Applying knowledge translation frameworks, approaches and principles to co-create a dissemination plan: Optimizing the spread of a pediatric concussion guideline

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Abstract

Background: Clinical practice guidelines are evidence-based statements that assist healthcare professionals with improving patient care. Achieving guideline aims depends on successful knowledge translation (KT) and includes dissemination and implementation efforts. Dissemination efforts are important precursors to implementation, help to maximize awareness and reach of best practices, and prepare for evidence adoption. This article shares the application of KT frameworks, approaches and principles in the creation of a dissemination plan and KT products for the Living Guideline for Pediatric Concussion Care. The target audience for dissemination are healthcare professionals delivering clinical care to patients between 5–18 years.

Methods: Guided by the Framework for Knowledge Transfer and an integrated KT (iKT) approach, 46 concussion experts participated in an iKT workshop and knowledge board activity to: 1) establish a Living Guideline dissemination plan; 2) identify products to share the Living Guideline; and, 3) prepare for Living Guideline implementation planning. Post-workshop, a snowball approach invited knowledge users including educators and youth/young adults with lived experience in concussion via interviews and focus groups, to expand upon the dissemination plan and recommended products.

Results: The dissemination plan yielded a reach of nearly 42,000 Living Guideline page views from September, 2019-January, 2022. Dissemination efforts included 13 multi-media interviews, over 40 activities (e.g. webinars), and 28 engagement emails to help raise awareness. Eight KT products were developed to foster sharing and use of the Living Guideline, with over 3000 downloads across all KT products.

Conclusions: Applying an iKT approach alongside appropriate frameworks and principles allowed for interaction and partnership building, resulting in the development of a robust dissemination plan and essential KT products. By showing the breadth and impact of the KT activities undertaken, it is hoped that the concussion community will explore how KT practices can bolster efforts to drive evidence into practice and optimize concussion care.

Keywords
Pediatric concussion, clinical practice guidelines, knowledge translation, dissemination, implementation, integrated knowledge translation

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Introduction

Concussion is a common injury among children and adolescents impacting their day-to-day activities at home, in school and extra-curriculars such as sport. Recent evidence-based consensus statements and clinical practice guidelines have been established as foundational products to assist healthcare professionals with the diagnosis and management of pediatric concussion. These products aim to improve the quality of care provided; enhance patient overall health and wellbeing; prevent long-term symptoms; reduce variation in healthcare professional practices; and optimize the use of health system resources to provide care. Widespread implementation of clinical practice guidelines is essential to achieve these aims and is dependent on effective knowledge translation (KT).

KT is defined as “…the broad range of activities meant to improve the use of health research [evidence] in practice and to inform further research leading to evidence-based decision-making in healthcare (p.1)” Central to KT are dissemination and implementation. Dissemination is a planned process that involves identifying a knowledge user group and setting, and tailoring specific messages, products (e.g. infographics) and sharing mechanisms or channels (e.g. journals, education sessions, websites) to that group to raise awareness. Implementation is the purposeful use of strategies (e.g. education, audit and feedback, reminders, etc.) guided by theories, models, frameworks and approaches to promote the uptake of evidence-based products to change care delivery. Dissemination is an important precursor to implementation and while necessary, does not act alone in driving evidence adoption and practice change.

Within the concussion context, peer-reviewed journal publications have most often been used to raise awareness of consensus statements and clinical practice guidelines, particularly within the field of sport medicine. While publications may be effective for reaching some healthcare professionals, they are not sufficient to maximize reach and prime for implementation. Developers of concussion consensus statements and clinical practice guidelines recommend more explicit use of KT models and approaches within this field. We identified an opportunity to create purposeful and planned dissemination efforts to maximize awareness and reach of best practices in concussion care and to effectively prepare knowledge users for evidence adoption.

