study. BMJ Open. 2015;5(7).

31. Strasser R, Cheu H. Needs of the many: Northern Ontario school of medicine students' experience of generalism and rural practice. Can Fam Physician. 2018 Jun;64(6):449–55.

32. Osborn HA, Glicksman JT, Brandt MG, Doyle PC, Fung K. Primary care specialty career choice among Canadian medical students: Understanding the factors that influence their decisions. Can Fam Physician. 2017;63(2):e107–13.

33. Scott I, Wright B, Brenneis F, Brett-MacLean P, McCaffrey L. Why would I choose a career in family medicine? Reflections of medical students at 3 universities. Can Fam Physician. 2007 Nov;53(11):1956–7.

34. Naimer S, Press Y, Weissman C, Zisk-Rony RY, Weiss YG, Tandeter H. Medical students' perceptions of a career in family medicine. Isr J Health Policy Res. 2018 Feb;7(1).

Appendix 1.

Surveys

Pre-FME

Demographics

1. E-mail Address:
2. What is your age?:
3. What campus are you on?: Hamilton, Waterloo, Niagara
4. What is your previous educational background?:
5. What is your gender?:
6. What is your marital status?: Single, Serious relationship, Married, Prefer not to say
7. Do you have children?: Yes, No
8. What is your identified race/ethnicity?:
9. What is the population of the town in which you graduated high school?: Large (>100,000), Medium (30,000-99,999), Small (<30,000)
10. What was your household annual income in high school?: >$500,000, $300,000-$499,999, $100,000-$299,999, $50,000-$99,999, <$50,000, Prefer not to say
11. What is your estimated financial debt at the end of medical school?: None, >$30,000, $10,000-$30,000, $1-$9,999, Prefer not to say

Specialties of Interest

1. What are your top specialties of interest?: Rank #1, #2, #3, #4, #5

Anesthesiology, Cardiac Surgery, Dermatology, Diagnostic Radiology, Emergency Medicine, Family Medicine, Family Medicine (+1), General Surgery, Internal Medicine (General), Internal Medicine (Subspecialty), Medical Genetics and Genomics, Medical Microbiology, Neurology, Neurosurgery, Nuclear Medicine, Obstetrics & Gynecology, Ophthalmology, Orthopedic Surgery, Otolaryngology (ENT), Pathology, Pediatrics, Physical Medicine & Rehabilitation, Plastic Surgery, Psychiatry, Public Health & Preventative Medicine, Radiation Oncology, Urology, Vascular Surgery, Unsure

2. How confident are you that your #1 selection will remain the same throughout medical school?: (1, Not confident – 5, Very confident)
3. What are the main factors affecting your specialty choice(s)? [select up to 5]:

Control/Predictability of Schedule, Income, Intellectual Content, Scope of Practice, Length of Training, Future Job Market, Job Flexibility, Availability of Residency Positions, Characteristics of Patient Population, Lifestyle during training, Lifestyle after training, Influence from a resident or attending physician, Perceived work environment, Influence of a personal mentor or family member, Prior knowledge or clinical experience in the specialty, Job satisfaction, Treatment outcomes of the patients, Opportunities to progress or sub-specialize, Gender distribution in specialty, Personal fit into the specialty, Opportunity to perform procedures/techniques, Prestige/status of the specialty

4. What is the most important factor for your #1 specialty selection?:
5. How likely are you to pursue family medicine (FM) in residency?: (1- not at all, 5- definitely)

Post-FME

1. E-mail Address:
2. How valuable was the FME as a learning experience?: (1- not at all, 5- very valuable)
3. How likely are you to pursue family medicine (FM) in residency?: (1- not at all, 5- definitely)
4. What are your top specialties of interest?: Rank #1, #2, #3, #4, #5

Anesthesiology, Cardiac Surgery, Dermatology, Diagnostic Radiology, Emergency Medicine, Family Medicine, Family Medicine (+1), General Surgery, Internal Medicine (General), Internal Medicine (Subspecialty), Medical Genetics and Genomics, Medical Microbiology, Neurology, Neurosurgery, Nuclear Medicine, Obstetrics & Gynecology, Ophthalmology, Orthopedic Surgery, Otolaryngology (ENT), Pathology, Pediatrics, Physical Medicine & Rehabilitation, Plastic Surgery, Psychiatry, Public Health & Preventative Medicine, Radiation Oncology, Urology, Vascular Surgery, Unsure

5. How did the FME affect your perceptions of FM and your likelihood of applying to FM? [2-4 sentences]:

Original Research Article

Factors affecting mental well-being among prolonged hospitalized patients in a tertiary care teaching hospital in Sri Lanka

Hettiarachchige Diluksha Prasad Jayawardana, MBBS

General Sir John Kotelawala defense university hospital, Sri Lanka.

Abstract

Introduction: Mental well-being is an essential component of health. Prolonged hospitalized patients are prone to have alterations in mental wellbeing. So, it is important to study the effects of prolonged hospitalization on the mental well-being of patients as it can affect their disease conditions as well.
Objective: This paper aims to assess the direct and indirect effects of prolonged hospitalization on the mental well-being of patients and to identify how social and environmental factors are involved in this matter.
Method: An observational cross-sectional study was conducted in hospitalized patients admitted to the medical, surgical, and orthopedic wards of the National Hospital of Sri Lanka, using a self-administered questionnaire. Participants were selected using simple random sampling. The categorical variables were described as frequency and percentage, and an ANOVA test was used to compare the level of mental well-being with social and environmental variables. Statistical significance was defined as $p < 0.05$ at 95% confidence interval.
Results: 130 subjects admitted for more than 14 days participated in the research, and they were from general medical wards (33%), orthopedic wards (60.7%), and general surgical wards (6.2%). Among them, 87.7% were hospitalized 14-30 days and 12.3% for more than 30 days. There was no significant association between duration of hospital stay and mental well-being ($p=0.072$). Regarding the source of food, the majority of patients (n=78; 60%) who consumed hospital-cooked food had better mental well-being scores. The better mental well-being scores had a significant association with higher monthly income ($p<0.05$), better hospital environment ($p<0.001$), and alcohol abstention ($p<0.01$). However, there was no significant association between mental well-being and distance from home to hospital ($p=0.081$). After categorizing according to mental well-being score, 14.6% obtained unsatisfactory mental well-being, 30.8% satisfactory mental well-being, and 54.6% very good mental well-being. The results did not show a significant relationship between mental well-being and prolonged hospitalization.
Conclusion: The analysis did not provide evidence of an association between alterations in the mental well-being of patients and the duration of their stay in the hospital. Further studies, such as multi-centric studies, may be needed to validate its results.

Keywords: Mental well-being; prolonged hospitalization; Sri Lanka; orthopedic surgery.

Corresponding Author: dilukshaprasad@gmail.com
Hettiarachchige Diluksha Prasad Jayawardana, 388/21, First Lane, Walawwatta, Kendaliyadapaluwa, Ganemulla, Western Province, Sri Lanka.

Introduction

Mental well-being is defined as a state of well-being in which individuals are coping with stress, working productively and fruitfully, and making contributions to the community within their potential (1). Prolonged hospitalization is defined as being admitted with a chronic disease to the hospital for more than two weeks (2). Experiences with a disability can also cause distress and isolate people from social support. In this regard, being in the hospital for prolonged periods deprives patients of many social, personal, and emotional interactions. Because of that, people living with chronic physical conditions often experience poor mental well-being.

In 2009, a study was done to assess mental well-being among patients with severe chronic obstructive pulmonary disease (COPD) (3). This study found that depressive symptoms were associated with COPD independent of known risk factors, along with worse health and functional status and self-management (3). In this study, we analyze the mental well-being of patients with a broader range of diseases, including asthma, heart disease, trauma, fractures, strokes, and pneumonia. Certain diseases, such as HIV-AIDS and multiple sclerosis (MS), have severe impacts on the brain. According to previous research in HIV-AIDS, approximately 70% of patients develop dementia, depression, or delirium (4-7). At least 50% of MS patients develop depression from the effects of the disease (8). Some chronic physical conditions cause hyperglycemia and disrupt cerebral circulation, which can impact brain function (9). It is known that there is an increasing prevalence of non-communicable diseases (10). Also, the number of patients coping with chronic conditions seems to be growing because of improvements in treatments and increases in survival times, particularly for conditions such as HIV infection and some malignancies (11). Hence there will be increased rates of prolonged hospitalization in the future. Evidence shows that, the more symptomatic the chronic physical condition, the more likely it is that a person will experience mental health issues (12). Thus, it is not surprising that people with chronic physical conditions often self-report poor mental health (13). Therefore, it is important and justifiable to study the mental status of patients with prolonged hospitalization.

If the alterations of a patient's mental well-being are not due to the effects of prolonged hospitalization, it would have been the same even if the patient was at home. However, if it is due to the effects of hospitalization, it can be modified by improvement of hospital settings and provision of patient-friendly medical care. Therefore, this study was undertaken to investigate mental status among prolonged hospitalized patients in a tertiary care teaching hospital and the variables affecting it.

Methods

This was an observational, cross-sectional study conducted in the general medical, general surgical, and orthopedic wards of the National Hospital of Sri Lanka. The number of patients selected from each ward was dependent on the percentage of patient turnover in the relevant ward. Various socio-demographic and clinical information for patients who were admitted and treated as inpatients in the hospital were retrieved. Patients with psychiatric morbidity, reduced conscious level, and acutely ill patients were excluded. A list of bed head ticket (BHT) numbers

of eligible patients was obtained from the respective wards. Power analysis was conducted before data collection to determine the smallest sample size. A total of 130 patients whose age was above 18 years and who were admitted to a ward for two weeks or more were selected using simple random sampling for the final analysis. All study participants provided written informed consent, and the study was approved by the medical ethics committee of the institution.

Data were obtained from the details entered into patients' BHTs, as well as from a self-administered questionnaire. The self-administered questionnaire was prepared in Sinhala, Tamil, and English using simple language without using any technical terms. The different socio-demographic variables including length of hospital stay, disease condition, area of residence, distance from home, occupation, monthly income, food source, alcohol use, home, and hospital environmental condition were collected. Hospital and home environments were further categorized into busy, calm, noisy, and quiet (Figure 1). Mental well-being was estimated using a scoring system ranging from 0-108 (0-42 not satisfactory, 43-63 satisfactory, and 64-108 very good mental well-being) (Appendix 1). Patient Health Questionnaire-9, Warwick Edinburgh Mental Well-being Scale, Oxford Happiness Questionnaire, and Satisfaction with Life questionnaire were used as a guide to develop our mental well-being questionnaire (14-17).