An integrated knowledge translation (iKT) approach is well-positioned to meet this need. Integrated KT refers to the dynamic relationship between researchers and knowledge users (e.g. concussion care providers) and involves collaborative knowledge production within a research context to foster decision-making. Benefits of iKT include broadening of networks, nurturing collaboration, fostering access to information, and promoting the spread, scale and use of research in practice. Uptake of iKT approaches is becoming more apparent across various contexts, such as community agencies. For example, the international Preventing Violence Across the Lifespan (PreVAIL) Research Network adopted an iKT approach to support the co-production and timely application of research to develop policies and influence systems around family violence. Activities included fostering authentic collaboration throughout the research process, plus priority setting and research question generation. Learning about new research, the evolution of research methods in the field of violence, and enhanced linkages across researchers in this field were valuable outputs identified across the Network. The Canadian Population Attributable Risk of Cancer (ComPARE) study team also adopted an iKT approach to maximize the impact of research on cancer prevention. Bringing together cancer prevention researchers (knowledge producers) and the Canadian Cancer Society (knowledge user) resulted in the co-creation of a KT blueprint to help plan for KT, develop KT products to share study findings, establish a dissemination plan for the work and an evaluation strategy. In the aforementioned examples, applying this approach provided a platform for the knowledge producers and users to create and share information in a way that was meaningful and useful to the knowledge users.

With the use of iKT in other health fields as a guide, there is an opportunity across the concussion landscape to bolster the integration of KT processes in the creation of evidence-based guidelines and tools and to promote their sharing (dissemination) and use (implementation). Embracing this spirit, a significant investment in KT practice was at the forefront of the development of the Living Guideline for Pediatric Concussion Care (herein referred to as the ‘Living Guideline’); an update of the 2014 “Guidelines for Diagnosing and Managing Pediatric Concussion” funded by the previous Ontario Neurotrauma Foundation (ONF; former not-for-profit organization that supported individuals with neurotrauma by conducting research and developing care strategies). See Reed et al. for details on guideline creation and on-going maintenance of this ‘living’ document. The objective of this article is to describe the iKT approach and showcase the application of KT frameworks and principles in the dissemination of the Living Guideline and the creation and sharing of guideline products.

Method

Development team

This work was co-led by two clinician scientists (a pediatric emergency medicine physician and an occupational
therapist) with expertise in pediatric concussion research and care, and a core development team comprised of a guideline developer, scientist with expertise in experimental psychology and behavioural neuroscience, and a post-doctoral fellow. Endorsement from the co-leads and dedicated funding allowed for KT planning to occur at the onset of guideline development. To establish a strong KT vision and integrate KT principles and activities in the guideline development process, a KT practitioner (i.e. KT Specialist) was engaged as the Knowledge Translation and Mobilization Lead. The KT practitioner is Masters’ trained in a health-related discipline, holds an advanced certificate in KT practice, and has experience in the application of KT to the pediatric concussion context. Engaging an individual with KT capacity and training was deemed essential to facilitate optimal KT practice.

**iKT design**

An in-person consensus meeting was held (Toronto, Ontario) with 46 expert panelist members, representing clinical care and research pediatric concussion experts (e.g. physiatry, neurology, neuropsychology, occupational therapy), administrators, educators and students from across Canada and the United States. Participants were invited based on their knowledge and expertise in the clinical assessment and management of pediatric concussion. The meeting focused on guideline development and provided a collaborative space for the expert panelist members to review and update recommendations, tools and clinical algorithms from the prior guideline, and generate new evidence-informed recommendations. During this two-day meeting there were two KT planning activities: 1. a KT workshop and 2. a knowledge board (a board capturing real-time insights and thoughts shared by others). An iKT approach was used as a foundation for engaging concussion care providers and researchers as knowledge users to assist with KT planning. These activities were informed by KT frameworks and principles to establish a dissemination plan, identify and create meaningful products to share the Living Guideline, and prepare for implementation planning. In order to expand upon recommended outputs from the KT workshop and knowledge board, healthcare professionals, educators, coaches and youth/young adults and families with lived experience in concussion were included via a snowball approach using interviews and focus groups. Specific to these KT aims, Figure 1 outlines iKT activities designed to foster engagement, with the following section describing these activities in greater detail.

**KT planning workshop**

Building on previous dissemination efforts from the 2014 guideline aims, the purpose of the in-person 4-h KT planning workshop was to co-create a plan to promote sharing and enable use of the Living Guideline. The workshop was organized into two activities: 1. dissemination planning and 2. priming for implementation planning. To position dissemination and implementation planning activities, lay definitions of key terms were provided to ensure participants had a collective understanding of terminology before progressing with KT planning efforts; see Table 1.