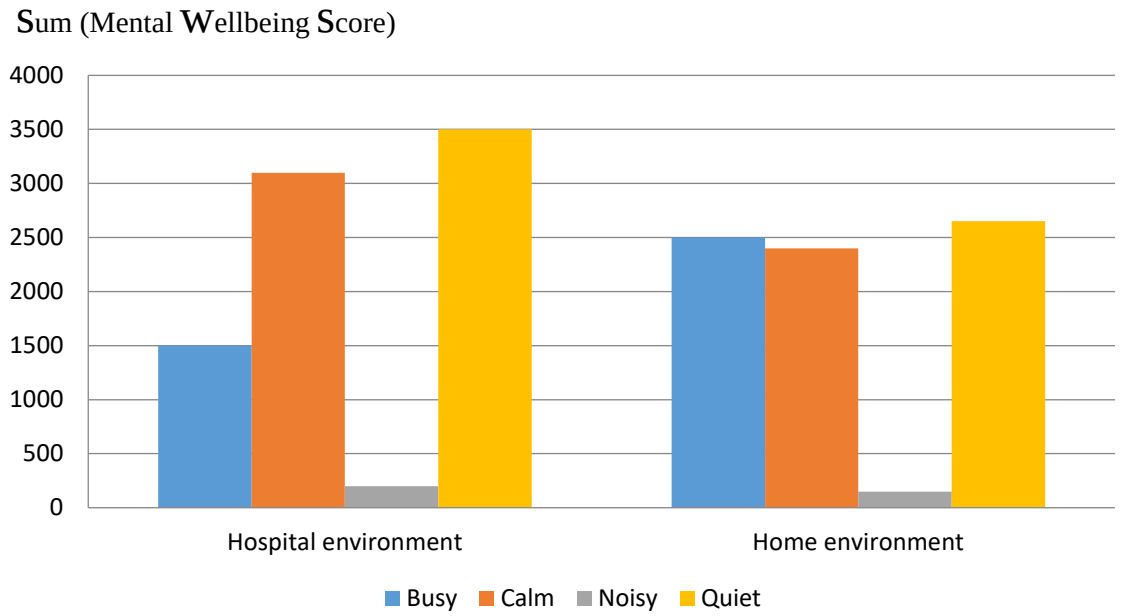

Figure-1. Mental well-being in hospital and home environments

Collected data were first entered into Microsoft Excel (Microsoft Office 2013). After preliminary analysis, data were entered into JASP (Jeffreys's Amazing Statistics Program) version 0.16.1 software for final data analysis. The various categorical variables were described as frequency and percentage using appropriate tables, and the ANOVA test was used to compare level of mental well-being with social and environmental variables. Statistical significance was defined as $P < 0.05$ at 95% confidence interval.

Results

In the present study, out of the total number of patients (n = 130), 33% of patients from general medical wards, 60.7% of patients from orthopedic wards, and 6.2% of patients from general surgical wards participated. Participants' mental well-being was compared based on the duration of hospital stay, disease category, distance from home to hospital, hospital environment, home environment, food source, alcohol use, and monthly family income (Tables 1 and 2). The majority of patients (85.38%) had mental well-being scores of more than 42. Among participants, 87.7% (n=114) were hospitalized for 14 to 30 days and 12.3% (n=16) for more than 30 days. However, there was no statistically significant association between the duration of hospital stay and mental well-being (p=0.072).

Table 1. Comparison of mental well-being according to length of hospital stay, disease category, food source, monthly income, and alcohol use

Variables		**Mental well-being (%)**			**P-value**
		Satisfactory	**Unsatisfactory**	**Very good**	
Length of hospital stay	<1 month(n=114)	33 (28.9%)	17 (14.9%)	64 (56.1%)	0.072
	>1 month(n=16)	7 (43.7%)	2 (12.5%)	7 (43.7%)	
Disease category	Medical (n=43)	13(30.2%)	13(30.2%)	17(39.5%)	0.051
	Surgical (n=8)	3(37.5%)	2(25%)	3(37.5%)	
	Orthopedic(n=79)	24(30.3%)	4(5%)	51(64.5%)	
Food source	Hospital (n=78)	28(35.9%)	10(12.8%)	40(51.3%)	0.066
	Home (n=52)	12(23.1%)	9(17.3%)	31(59.6%)	
Monthly income (LKR)	<5000(n=8)	3(37.5%)	3(37.5%)	2(25%)	0.027
	5000-14999 (n=69)	27(39.1%)	9(13%)	33(47.8%)	
	15000-34999 (n=48)	9(18.7%)	7(14.6%)	32(66.7%)	
	35000-75000 (n=5)	1(20%)	0	4(80%)	
Alcohol use	Yes (n=44)	22(50%)	7(15.9%)	15(34.1%)	< 0.001
	No (n=86)	18(20.9%)	12(14%)	56(65.1%)	

After categorizing diseases into medical, orthopedic, and surgical categories, orthopedic patients had higher mental well-being scores compared to the other two categories. According to this study, even though there was a statistically significant association between having better mental well-being scores and a better hospital environment (p<0.001), there was no such association with a better home environment (p>0.05). Regarding the source of food, the majority of patients (n=78; 60%) who consumed hospital-cooked food had better mental well-being scores. Better mental well-being scores had a statistically significant association with higher monthly income (p<0.05) and alcohol abstinence (p<0.01) (Figures 2 and 3). However, there was no statistically significant association between mental well-being and distance from

Table 2. Statistical analysis of mental well-being score with length of hospital stay, disease category, food source, monthly income, and alcohol use.

Variables		Mean mental well-being score	Standard deviation	95% confidence interval	Effect size
Length of hospital stay	<1 month(n=114)	66.75	24.08	62.3 - 71.2	
	>1month(n=16)	63.43	22.99	52.1- 74.7	0.141
Disease category	Medical (n=43)	56.37	27.31	48.2 - 64.5	
	Surgical (n=8)	57.37	27.15	38.6 - 76.2	0.317
	Orthopedic(n=79)	72.68	19.29	68.4 - 76.9	
Food source	Hospital (n=78)	65.82	23.07	60.7 - 70.9	0.054
	Home (n=52)	67.13	25.28	60.3 - 74	
Monthly income (LKR)	<5000(n=8)	49.25	27.09	30.4 - 68	
	5000-14999(n=69)	64.61	22.96	59.2-70	
	15000-34999(n=48)	70.33	24.23	63.5 - 77.2	
	35000-75000(n=5)	79.40	14.76	66.5 - 92.3	0.249
Alcohol use	Yes (n=44)	59.16	22.53	52.5 - 65.8	0.468
	No (n=86)	70.02	23.85	65 - 75.1	

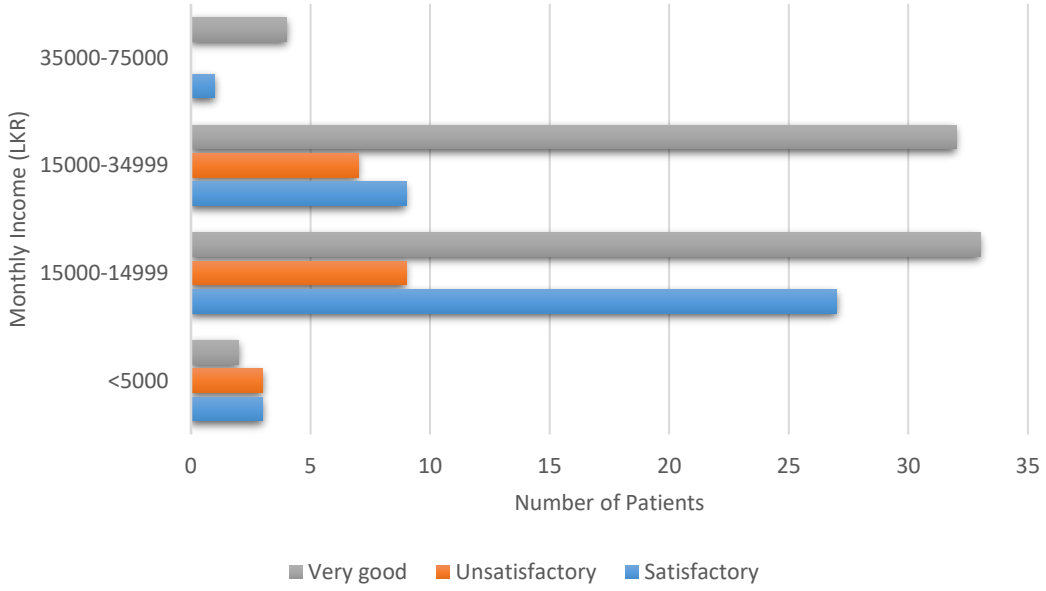

Figure 2. Mental well-being with monthly income

home to hospital (p=0.081) (Figure 4). After categorizing according to mental well-being score, 14.6% of patients obtained unsatisfactory mental well-being scores, 30.8% satisfactory mental well-being, and 54.6% very good mental well-being. Thus, the results did not show a significant relationship between the level of mental well-being and prolonged hospitalization.

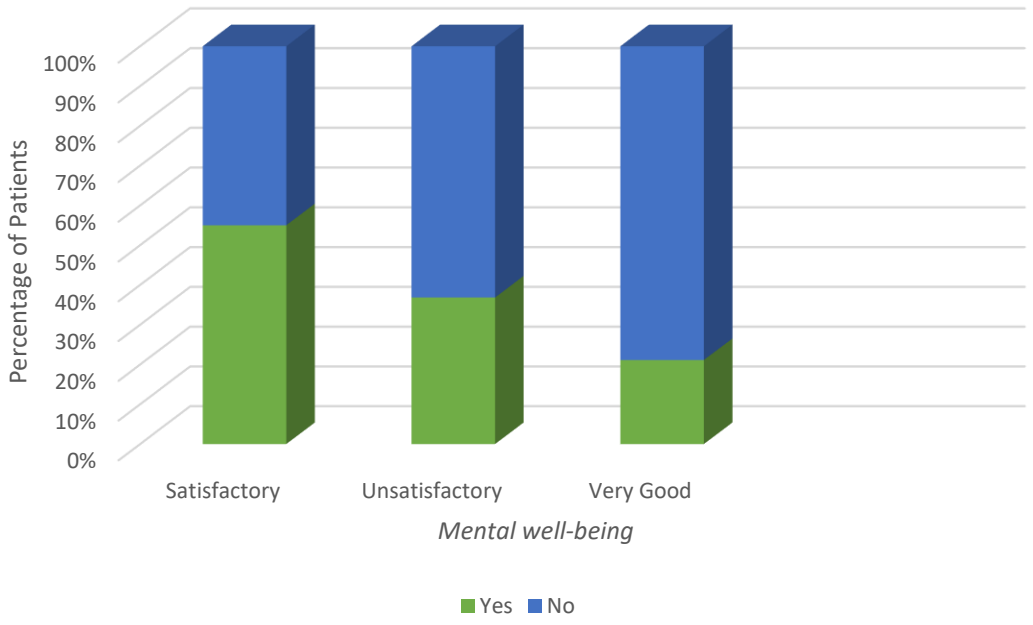

Figure 3. Mental well-being with alcohol use

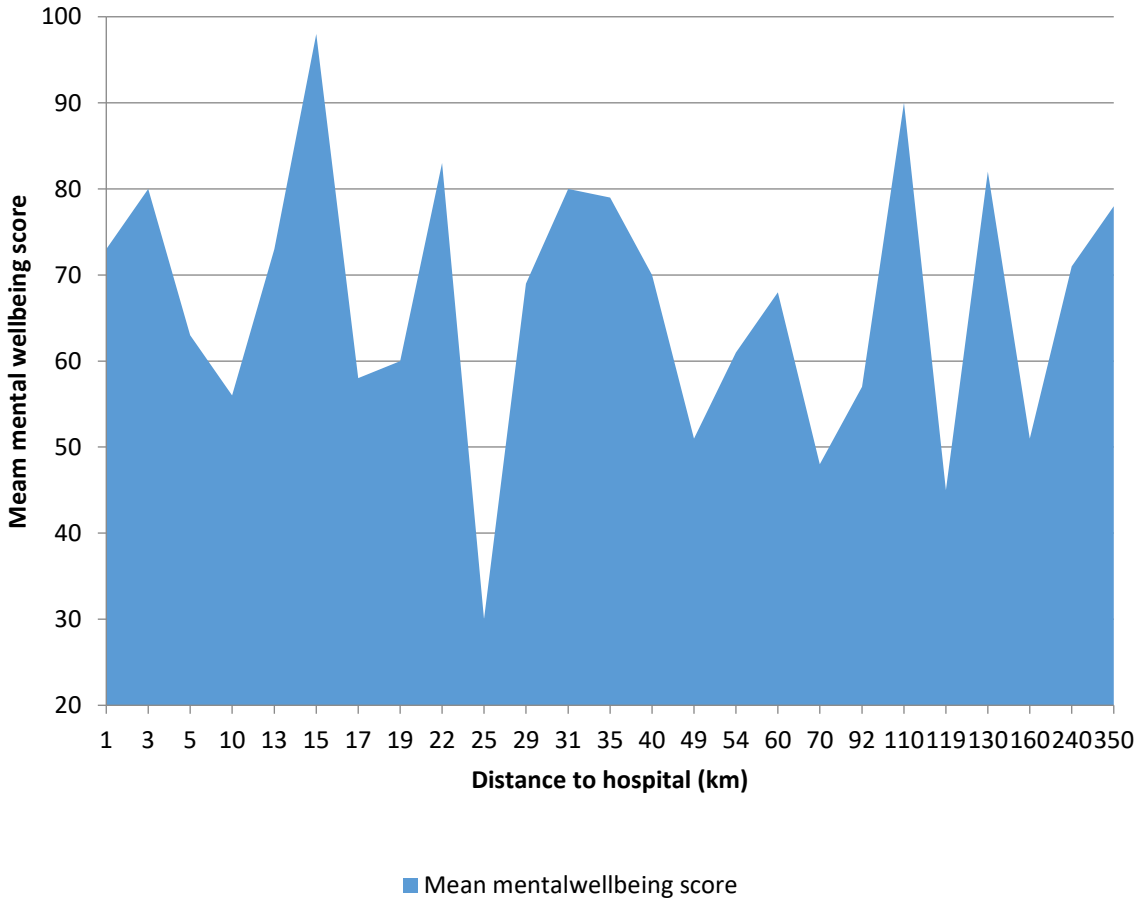

Figure 4. Mental well-being with distance to hospital

Discussion

The main aim of this study was to find out how prolonged hospitalization affects the mental well-being of patients. The results did not show a significant relationship between prolonged hospitalization and mental well-being score, as there were even higher mental well-being scores in patients with longer durations of hospital stay. It was found that patients with the longest hospital stay were mostly orthopedic patients, and they also had the highest mental well-being scores. This could be due to most of them having potentially reversible conditions, such as fractures with internal and external fixations, and they know that they would completely recover eventually. On the contrary, patients in medical wards did not stay in the hospital as long as orthopedic patients. However, most of them had potentially incurable conditions such as systemic lupus erythematosus, stroke, chronic renal failure, etc. They had relatively low mental well-being scores as they know that they will not completely recover. Turner et al. posit depression rates among patients admitted for acute care and among patients with cancer can exceed 30%, compared with a prevalence of depression in the community of about four to eight percent (11). It is clear that, rather than the duration of hospital stay, it is the type of illness that determines mental well-being of patients with prolonged hospitalization.

Only five percent of orthopedic patients had unsatisfactory mental well-being during their hospital stay. In contrast to the results of this study, Bhandari et al. posit one in five orthopedic trauma patients met the criteria for psychological illness following discharge from the hospital (18). Among patients in medical wards, only 30% had unsatisfactory mental well-being. Mental well-being scores of surgical patients stayed between the other two categories, with 25% of them having unsatisfactory mental well-being. So, overall, only 14% of patients had unsatisfactory mental well-being. Therefore, this study concluded that mental well-being of prolonged hospitalized patients is fairly satisfactory. This study also adds that hospital environment, monthly income, and alcohol usage can significantly affect the mental well-being of prolonged hospitalized patients.

A Canadian study showed that mental and physical health are fundamentally linked, and people with chronic physical health conditions experience depression and anxiety at twice the rate of the general population (19). This correlates with the findings of this study, as mental well-being scores are fairly low in patients with chronic medical conditions. Other studies also found that poor physical health brings an increased risk of depression, as do social and relationship problems that are very common among chronically ill patients (20). Similarly, we identified an association between the source of patients' food and their mental wellbeing score, where it was above 42 in patients whose family members brought them food every day, which elaborates the effect of social relationships on mental well-being. We also observed a statistically significant association between monthly income and mental well-being. Possibly, this is because of the ability to bear expenditures during the hospital stay. Similar to this study, Haghparsat-Bidgoli et al. posit the mean length of hospital stay of patients with insurance to be more than patients without insurance (21).

Conclusion

This study assessed factors affecting the mental well-being of prolonged hospitalized patients in a tertiary care hospital in Sri Lanka. The majority of patients with prolonged duration of stay were from orthopedic wards, and those with low mental well-being scores were from medicine wards. The level of mental well-being among orthopedic patients was higher than that of patients in general medical and surgical wards. Further, there was no association between level of mental well-being and length of hospital stay. The main implication of this study was to identify whether there is poor mental well-being in patients with prolonged hospitalization as its prevention will help improve patients' overall health, as health is not just merely being free of physical illnesses.

Limitations and recommendations

The main limitation of the current study was the lack of generalizability of the results, since it is a single institution-based study. Nevertheless, the results are of major importance and significance to the local populations of a developing country like Sri Lanka. Further studies, such as multi-centric studies, may be needed to validate its results.

Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this paper.

Acknowledgements

The author would like to acknowledge the assistance given by the patients included in this study.

References

1. Mental health: Strengthening our response. World Health Organization. Last updated Mar 30, 2018; Access Mar 21, 2022. https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response

2. Moradiya Y, Murthy S, Shah S, Modi S. Risk factors and outcomes of prolonged hospitalization after intracerebral hemorrhage in United States (P7.140). Neurology. 2014;82(10 Supplement):P7.140.

3. Ng TP, Niti M, Fones C, Yap KB, Tan WC. Co-morbid association of depression and COPD: A population-based study. Respir Med. 2009;103(6):895-901.

4. Watkins CC, Treisman GJ. Cognitive impairment in patients with AIDS - Prevalence, and severity. HIV AIDS (Auckl). 2015;7:35-47.

5. Sonneville R, Ferrand H, Tubach F, et al. Neurological complications of HIV infection in critically ill patients: Clinical features and outcomes. J Infect. 2011;62(4):301–308.

6. Cysique LA, Deutsch R, Atkinson JH, et al. Incident major depression does not affect neuropsychological functioning in HIV-infected men. J Int Neuropsychol Soc. 2007;13(1):1–11.

7. Stern Y, McDermott MP, Albert S, et al. Factors associated with incident human immunodeficiency virus-dementia. Arch Neurol. 2001;58(3):473–479.

8. Patten SB, Marrie RA, Carta MG. Depression in multiple sclerosis. Int Rev Psychiatry. 2017;29(5):463-472.

9. D.L. Evans et al., Mood disorders in the medically ill: Scientific review and recommendations. Biol Psychiatry. 2005 Aug;58(3):175-89.

10. Gowshall M, Taylor-Robinson SD. The increasing prevalence of non-communicable diseases in low-middle income countries: The view from Malawi. Int J Gen Med. 2018 Jun;11:255-264.

11. Turner J, Kelly B. Emotional dimensions of chronic disease. West J Med. 2000 Feb;172(2):124-8.

12. Carney CP, Jones L, Woolson RF. Medical comorbidity in women and men with schizophrenia: A population-based controlled study. J Gen Intern Med. 2006 Nov;21(11):1133-7.

13. National Institute of Mental Health.Chronic illness and mental health: Recognizing and treating depression. Last updated 2021; Access Mar 26, 2022. https://www.nimh.nih.gov/health/publications/chronic-illness-mental-health;

14. Patient health questionnaire (PHQ-9). Stanford Medicine. Accessed Mar 21, 2022. https://med.stanford.edu/fastlab/research/imapp/msrs/_jcr_content/main/accordion/accordion_content3/download_256324296/file.res/PHQ9%20id%20date%2008.03.pdf

15. The Warwick-Edinburgh mental wellbeing scales. Info NTD. Last updated 2006; Access Mar 21, 2022. https://www.infontd.org/toolkits/warwick-edinburgh-mental-wellbeing-scale-wemwbs;

16. Oxford happiness questionnaire. Meaning and Happiness.com. Last updated 2008; Access Mar 21, 2022.http://www.meaningandhappiness.com/oxford-happiness-questionnaire/214/;

17. Diener E, Emmons RA, Larsen RJ, Griffin S. The satisfaction with life scale. J Pers Assess.1985;49: 71-75.

18. Bhandari M, Busse JW, Hanson BP, Leece P, Ayeni OR, Schemitsch EH. Psychological distress and quality of life after orthopedic trauma: An observational study. Can J Surg. 2008;51(1):15-22.

19. Canadian Mental Health Association. The relationship between mental health, mental illness, and chronic physical conditions. Last updated 2021; Accessed Dec 26, 2021.https://ontario.cmha.ca/documents/the-relationship-between-mental-health-mental-illness-and-chronic-physical-conditions/;

20. Ohrnberger J, Fichera E, Sutton M. The relationship between physical and mental health: A mediation analysis. Soc Sci Med. 2017;195:42-49.

21. Haghparast-Bidgoli H, Saadat S, Bogg L, Yarmohammadian MH, Hasselberg M. Factors affecting hospital length of stay and hospital charges associated with road traffic-related injuries in Iran. BMC Health Serv Res. 2013;13:281.

Appendix 1

Mental well-being scoring system

Part-1

Please mark (X) in the appropriate column for each question/statement.

0 - None of the time
1 —Rarely
2 - Some of the time
3 — Often
4 –All of the time

	0	1	2	3	4
I've been feeling optimistic about the future					
I've feeling useful					
I've been feeling relaxed					
I've been feeling interested in other people					
I've had the energy to spare					
I've been dealing with problems well					
I've been feeling good about myself					
I've been feeling close to other people					
I've been feeling confident					
I've been able to make up my mind about things					
I've been feeling loved					
I've been interested in new things					
I've been feeling cheerful					

(score= /52)

Part-2

0 - Nearly every day
1 - More than half the days
2 - Several days
3 —Not at all

	0	1	2	3
How often have you been bothered by trouble concentrating on things, such as reading the newspaper or watching television?				
How often have you been bothered by feeling nervous, anxious, or on edge?				
How often have you been bothered by having trouble relaxing?				
How often have you had little interest or pleasure in doing things?				
How often have you been bothered by not being able to stop or control worrying?				
How often have you been bothered by becoming easily annoyed or irritable?				
How often have you been bothered by moving or speaking so slowly that other people could have noticed, or the opposite being so fidgety or restless that you have been moving around a lot more than usual?				
How often have you been bothered by feeling down, depressed or hopeless?				
How often have you been bothered by feeling tired or having little energy?				

How often have you been bothered by being so restless that it is hard to sit still?				
How often have you been bothered by feeling bad about yourself, or that you are a failure, or have let yourself or your family down?				
How often have you been bothered by worrying too much about different things?				
How often have you been bothered by poor appetite or overeating?				
How often have you been bothered by feeling afraid as if something awful might happen?				
How often have you been bothered by trouble falling or staying asleep, or sleeping too much?				

(score= /45)

Part-3

Have you ever been bothered by worrying about any of the following? (underline appropriate)

- Your health (Yes / No)
- Your weight or how you look (Yes / No)
- Little or no sexual desire or pleasure during sex (Yes / No)
- Difficulties with your partner (Yes / No)
- The stress of taking care of family members (Yes / No)
- Stress at work, school, or outside the home (Yes / No)
- By financial problems or worries (Yes / No)
- Something bad that happened recently (Yes / No)

(score= /08)

Total score= /108

Case Report

Immediate breast reconstruction post-mastectomy in a patient with prior breast augmentation mastopexy and lumpectomy with radiation: A case report

Kim Phan (BHSc)[1], Muralie Vignarajah (BSc, MPhil)[1], Chloe Wong (BHSc, MD)[2], Anna Kobylecky (MD)[3], Peter Young (HBSc, MD)[4]

[1]McMaster University, Department of Undergraduate Medicine, Hamilton, Ontario, Canada
[2]University of Toronto, Plastic Surgery, Toronto, Ontario, Canada
[3]St. Catharines General Hospital, General Surgery, St. Catharines, Ontario, Canada
[4]St. Catharines General hospital, Plastic Surgery, St. Catherines, Ontario, Canada

Abstract

Mastectomy for invasive ductal carcinoma can be followed by either immediate or delayed breast reconstruction. Immediate implant reconstruction is more cost-effective, practical, and can provide substantial psychosocial benefits for the patient. However, patients with prior breast surgeries and radiation exposure carry an increased risk of postoperative complications such as mastectomy flap necrosis, and therefore are often not offered the procedure. We present a patient who received mastopexy augmentation followed by lumpectomy with radiation, who then many years later underwent a successful skin-sparing mastectomy with immediate reconstruction. To our knowledge, this is the first study to demonstrate the feasibility of immediate implant-based breast reconstruction following skin-sparing mastectomy in a patient with several prior breast surgeries and radiation exposure to the same breast.

Keywords: Augmentation; immediate reconstruction, invasive ductal carcinoma, mastectomy, mastopexy

Corresponding author: Dr. Peter Young, 211 Martindale Road, St Catharines, ON L2S 3V7
Phone: (905) 988-6153, Fax: (905) 988-6298, pyoungoffice@gmail.com

Introduction

Breast cancer affects one in every eight Canadian women at some point during their lifetime, with invasive ductal carcinoma (IDC) being the most common type (1). Early-stage IDC is often treated with breast conservation surgery and radiation (2). Local cancer recurrence following breast conservation surgery occurs in less than five percent of patients at 10 postoperative years and is frequently managed with surgical mastectomy (2,3). Following mastectomy, a delayed or immediate reconstruction can be performed to re-create the breast mound. Immediate reconstruction is growing in popularity due to reduced overall costs and potentially improved aesthetic outcomes (4). Breast envelope viability is of critical importance for immediate implant reconstruction. Patients with prior breast surgeries and radiation exposure are often not offered the procedure due to fears surrounding postoperative complications, such as mastectomy flap necrosis (5).

We present a 59-year-old female who received mastopexy with augmentation followed by lumpectomy with radiation, who then several years later underwent a successful mastectomy with immediate implant reconstruction. To our knowledge, this is the first documented case of immediate reconstruction following mastectomy in a patient with several prior breast surgeries and radiation exposure.

Case presentation

The patient was a 59-year-old female who underwent mastopexy and augmentation in the late 1990s, with prostheses placed in both breasts. In 2015, the patient was found to have a 1.4 cm mass in her right breast, later characterized as IDC. The patient subsequently underwent a successful right-sided lumpectomy with adjuvant radiation therapy. Two sentinel nodes were identified.

In 2021, the patient presented with a new two-centimeter mass in her right breast. This mass was determined to be HER-2 negative, estrogen receptor-positive, and progesterone receptor-positive IDC. At this time, the patient had no other comorbid conditions. On examination, the patient appeared to have developed a capsular contracture in her right breast and her left breast implant appeared to have ruptured (Figure 1).

Due to her previous periareolar incision from mastopexy and the risk of the compromised vascular supply, it was determined that she would not be a good candidate for nipple-sparing mastectomy. As such, the patient consented to a right-sided skin-sparing mastectomy with sentinel lymph node biopsy followed by immediate reconstruction with permanent implant and placement of AlloDerm, a type of acellular dermal matrix.

For the mastectomy, a right circumareolar incision was made with electrocautery-raised skin flaps. The breast tissue and pectoral fascia were removed from the chest wall using electrocautery and the tumour specimen was excised. Gamma probes were used to direct the dissection of the axilla, where a single sentinel lymph node was identified and excised.

Figure 1. Preoperative imaging showed a right-sided capsular contracture

Following the mastectomy, the pocket was irrigated with bacitracin solution and the lateral border of the pectoralis was elevated, first with blunt dissection and then with a light retractor. A pocket was created in the submuscular plane. The inferior border of the pectoralis was released and a sheet of AlloDerm was used to attach it to the new inframammary fold. The pocket was irrigated, sewn in with 2-0 vicryl, and irrigated again with bacitracin solution. An Allergan Style SSF 560 cc implant was inserted into the submuscular plane and the inferior border of the pectoralis was attached to the superior border of the AlloDerm. A 1/4 Blake was inserted through a separate site and was sewn in. 3-0 monocryl was used for subcutaneous, deep dermal, and skin closure. Incisions were covered with mastisol, steri-strips, and dry gauze.

The patient was seen in follow-up after one week and had her drain removed. After two weeks the patient developed a small seroma (Figures 2 and 3). The seroma was aspirated (approximately 20mL) and no other complications were noted postoperatively.

Discussion

Following mastectomy, an immediate or delayed implant reconstruction can be performed. The rates of immediate breast reconstruction following mastectomy are increasing, partially due to reduced overall costs, reduced number of patient days spent in hospital, increased psychosocial benefit to the patient, and potentially increased aesthetic outcomes (4,6). Delayed implant reconstruction also frequently requires the use of tissue expanders, which can require several outpatient follow-up visits.

A potential drawback of immediate reconstruction is the increased risk of postoperative complications. Immediate implant reconstruction, when compared to delayed reconstruction, carries an increased rate of surgical site infections and non-infectious wound complications (6).

Figure 2. Anterior view of right breast at two weeks follow-up. Small seroma noted along the inferior border of the right breast.

Figure 3. Lateral view of right breast at two weeks follow-up. Small seroma noted along the inferior border of the right breast.

Wound complications, such as tissue necrosis or dehiscence, following reconstruction can necessitate repeat surgical interventions and may delay adjuvant cancer treatments (6). Patients with prior lumpectomy and radiation who undergo immediate reconstruction are also thought to have increased rates of mastectomy skin flap loss (5,7). Mastectomy skin flap necrosis can affect aesthetic outcomes and may introduce infection, which may necessitate implant removal (4). Thus, due to concerns surrounding postoperative complications, patients with prior breast procedures and radiation are not usually offered immediate breast reconstructions.

Regarding our patient's past surgical history, breast augmentation mastopexy carries a risk of implant or nipple malposition and poor scarring (8). This procedure can also lead to breast envelope thinning, which may further decrease envelope viability for further surgical interventions. In addition, the patient's prior radiation exposure can cause fibrosis and decreased skin elasticity, which may lead to worsened aesthetic outcomes (4).

Despite the potential risks of her surgical procedure, the only postoperative complication in our patient was a small seroma formation. To our knowledge, there have been no other reports of a patient with several prior breast surgeries and radiation exposure who underwent a successful mastectomy with immediate implant reconstruction. The success of this operation may be partially attributable to the patient's lack of comorbid conditions. Nevertheless, we have demonstrated that prior breast surgeries and radiation exposure may not need to act as a barrier for mastectomy and immediate reconstruction. Further research is required to assess the feasibility of immediate implant reconstruction in the broader population of patients with prior breast procedures and radiation.

Conclusion

We present a patient with a history of breast augmentation mastopexy and lumpectomy with radiation who successfully underwent a right-sided skin-sparing mastectomy with immediate implant reconstruction. This report raises awareness for the possibility of immediate reconstruction following mastectomy in patients with prior breast surgeries and radiation exposure.

References

1. Lagacé F, Ghazawi FM, Le M, Rahme E, Savin E, Zubarev A, et al. Analysis of incidence, mortality trends, and geographic distribution of breast cancer patients in Canada. Breast Cancer Res Treat. 2019;178(3):683–91.

2. O'Sullivan CC, Loprinzi CL, Haddad TC. Updates in the evaluation and management of breast cancer. Mayo Clin Proc. 2018;93(6):794–807.

3. Walstra CJEF, Schipper R-J, Poodt IGM, van Riet YE, Voogd AC, van der Sangen MJC, et al. Repeat breast-conserving therapy for ipsilateral breast cancer recurrence: A systematic review. Eur J Surg Oncol. 2019;45(8):1317–27.

4. Chevray PM. Timing of breast reconstruction: Immediate versus delayed. Cancer J. 2008;14(4): 223-9.

5. Cordeiro PG, Snell L, Heerdt A, McCarthy C. Immediate tissue expander/implant breast reconstruction after salvage mastectomy for cancer recurrence following lumpectomy/irradiation. Plast Reconstr Surg. 2012;129(2):341-50.

6. Olsen MA, Nickel KB, Fox IK, Margenthaler JA, Wallace AE, Fraser VJ. Comparison of wound complications after immediate, delayed, and secondary breast reconstruction procedures. JAMA Surg. 2017;152(9):e172338.

7. Khansa I, Colakoglu S, Curtis MS, Yueh JH, Ogunleye A, Tobias AM, et al. Postmastectomy breast reconstruction after previous lumpectomy and radiation therapy: Analysis of complications and satisfaction. Ann Plast Surg. 2011;66(5):444-51.

8. Spear SL, Dayan JH, Clemens MW. Augmentation mastopexy. Clin Plast Surg. 2009;36(1):105–15.

Case Report

Knee pain: A diagnostic dilemma

Hettiarachchige Diluksha Prasad Jayawardana

Sri Jayewardenepura General Hospital, University of Sri Jayewardenepura, Sri Lanka.

Abstract

Tears of the anterior cruciate ligament (ACL) are common among athletes. We present the case of a 17-year-old Asian male rugby player with a one-year history of undiagnosed traumatic right knee pain. On physical examination, range of motion (ROM) of the right knee was restricted. There were neither gross deformities nor tenderness elicited on palpation. Magnetic resonance imaging (MRI) revealed a complete tear of the right ACL and a bucket handle tear of the anterior horn of the medial meniscus. Arthroscopic reconstruction of the ACL was performed, and the patient engaged in regular physical therapy post-operatively. This case demonstrates that skilled clinical assessment, advanced imaging, and diagnostic arthroscopy can facilitate the early detection of ACL and meniscal injuries to ensure timely and appropriate treatment. In order to minimize individual patient and healthcare system burdens, it is essential to develop and implement a primary care decision protocol and a follow-up protocol with appropriate referral criteria to diagnose and manage ACL and meniscal injuries.

Keywords: Anterior cruciate ligament; meniscus; magnetic resonance imaging; arthroscopy; primary Care

Corresponding author: *dilukshaprasad@gmail.com*

Introduction

Orthopaedic surgeons commonly encounter knee pain in practice. The most common knee pathologies include meniscal tears, loose bodies, and synovial, ligamentous, and articular cartilaginous injuries. Among them, anterior cruciate ligament (ACL) injuries are the most common ligamentous injury of the knee, especially in athletes participating in sports involving jumping or pivoting movements (1). ACL injuries often lead to instability in valgus and external rotation, and also to anteromedial instability of the knee. Since ACL injuries have poor healing potential, undiagnosed ACL injuries can increase stress on the menisci and can damage articular cartilage over time (2). Therefore, early detection of ACL injuries is important, especially in younger patient populations.

Assessment of patients presenting with knee pain or instability begins with a full history and a comprehensive physical examination (3,4). Advanced imaging modalities should also be considered. Although computed tomography (CT) imaging is the modality of choice for evaluating bony lesions, magnetic resonance imaging (MRI) allows for fast, non-invasive imaging of intraarticular soft tissue pathologies (5). However, some abnormalities detected on MRI are normal variants between individuals or can be artifacts rather than true pathology (6,7).

Arthroscopy is the most common orthopaedic surgical procedure for diagnosis and treatment of various knee pathologies (8). Arthroscopy is a minimally invasive procedure that allows visualization and evaluation of intraarticular anatomy. As a result, arthroscopy has become the gold standard technique for definitive diagnosis of ACL and meniscal injuries (5). This case report presents a 17-year-old male patient with chronic knee pain who underwent arthroscopic ACL repair. It highlights the importance of early detection and accurate diagnosis of ACL and meniscal injuries in primary care settings.

The case

A 17-year-old, otherwise healthy, Asian male rugby player presented to the emergency department with right knee pain and instability. He reported that the pain started 12 months prior, following a traumatic injury during a rugby training session where he collided face-to-face with an opponent while running to catch a high ball. He fell backward, hyperextended his right knee, and hit his head against the ground. He did not lose consciousness. However, immediately following the incident, he experienced intense right knee pain. He was subsequently unable to bear weight on it. He presented to his local primary care clinic with an oedematous and unstable right knee. Radiographs revealed no fractures. Recommendations for management included analgesia and taping. He subsequently went home with no follow-up.

He found these initial recommendations inadequate, and consequently pursued physical therapy to improve stability of the joint. Five months later, he presented to the same clinic with recurrent subluxation and persistent moderate pain of the right knee without further trauma. Pain was exacerbated by bending the knee or squatting. He was prescribed isometric knee exercises and further analgesia. No additional follow-up was arranged.

Despite conservative treatment, pain and instability progressively worsened. He was unable to participate in training sessions or tournaments, and he had trouble with day-to-day activities. As a result, he explored alternative therapies, including Ayurvedic remedies and acupuncture, which provided no relief. This patient did not have any significant past medical or surgical history. He did not report any allergies, medications, or substance use, either.

He was seen in the emergency department 12 months after the initial trauma. On assessment, antalgic gait was observed—he hesitated to flex and bear weight on his right knee. Physical examination revealed no gross deformities, erythema, or oedema of the right knee joint. There was no tenderness on palpation over the medial and lateral joint lines, patellar tendon, popliteal fossa, or distal iliotibial insertion. Active left knee flexion ROM was 140°, while active right knee flexion ROM was limited to 70° due to pain. ACL injury was suspected due to a positive anterior drawer test and positive Lachman's test. Suspicion for a PCL injury was low due to a negative posterior sag sign. The stroke test for effusion, valgus and varus stress tests for collateral ligament injuries, McMurray test for meniscal injuries, and subluxation suppression test for subluxation of the patella were all negative. Neurovascular examination of both lower extremities was normal.

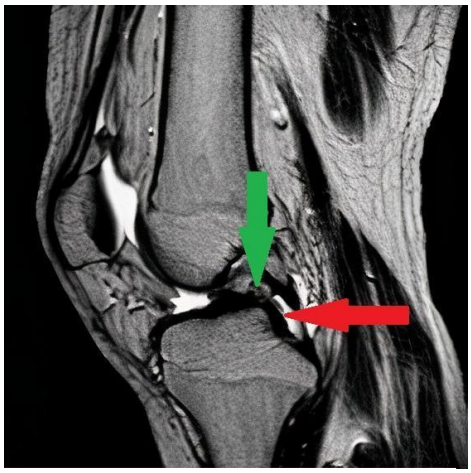

Figure 1. MRI demonstrating bucket handle tear of the anterior horn of medial meniscus (red arrow), complete tear of the right ACL (green arrow), anterior translocation of tibia compared to femur, and joint effusion.

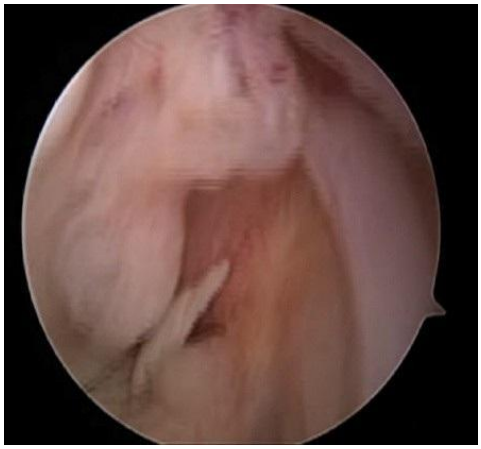

Figure 2. Arthroscopic view of the torn ACL.

Due to a high index of suspicion for an ACL injury, an urgent right knee MRI was performed three days later. MRI revealed a complete tear of the right ACL, a bucket handle tear of the anterior horn of the medial meniscus, anterior translocation of the tibia relative to the femur, and joint effusion (Figure 1). Arthroscopic ACL and meniscal repair were offered. Consent for the procedure was obtained and the operation proceeded one week later.

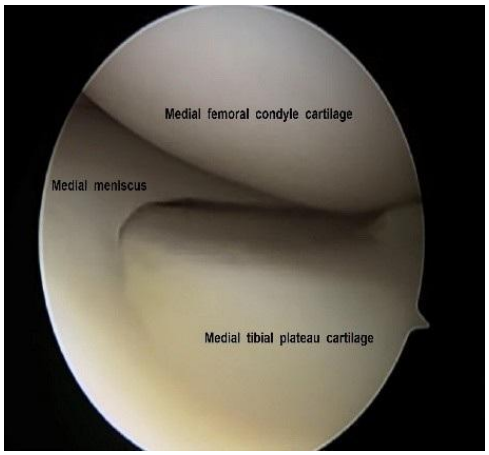

Figure 3. Arthroscopic view of the medial meniscus.

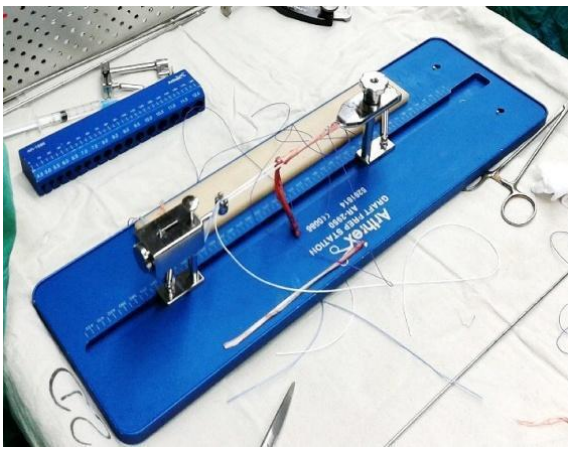

Figure 4. 9 × 80 mm tendon graft.

Diagnostic arthroscopy confirmed a complete tear of the right ACL (Figure 2). However, no bucket handle tear of the medial meniscus was seen (Figure 3). Ipsilateral semitendinosus and gracilis tendons were harvested and the right ACL was reconstructed by placing a 9 × 80 mm autologous tendon graft (Figure 4). A brace was prescribed postoperatively for 12 weeks.

The patient was discharged the following day after experiencing no postoperative complications and was scheduled for follow-up with physical therapy. Partial and then full weight-bearing were permitted nine and 11 weeks postoperatively, respectively. Six months of physical rehabilitation were successfully completed. He was asymptomatic and was able to return to sport. The rehabilitated knee demonstrated nearly the same functional parameters as the healthy knee (Table 1).

Table 1. Clinical evaluation of the right knee joint before surgery and at final follow-up

Test	Preoperative	6 months postoperative
Anterior drawer test	+3	+1
Lachman's test	+3	+1

Discussion

Primary care physicians often encounter musculoskeletal complaints. ACL injuries represent about 4% of all knee joint pathologies in primary care settings (9). However, only about 6.8 to 28.2% of patients with ACL injuries are accurately diagnosed (10,11). Therefore, patients are often required to consult with multiple healthcare providers before being diagnosed correctly. This delays rehabilitation or surgical management, as seen in this patient (11,12).

Typically, diagnosis of an ACL tear is achieved by considering various factors. It is important to consider the mechanism of injury. A clinician must consider hyperextension, hyperflexion, pivoting, valgus or varus motions, and whether the trauma was contact or non-contact. It is also important to consider what the patient experienced at the time of injury. This includes hearing or feeling a "pop", immediate or delayed pain and swelling, knee catching, locking or instability, inability to return to activity, or inability to weight-bear. Other important aspects of the clinical picture include pain localization, inspection, palpation, and outcomes of special tests (10,13). Attaining a detailed history of a sport-related traumatic event is imperative for the diagnosis of some ACL tears (14). For example, increased age and a family history of an ACL tear may increase risk for ACL tears (15). The anterior drawer test, Lachman test, and McMurray test are special clinical examination manoeuvres that can be utilized to aid in the diagnosis and differentiation of ACL and meniscal tears (16). The sensitivity and specificity of these special tests are found in Table 2 (17). However, it may be difficult to elicit positive physical signs in an acute presentation due to pain, swelling, and muscle guarding. This can contribute to inconclusive diagnoses. However, since this patient presented almost one-year post-trauma, a comprehensive physical examination was able to be performed, and an ACL injury was confirmed with MRI and arthroscopy.

Table 2: Sensitivity and specificity of special tests of the knee joint (17).

Special tests	Pathology		Sensitivity (%)	Specificity (%)
Anterior drawer	Anterior cruciate ligament tear		92	91
Lachman's	Anterior cruciate ligament tear		76–98	89–96
McMurray	Meniscal tear	Medial	86	73
		Lateral	56	95

Radiological assessment of the knee joint is often initiated with plain radiographs to rule out fractures. Segond fractures, lipohaemarthroses, and avulsions from the tibial spines are some radiographic findings consistent with ACL injuries (18). These changes can be missed in primary care settings before imaging is acquired. Additionally, plain radiographs may have limited diagnostic value unless an injury is caused by direct impact to the knee joint (19). In contrast to conventional CT scans, which can detect bony injuries such as tibial plateau fractures or osteochondral injuries, CT arthrography is effective at evaluating soft-tissue structures and identifying abnormalities such as ACL and meniscal injuries (20). MRI has better soft-tissue resolution and is usually performed as an initial non-invasive diagnostic modality to evaluate intra-articular soft tissue structures. The diagnostic accuracy of MRI for identifying a full-thickness ACL tear (sensitivity 77–96%, specificity 93–100%) is superior to identification of medial (sensitivity 47–76%, specificity 52–95%) and lateral (sensitivity 61–100%, specificity 75–92%) meniscal injuries (17). Preoperative MRI should be performed as part of

comprehensive surgical planning before performing arthroscopy (21,22). MRI should also be considered for more equivocal, difficult, or complex knee injuries (23). Therefore, this patient was an ideal candidate for MRI. If the primary care physician had requested MRI at the initial or subsequent presentation, the ACL injury and underlying pathologies would have been detected earlier. Although some abnormalities detected on MRI are true pathologies seen during arthroscopic evaluation, other abnormalities can be normal variants or artifacts (6,7). These cases may be due to poor quality of the MRI magnets, metallic artifacts, or positional changes of the patient during imaging.

The accuracy of diagnosing full-thickness ACL tears using clinical examination is high when performed by a physician with advanced orthopaedic training (sensitivity 77–99%, specificity 73–100%) (24). This patient initially presented to a primary care physician, who may not have had this level of training. This may have contributed to the delay in his diagnosis. However, similar to other cases with uncertain diagnoses, primary care physicians should follow up with patients at least until they show clinical improvement. This case highlights the need to implement proper follow-up protocols for patients with traumatic knee injuries.

Treatment options for traumatic ACL rupture include conservative management, ACL repair, and ACL reconstruction. Conservative management of ACL tears includes formal physical therapy to strengthen the muscles that help stabilize the knee (25). ACL repair can be performed by re-approximating the ruptured ends of the native ACL with the use of suture anchors (26). Conversely, ACL reconstruction is characterized by debriding the torn end of the native ACL and reconstructing a new ligament using grafts harvested from the hamstring tendon, quadriceps tendon, or patellar tendon (26). Arthroscopy is a common diagnostic and therapeutic modality performed by orthopaedic surgeons for ACL and meniscal injuries. It offers real-time visualization of the joint cavity. In-office needle arthroscopy, a newer technique, allows orthopaedists safe, cost-effective, and accurate diagnosis with low risk for post-surgical complications (27). Patients with ACL injuries should be referred to an orthopaedic surgeon if they have recurrent giving-way episodes, intent to resume high-intensity activity, concomitant meniscal or collateral ligament damage, or lack of success with conservative treatment (28,29). This patient had undergone five months of physical therapy without improvement. He was a young patient with recurrent subluxation of the right knee and planned to resume playing rugby. Therefore, he fit these criteria for a referral to an orthopaedic surgeon in order to prevent delays in assessment for surgical intervention.

Early and accurate diagnosis is vital to ensure timely and appropriate treatment to improve both immediate (e.g., return to work, return to sport) and long-term (e.g., physical activity) outcomes (30). Misdiagnosis can lead to reduced mobility, physical inactivity, delayed return to work/sport, obesity, and an increased risk of subsequent knee pathologies such as meniscal tears or post-traumatic osteoarthritis (10,31-35). Therefore, primary care physicians have an active role in accurate diagnosis of ACL tears early after an injury, or to establish a high degree of suspicion in order to refer to specialists. This case report demonstrates the importance of developing and implementing a primary care clinical decision protocol to improve the

efficiency of ACL and meniscal injuries diagnosis, and triaging patients to the most appropriate diagnostic or therapeutic modality.

Conclusion

Missed or falsely diagnosed ACL tears may result in delayed or misdirected rehabilitation, physician visits, or diagnostic imaging. Skilled clinical assessment, appropriate imaging, and diagnostic arthroscopy, if indicated, facilitate the early detection of ACL and meniscal injuries. Therefore, it is essential to develop and implement primary care decision protocols, regular follow-up protocols, and clear referral criteria to diagnose ACL and meniscal injuries promptly and accurately in order to minimize individual patient and healthcare system burden.

Limitations and Recommendations

The foremost limitation of this case report is the inability to make specific diagnostic guidelines, follow-up protocols, and referral criteria in primary care settings based on a single patient's experience. Further studies are required to design these standardized tools for patients with ACL and/or meniscal injuries.

Acknowledgments

The author would like to acknowledge the patient for his support and cooperation with this case report.

Conflicts of Interest

The author declares no conflict of interest regarding this case report.

References

1. Barber-Westin SD, Noyes FR. Factors used to determine return to unrestricted sports activities after anterior cruciate ligament reconstruction. Arthroscopy. 2011 Dec;27(12):1697–1705.

2. Arnoldi AP, Weckbach S, Nussbickel C, Horng A, Nobauer I, Zysk S, et al. MRI based volumetric assessment of knee cartilage after ACL–reconstruction, correlated with qualitative morphologic changes in the joint and with clinical outcome. Is there evidence for early posttraumatic degeneration?. Rofo. 2011 Dec 28;183(12):1138-1144.

3. Shea KG, Carey JL, Richmond J, Sandmeier R, Pitts RT, Polousky JD, et al. The American Academy of Orthopaedic Surgeons evidence-based guideline on management of anterior cruciate ligament injuries. J Bone Joint Surg Am. 2015 May;97(8):672–674.

4. Meuffels DE, Poldervaart MT, Diercks RL, Fievez AW, Patt TW, Hart CP, et al. Guideline on anterior cruciate ligament injury. Acta Orthop. 2012 Aug;83(4):379–386.

5. Bari AA, Kashikar SV, Lakhkar BN, Ahsan MS. Evaluation of MRI versus arthroscopy in anterior cruciate ligament and meniscal injuries. J Clin Diagn Res. 2014 Dec;8(12):RC14–18.

6. Fox MG. MR imaging of the meniscus: review, current trends, and clinical implications. Magn Reson Imaging Clin N Am. 2007 Feb;15(1):103–123.

7. Sproule JA, Khan F, Rice JJ, Nicholson P, McElwain JP. Altered signal intensity in the posterior horn of the medial meniscus: an MR finding of questionable significance. Arch Orthop Trauma Surg. 2005 May;125(4):267–271.

8. Treuting R. Minimally invasive orthopedic surgery: arthroscopy. Ochsner J. 2000 Jul;2(3):158–163.

9. Jackson JL, O'Malley PG, Kroenke K. Evaluation of acute knee pain in primary care. Ann Intern Med. 2003 Oct;139(7):575–588.

10. Arastu MH, Grange S, Twyman R. Prevalence and consequences of delayed diagnosis of anterior cruciate ligament ruptures. Knee Surg Sports Traumatol Arthrosc. 2015 Apr;23(4):1201–1205.

11. Parwaiz H, Teo AQ, Servant C. Anterior cruciate ligament injury: A persistently difficult diagnosis. Knee. 2016 Jan;23(1):116–120.

12. Hartnett N, Tregonning RJ. Delay in diagnosis of anterior cruciate ligament injury in sport. N Z Med J. 2001 Jan;114(1124):11–13.

13. Rayan F, Bhonsle S, Shukla DD. Clinical, MRI, and arthroscopic correlation in meniscal and anterior cruciate ligament injuries. Int Orthop. 2009 Feb;33(1):129–132.

14. Decary S, Fallaha M, Belzile S, Martel-Pelletier J, Pelletier JP, Feldman D, et al. Clinical diagnosis of partial or complete anterior cruciate ligament tears using patients' history elements and physical examination tests. PLoS One. 2018 Jun;13(6):e0198797.

15. Whittaker JL, Chan M, Pan B, Hassan I, Defreitas T, Hui C, Macedo L, Otto D. Towards improving the identification of anterior cruciate ligament tears in primary point-of-care settings. BMC Musculoskelet Disord. 2020 Apr;21(252):1-11.

16. Kopkow C, Lange T, Hoyer A, Lützner J, Schmitt J. Physical tests for diagnosing anterior cruciate ligament rupture. Cochrane Database Syst Rev. 2018 Dec;12:CD011925.

17. Slaughter AJ, Reynolds KA, Jambhekar K, David RM, Hasan SA, Pandey T. Clinical orthopedic examination findings in the lower extremity: Correlation with imaging studies and diagnostic efficacy. Radiographics. 2014 Mar–Apr;34(2):e41–55.

18. Fulcher M. Can we diagnose ACL injuries based on x-ray findings alone? [Internet]. [Place unknown]: Axis; 2021 Aug [cited 7 May 2022]. Available from: https://www.axissportsmedicine.co.nz/blog/can-we-diagnose-acl-injuries-based-on-x-ray-findings-alone

19. McNally EG. Magnetic resonance imaging of the knee. BMJ. 2002 Jul;325(7356):115–116.

20. Lee W, Kim HS, Kim SJ, Kim HH, Chung JW, Kang HS, et al. CT arthrography and virtual arthroscopy in the diagnosis of the anterior cruciate ligament and meniscal abnormalities of the knee joint. Korean J Radiol. 2004 Jan–Mar;5(1):47–54.

21. Crawford R, Walley G, Bridgman S, Maffulli N. Magnetic resonance imaging versus arthroscopy in the diagnosis of knee pathology, concentrating on meniscal lesions and ACL tears: a systematic review. Br Med Bull. 2007 Feb;84(1):5–23.

22. Elvenes J, Jerome CP, Reikeras O, Johansen O. Magnetic resonance imaging as a screening procedure to avoid arthroscopy for meniscal tears. Arch Orthop Trauma Surg. 2000 Jan;120(1–2):14–16.

23. MRI of the knee for meniscal and anterior cruciate ligament tears [Internet]. Australia: Royal Australian College of General Practitioners; 2013 [cited 2022 May 7]. Available from: https://www.racgp.org.au/getattachment/a1896e29-991c-4bde-afdf-a7dcb921cd18/Summary-sheet-MRI-of-the-knee-for-meniscal-and-anterior-cruciate-ligament-tears.pdf.aspx

24. Rayan F, Bhonsle S, Shukla DD. Clinical, MRI, and arthroscopic correlation in meniscal and anterior cruciate ligament injuries. Int Orthop. 2009 Feb;33(1):129–132.

25. ACL Non-Operative Protocol. [Internet]. Boston (MA): South Shore Orthopedics; [cited 2022 May 7]. Available from: https://southshoreorthopedics.com/wp-content/uploads/2016/12/ACL_non-operative_managment.pdf

26. Kiapour AM, Murray MM. Basic science of anterior cruciate ligament injury and repair. Bone Joint Res. 2014 Feb;3(2):20–31.

27. Baeten D, Van den Bosch F, Elewaut D, Stuer A, Veys EM, De Keyser F. Needle arthroscopy of the knee with synovial biopsy sampling: Technical experience in 150 patients. Clin Rheumatol. 1999 Nov;18(6):434–441.

28. Alford JW, Bach BR,JR. Managing ACL tears: When to treat, when to refer. J. Musculoskel Med. 2004 Oct;21:520–526.

29. Cimino F, Volk BS, Setter D. Anterior cruciate ligament injury: Diagnosis, management, and prevention. Am Fam Physician. 2010 Oct;82(8):917–922.

30. Filbay SR, Roos EM, Frobell RB, Roemer F, Ranstam J, Lohmander LS. Delaying ACL reconstruction and treating with exercise therapy alone may alter prognostic factors for 5-year outcome: An exploratory analysis of the KANON trial. Br J Sports Med. 2017 May;51(22):1622–1629.

31. Whittaker JL, Toomey CM, Nettel-Aguirre A, Jaremko JL, Doyle-Baker PK, Woodhouse LJ, et al. Health-related outcomes following a youth sport-related knee injury. Med Sci Sports Exerc. 2018 Sep;51(2):255–263.

32. Paterno MV, Rauh MJ, Schmitt LC, Ford KR, Hewett TE. Incidence of contralateral and ipsilateral anterior cruciate ligament (ACL) injury after primary ACL reconstruction and return to sport. Clin J Sport Med. 2012 Mar;22(2):116–121.

33. Toomey CM, Whittaker JL, Nettel-Aguirre A, Reimer RA, Woodhouse LJ, Ghali B, et al. Higher fat mass is associated with a history of knee injury in youth sport. J Orthop Sports Phys Ther. 2017 Feb;47(2):80–87.

34. Ajuied A, Wong F, Smith C, Norris M, Earnshaw P, Back D, et al. Anterior cruciate ligament injury and radiologic progression of knee osteoarthritis: A systematic review and meta-analysis. Am J Sports Med. 2014 Sep;42(9):2242–2252.

35. Sanders TL, Kremers HM, Bryan AJ, Fruth KM, Larson DR, Pareek A, et al. Is anterior cruciate ligament reconstruction effective in preventing secondary meniscal tears and osteoarthritis? Am J Sports Med. 2016 Jul;44(7):1699–1707.

Commentary

Managing the influx: A peer-led session on communication and professionalism in medicine

Colin Whaley MSc[1], Bradley Murphy BSc PharmD[1], Connie Li BSc (Hons)[1], Amanda Bell MD, MSc, CCFP, FCFP[1,2]

[1]Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Canada
[2]Niagara Regional Campus, Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Canada

Abstract

As student leaders in the undergraduate MD Program at McMaster, we saw our classmates experiencing challenges in the areas of communication and professionalism. One of several key domains highlighted in undergraduate medical curricula and frameworks, including CanMEDS, is the development of professional identity. To meet these expectations, core competencies such as communication are crucial for effective future practice with patients and colleagues. In response, we set out to create a novel addition to the McMaster undergraduate medical curriculum through the creation of a student-led teaching session delivered to the incoming MD Program class. We addressed two main aspects: appropriately receiving and integrating new information provided, and efficiently retrieving existing information. The aim of our session was to minimize unnecessary communications within class group chats, frustration from administration around missed deadlines, and student burnout created by the increased administrative burden. We explain the process of developing this peer-led session on professionalism and provide a figure to help fellow students develop their communication and professionalism skills. The session met its stated goal of introducing students to some strategies to promote clear, effective communication.

Keywords: Medical education; professionalism; communication; peer-led initiatives

Corresponding author: research@whaley.ca

Introduction

Undergraduate medical curricula and frameworks, including CanMEDS, have established expectations for developing a professional identity (1). Core competencies such as communication are crucial for effective future practice with patients and colleagues.

Our (B.M., C.L., C.W.) roles on McMaster University's undergraduate medical education (UGME) committees enabled us to identify areas in which our classmates experienced communication and professionalism challenges. In previous work, students are thought of as knowledge workers, subject to many competing demands on their time away from their core task of learning medicine (2). We observed struggles with two aspects of communication management: 1) appropriately receiving and integrating new information provided; and 2) retrieving existing information. In our experience, these challenges have led to unnecessary communications within our class group chat, frustration from program leadership around missed deadlines, and have possibly contributed to student burnout.

We felt that skills around information location and management were not explicitly taught to our class. We believe that improvements can be made in professional development, especially in intra-classmate communication (i.e., group chats) and intra-program communication (i.e., managing emails from UGME faculty and staff). This commentary addresses an initiative led by B.M., C.L., and C.W. to support the incoming MD Program class in gaining skills in these areas.

The Initiative

We aimed to provide professionalism education through student-led teaching as an addition to the McMaster UGME curriculum. Student leaders occupy a unique niche within medical education: they receive the delivery of the formal curriculum, but also simultaneously gain insight into hidden curriculum through experience (3). As a result, upper-year students offer valuable insight into the medical training process by passing on their experience to incoming students. New students also look to upper-year students for advice and specific suggestions. In their role as upper-year medical students, they are able to act as mentors and model professional behaviours (4).

In the development of this session, we focused on the themes of managing online communication, professionalism in virtual communication, and balancing academic communication with extra- or non-curricular communication. We did not include social media professionalism as this topic was addressed in other presentations. We also did not explore in-person communication skills as these are included in the clinical skills curriculum. The specific topics we addressed included: 1) seeking resources; 2) managing information influx; and 3) follow-up and balancing competing responsibilities. We used personal anecdotes to inform our presentation, presented tools and strategies, and discussed professional identity in communication. Considering these themes, we developed a new session, with didactic material and an interactive

question-and-answer period, that was delivered by second-year students to first-year students during their orientation week (5).

To examine current resources available to students, we reviewed and stratified them based on their applicability to our first year of medical training. Noting students' uncertainty about where to seek assistance, we designed a flowchart (Figure 1) to present actionable steps for students to take before contacting colleagues or support staff. By prioritizing proactive steps for

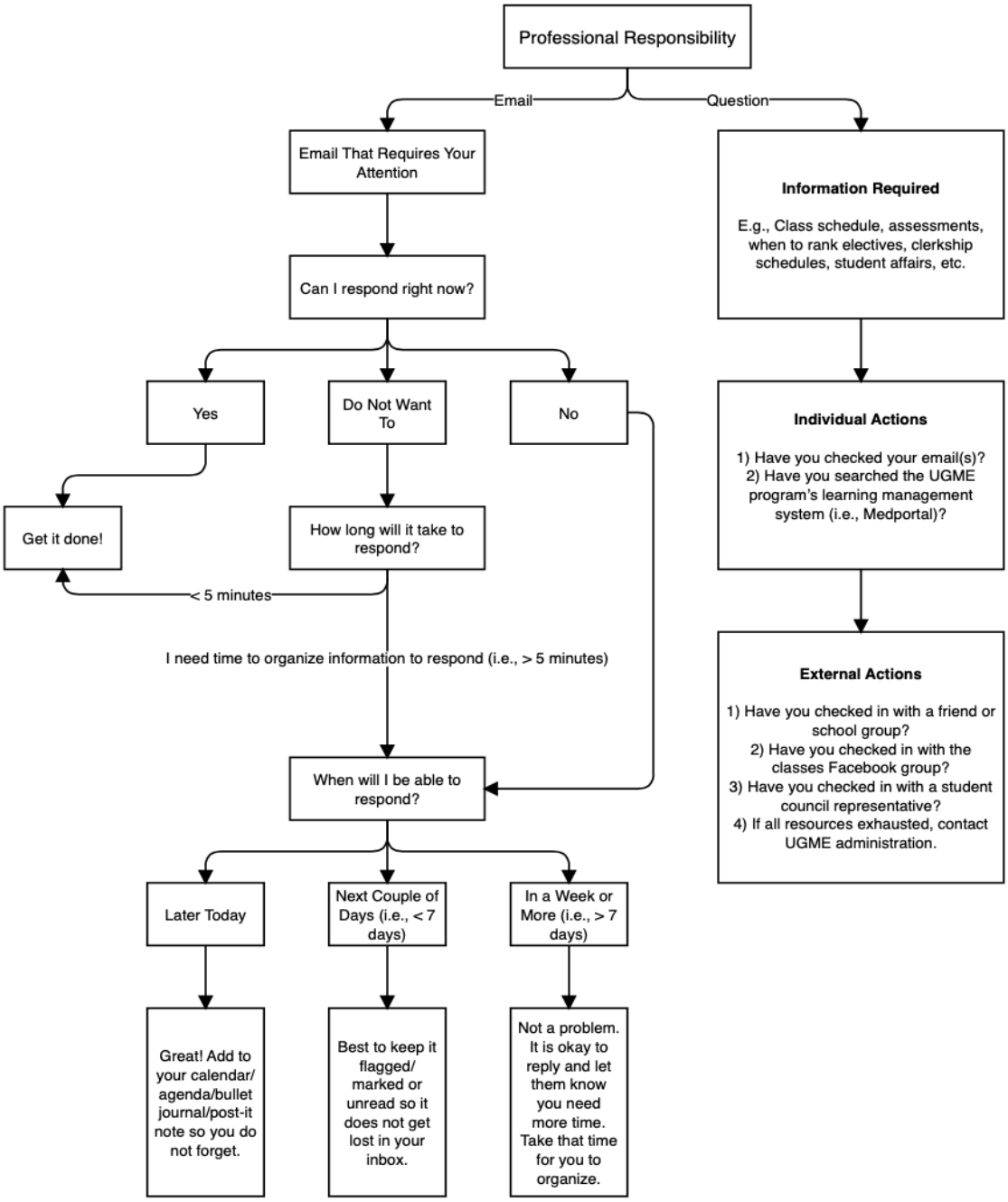

Figure 1. Workflow for information seeking and communications management based on students' academic and professional responsibilities in medical school.

information seeking, we strove to minimize "notification fatigue" associated with messaging within a class-wide chat that includes over 200 students.

In the presentation and question-and-answer period, we explored the intersection of professional identity and online communication, in addition to the importance of boundary setting when encountering competing priorities. Figure 1 contains a graphic representation of timelines that could help students balance their professional communications with variable urgency.

Next Steps

We successfully delivered a timely, interactive session for the incoming UGME class, which demonstrated strong engagement during the question-and-answer period (80+ questions). We believe we were successful in accomplishing our goal of supporting the development of medical students as professionals through the delivery of this session. Despite holding this session during the orientation week, we were pleased to see students engaging with this topic, which we posit may reflect students' desires to connect with and learn the "hidden curriculum" of medicine from upper-year colleagues.

In future sessions, student leaders can prepare their incoming class by recognizing strengths and weaknesses faced throughout their time in medical school, especially in the context of professionalism. Hosting a student-led session during orientation aimed at supporting students' professional development and presenting meaningful strategies will assist in their transition as professionals. Future iterations of the talk will involve gathering feedback for the purpose of improving the presentation and flowchart, both directly after the talk and further along in attendees' training.

Conflict of interest

The authors have no conflicts of interest to declare.

References

1. Frank JR, Snell L, Sherbino J. CanMEDS 2015 Physician Competency Framework [Internet]. Ottawa; 2015. Available from: https://www.royalcollege.ca/rcsite/documents/canmeds/canmeds-full-framework-e.pdf

2. Broberg A. Learners as knowledge workers—Some implications*. J Eng Educ [Internet]. 2001 Jan 1;90(1):63–8. Available from: https://doi.org/10.1002/j.2168-9830.2001.tb00568.x

3. Lempp H, Seale C. The hidden curriculum in undergraduate medical education: Qualitative study of medical students' perceptions of teaching. BMJ [Internet]. 2004;329(7469):770–3. Available from: https://www.bmj.com/content/329/7469/770

4. Shrank WH, Reed VA, Jernstedt GC. Fostering professionalism in medical education: A call for improved assessment and meaningful incentives. J Gen Intern Med [Internet]. 2004 Aug;19(8):887–92. Available from: https://pubmed.ncbi.nlm.nih.gov/15242476

5. Whaley C, Li C, Murphy B. "You've Got Mail!" Tips on managing communications professionally as a medical learner. 2021. https://10.13140/RG.2.2.23145.62562

Author Biographies

Colin Whaley is a second-year medical student at the Michael G. DeGroote School of Medicine at McMaster University, and Vice President Academic, Senior on the McMaster Medical Student Council.

Bradley Murphy is also a second-year medical student at the Michael G. DeGroote School of Medicine at McMaster University, and Class President for the McMaster MD Class of 2023.
Connie Li is as well a second-year medical student at the Michael G. DeGroote School of Medicine at McMaster University and sits on the Medical Foundations 1 and Professional Competencies Committees.

Amanda Bell is a family physician in Niagara, Ontario, Associate Clinical Professor in the Department of Family Medicine, and currently serves as the Regional Assistant Dean of the Niagara Regional Campus at the Michael G. DeGroote School of Medicine, McMaster University.

Commentary

Cervical cancer screening in transgender men and non-binary people with a cervix

Tessa Anzai[1], Amanda Selk[2], and Julie My Van Nguyen[3]

[1]Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Canada
[2]Department of Obstetrics and Gynecology, University of Toronto, Toronto, Canada
[3]Department of Obstetrics and Gynecology, McMaster University, Hamilton, Canada

Abstract

Mortality from cervical cancer is projected to decline over the next several years; however, this estimate relies on the inclusion of all eligible individuals in screening processes. This requires a robust understanding of barriers to routine screening, especially in at-risk populations such as transgender men and those across a trans-masculine spectrum. Barriers include miseducation surrounding screening protocols, distrust in the healthcare system, and histological inadequacy of samples obtained. These barriers can be addressed through proper education of both practitioner and patient, appropriate signage and outreach, and adjustments to clinical practices to meet evolving guidelines.

Keywords: Transgender health; cervical cancer; cancer screening; reproductive health

Corresponding author: tessa.anzai@medportal.ca

Introduction

In the era of modern medicine, it can be tempting to place a healthy amount of reliance on preventative health protocols and regimes, and there have certainly been drastic benefits seen from implementation of routine screening and vaccination programs. Cervical cancer is one such example, and mortality from cervical cancer is projected to continue declining over the next several years (1). Still, this hardly equates to the diagnosis being eliminated. This projected decrease relies on both continued HPV vaccination programs and participation in screening practices by all eligible individuals. When the more minute details of this plan are examined, cracks start to appear. One of the largest gaps is the inclusion of transgender men (TM) and non-binary individuals with a cervix in these programs. It is becoming more broadly recognized that cervical cancer screening should be conducted in everyone with a cervix regardless of gender, and, while Ontario Cancer screening guidelines have changed their verbiage to reflect this, practical data show that this is not implemented equally (1,2). This commentary aims to highlight the importance of cervical cancer screening in all individuals with a cervix, covers details that are glossed over in medical school curricula (3), and primes readers to future developments in the field.

Cervical cancer screening in transgender men

Cervical cancer screening practices should be applied uniformly to all individuals with a cervix, including in TM with a cervix. It has been previously reported that approximately 21% of TM have undergone gender-confirming total hysterectomies, thus 79% of patients require regular cervical cancer screening. These screening practices should be offered to TM patients regardless of history of penetrative vaginal intercourse (1). This is in part since HPV vaccination rates are lowest in TM, with a prevalence of only 20% (4). Overall, TM patients are up to 18% less likely to receive routine cervical cancer screening in comparison to cis women. This can be due to lack of education on the part of both patient and practitioner, discomfort or distrust in the healthcare system, or exclusion from systemic screening programs that use patients' health records if they've legally changed their sex to male (5).

The rate of inadequate samples in TM is eight times greater than for cis females (6). This is attributed to scant cellularity and vaginal atrophy from use of androgen therapy. Temporary use of vaginal estrogen one to two months prior to the examination can be considered after discussion between the patient and their healthcare provider. Following an inadequate result, the average length of time before a repeat sample is taken has been found to be significantly longer for TM when compared to cis females, further increasing the risk for a true abnormal cytology finding to go undetected for a longer period (6).

Inclusive healthcare strategies

There are several steps that can be taken by healthcare providers to combat this issue. Care should be taken to create a structurally affirming clinic environment. This includes the entire duration of the patient experience, from front-of-house signage to the procedure itself to follow-up afterwards. A safer and more supportive clinic space can be developed by encouraging cultural competency training for all staff, ensuring that indicated pronouns and names are used and that gender-neutral bathrooms are available, and avoiding cisgender assumptions (for example, on intake forms, and for clinic names such as "Women's Health" clinics). Practitioners should take care to minimize patient distress during sensitive exams. Important considerations include the use of neutral language (Table 1) and trauma-informed care and examinations, as well as the use of non-interfering lubricant and a smaller-sized speculum as needed (6). It is important for practitioners to recognize that pelvic exams hold the potential for re-traumatization of TM patients in addition to the physical discomfort of the exam. This can come from heightened emotions related to gender dysphoria due to the exam itself, language used, or the menstrual-like spotting that is common after a cervical cancer screening (6).

Table 1. Examples of non-sexualized language for use during pelvic examinations

Gendered/Negative Connotation	*Neutral/positive connotation*
Vulva	External pelvic area
	Outer genitalia
Labia	Outer folds
Vagina	Genital opening, frontal pelvic opening, internal canal
Uterus, ovaries	Internal organs
Pap smear	Cancer screening
	Cancer, HPV-related cancer
Period/Menstruation	Bleeding
Stirrups	Footrests
"Scoot down until your bottom touches my hand"	Ask patient to move to the end of the table
"Open your legs"	"Let your legs drop to either side"
	"Point your knees to the wall"
"Blades of the speculum"	"Bills of the speculum"
"I'm going to insert the speculum"	"Opening the speculum"
"You're going to feel a little poke"	"You may feel some pressure"

Adapted from Potter et al. (7,8)

HPV DNA testing

Practitioners and medical trainees alike should be aware of alternate options to Pap smear screening, and that provincial guidelines around cervical cancer screening are quickly evolving. Emerging evidence reveals that HPV DNA testing is more sensitive than traditional testing with Pap smears (9). It can be self-collected and is thus less invasive, providing a more comfortable experience for some patients. While self-swab HPV tests are not yet approved in most provinces, this is expected to change in the next years. Ontario Cervical Cancer guidelines already acknowledge that this change is coming and that recommendations will be shifting. There is not yet a timeline in place, however, and this remains an area of future advancement. Current guidelines do not specifically include transgender patients as a patient population where testing beginning at the age of 21 is indicated; instead, inclusion criteria in accordance to the most recent provincial guidelines should be applied to these patients (2).

Conclusion

Trans health remains an overlooked aspect of the medical school curriculum, and the changes that are made for current students will take years to be fully implemented. It is essential for practitioners to remain updated on current guidelines and barriers to implementation to adequately treat their patients. TM are less likely to be up to date on cervical cancer screening, and barriers to this are multifactorial, including inadequate histology of samples, avoidance on part of the patient, physician experience, and education of both parties. Strategies to address these barriers include prioritizing affirming clinic experiences for patients and ensuring practices reflect updated guidelines.

References

1. Beswick A, Corkum M, D'Souza D. Locally advanced cervical cancer in a transgender man. CMAJ. 2019 Jan 21;191(3):e76-8.

2. Murphy J, Kennedy E, Dunn S, Fung Kee Fung M, Gzik D, McLachlin CM, et al. Ontario Cervical Cancer Screening Program (OCSP) screening recommendations summary [Internet]. Toronto (ON): Cancer Care Ontario; 2011 Oct 5 [cited 2022 Jan 6]. Available from https://www.cancercareontario.ca/en/guidelines-advice/types-of-cancer/2156

3. Nolan IT, Blasdel G, Dubin SN, Goetz TG, Greene RE, Morrison SD. Current state of transgender medical education in the United States and Canada: Update to a scoping review. J Med Educ Curric Dev. 2020 Jun;7:2382120520934813.

4. Weyers S, Garland SM, Cruickshank M, Kyrgiou M, Arbyn M. Cervical cancer prevention in transgender men: A review. BJOG: Int J Obstet Gynaecol. 2021 Apr;128(5):822-6.

5. Kiran T, Davie S, Singh D, Hranilovic S, Pinto AD, Abramovich A, et al. Cancer screening rates among transgender adults: Cross-sectional analysis of primary care data. Can Fam Physician. 2019 Jan 1;65(1):e30-7.

6. Peitzmeier SM, Reisner SL, Harigopal P, Potter J. Female-to-male patients have high prevalence of unsatisfactory Paps compared to non-transgender females: Implications for cervical cancer screening. J Gen Intern Med. 2014 May 1;29(5):778-84.

7. Potter J, Peitzmeier SM, Bernstein I, Reisner SL, Alizaga NM, Agénor M, et al. Cervical cancer screening for patients on the female-to-male spectrum: A narrative review and guide for clinicians. J Gen Intern Med. 2015 Dec;30(12):1857-64.

8. Potter J, Peitzmeier SM, Bernstein I, Reisner SL, Alizaga NM, Agénor M, et al. Cervical cancer screening for patients on the female-to-male spectrum: a narrative review and guide for clinicians. J Gen Intern Med. 2015 Dec;30(12):1857-64.

9. Reisner SL, Deutsch MB, Peitzmeier SM, White Hughto JM, Cavanaugh TP, Pardee DJ, et al. Test performance and acceptability of self-versus provider-collected swabs for high-risk HPV DNA testing in female-to-male trans masculine patients. PLoS One. 2018 Mar 14;13(3):e0190172.

Author biographies

Tessa Anzai is a second-year medical student at McMaster University, and she holds a Joint Honours Bachelor of Science in Biology & Psychology. She is actively involved in student leadership and has clinical and academic interests in internal medicine, geriatrics, and women's health.

Dr Amanda Selk is an Associate Professor in the Department of Obstetrics and Gynecology at the University of Toronto. She is the president of the Society of Canadian Colposcopists and the President of the International Society for the Study of Vulvovaginal Disease North American Chapter. She is the host of the podcast "The Vulva Diaries".

Dr Julie My Van Nguyen is an Assistant Professor at McMaster University, Gynecologic Oncologist at the Juravinski Hospital and Cancer Centre, and she holds an MSc in Quality Improvement and Patient Safety. Her research interests include perioperative care, frailty and aging, and advancing equity and inclusion in clinical care and academic medicine.

Cambridge Memorial Hospital has immediate openings for:

- Endocrinologist
- Hospitalist
- Geriatrician
- Dermatologist
- Pediatrician
- General Internal Medicine
- Respirologist
- Psychiatrist
- Emergency Physician
- Surgical Assist

We are a 186-bed acute care hospital. We have recently undergone an expansion of our facilites and continue to grow our services. We are affiliated with the Waterloo Campus of the Michael G. DeGroote School of Medicine, McMaster University, supporting academic interests of professionals practicing in Cambridge, Ontario and the Region of Waterloo

Our specialist programs include: Cardiology, Respirology, Gastroenterology, Rheumatology, Infectious Diseases, Hospitalist Medicine, General Surgery, Urology, OBS/GYN, Pediatrics, ENT, Oncology, Orthopedic Surgery, Plastic Surgery, Geriatrics, Neurology, Radiology and Psychiatry. Access to other specialist programs are available within the Region

Cambridge is a family-oriented community of 140,000 in the bustling, high-tech Region of Waterloo. It is conveniently located one hour from Toronto, London, and Hamilton. Our business-friendly environment and appealing lifestyle have made us one of the fastest-growing cities in Canada

More Information? Connect with:

Stephanie Evans, Medical Credentialing & Physician Recruitment
Tel: 519-621-2333, ext. 2370; Fax: 519-740-4934
Email: sevans@cmh.org

Please quote posting # MCMAR19

CAMBRIDGE MEMORIAL HOSPITAL

MCI THE DOCTOR'S OFFICE™

YOUR NEXT STEP IS WITH US

CELEBRATING 30 YEARS 1986 - 2016

- Walk-In & Family Practice Opportunities
- Billing Support To Maximize Your Income
- Marketing To Build Your Practice
- Professionally Trained Staff
- Complete EMR Training
- 20+ MCI Clinics in Ontario & Alberta

Contact MCI Today!
416 440 4040 EXT 105
practice@mcimed.com

Physician Opportunities Available Online

mcithedoctorsoffice.com

St. Joseph's Healthcare Hamilton | Department of Education & Innovation

Congratulations to our NEW DOCTORS!

The McMaster University Graduating Class of 2022

St. Joseph's Healthcare Hamilton is committed to high quality education and is honoured to have been a part of your learning journey.

We are so proud of your achievements. A bright future lies ahead!

www.StJoes.ca

Charlton Campus	King Campus	West 5th Campus
50 Charlton Avenue East	2757 King Street East	100 West 5th Street
Hamilton ON L8N 4A6	Hamilton ON L8G 5E4	Hamilton ON L8N 3K7

LIVE PLAY WORK

This is where you make a difference

Let Us Be The Bridge to Your Future

CITY OF BRANTFORD

Family Physician Recruitment

BRANTFORD

Family Physician Recruitment

Our Bridge to Your Future

We can build bridges reflecting community engagement; medical career paths to meet your diverse needs; introduce individuals and families to local amenities and friendly neighbours; and at an affordable cost of living, in the ever-growing community of Brantford.

Let us be the bridge to your future.

Family Physician Opportunities

Brantford, Ontario

- Family Health Organizations
- Family Health Teams
- Turn-Key Group Practices
- Walk-in Clinics
- Hospitalist Roles
- Surgical Assisting
- Community Healthcare Centres
- Fee-For-Service

For more information visit our website

familyphysicianrecruitment.com

and contact:

Lebené Numekevor
Recruitment Manager

519-761-7817
info@familyphysicianrecruitment.com