**Activity 1: dissemination planning**

Dissemination planning was guided by core concepts from Lavis et al.’s Framework for Knowledge Transfer, chosen for its operational and active focus on sharing evidence-based knowledge. The knowledge transfer framework poses five key questions for consideration when developing a knowledge sharing strategy: 1. What is the message that you are sharing with decision makers?; 2. Who should the message be shared with?; 3. Who should be sharing the message?; 4. What strategies should be used for sharing the message?; and, 5. With what impact should the message be shared?

![Figure 1. Integrated knowledge translation activities to promote dissemination planning, implementation preparation and product development.](image-url)
The session started by sharing the specified goal and then expert panel members were invited to reflect individually on the impact question “How might we get the Living Guideline into the hands of healthcare professionals?” Next, they completed a dissemination-focused commitment form responding to questions related to key messaging, knowledge users and sharing mechanisms shaped by the selected knowledge transfer framework within the context of the guideline. A summary of the commitment form responses is provided in Table 2. Information gathered was subsequently used by the development team to inform a dissemination plan for the Living Guideline, as well as resource development to support guideline sharing. Participant forms were photocopied and provided back as a strategy to remind them of their commitment to share, raise awareness of and provide knowledge on the Living Guideline.

### Activity 2: preparing for implementation planning

A group-based activity was further used to inspire creative and critical thinking and foster active participation among the expert panel members. Activity design features included a defined task with specific objectives that would allow participants to bring their knowledge and expertise to the activity through discussion, questioning and reflection, and work together to problem solve and generate ideas related to guideline implementation. The goal was to gather insights across different clinical contexts regarding strategies that would help healthcare professionals implement the Living Guideline and use it to ‘start, stop and/or change’ their concussion practices (behaviour change). Based on their unique disciplines and clinical contexts, experts were asked to select one setting that resonated with them – (i) primary care hospital; (ii) rehabilitation hospital; (iii) primary care community; or (iv) rehabilitation community for small group work. All four groups were asked to review the following scenario, influenced by appreciative inquiry principles, from the perspective of their selected clinical context:

The new clinical practice guideline has been launched. Your clinical team is now expected to use the recommendations in practice. You have been asked by your Manager to create an implementation strategy for the clinic team. You have a 6 month window to put supports in place and are working with champions to help you do it.

After reviewing the scenario, each group was presented with the generative question “What will help you use this guideline tomorrow?” All groups engaged in a 20-min brainstorming discussion guided by a facilitator. Facilitation prompts, outlined in Table 3, were provided to stimulate discussion among the expert panelist members.

After 20 min of brainstorming, the groups were instructed to mock-up implementation strategies, defined as methods to increase the delivery of an evidence-based practice for healthcare professionals use the guideline. The groups were given 40 min and were provided with supplies (e.g. markers, chart paper, post-its) to help them mock-up their strategies. All groups were asked to identify content to be included in their strategies and think about the operational resources (e.g. budget, people) required to create them. After the mock-up portion of the session, the four groups presented their ideas, followed by a large group discussion regarding priority areas for implementation strategies.

The KT specialist and primary author (CP) engaged in a sense making activity to organize the suggested strategies and identify what purpose these strategies could serve with implementation efforts. Ideas for implementation strategies were organized using Michie, van Stralen and West’s Behaviour Change Wheel (BCW) and are summarized in Table 4. The BCW is an approach to characterizing interventions or activities, such as education or training, that promote behaviour change (starting, stopping or changing a practice) in this instance, use of the Living Guideline in clinical practice.

### Knowledge boards

Knowledge boards (i.e. large poster boards), were also used to stimulate and co-inform dissemination efforts.

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**Table 1. Definitions of KT terms shared with expert panelist members.**

| Terms             | Definitions                                                                 |
|-------------------|----------------------------------------------------------------------------|
| Knowledge translation | “…the broad range of activities meant to improve the use of health research [evidence] in practice and to inform further research leading to evidence-based decision-making in healthcare” (p.1).6    |
|                   | Positioned as an umbrella term, with emphasis placed on dissemination and implementation as key activities for putting evidence into the hands of knowledge users (e.g. healthcare professionals) and making evidence-based decisions to provide optimal pediatric concussion care. |
| Dissemination     | Explained as the intent to spread information, whereby information is purposefully tailored and distributed to a specific knowledge user group using planned and meaningful products and channels.8 |
| Implementation    | Described as using purposeful strategies to adopt and integrate evidence-based interventions and change practice within specific settings.20 |

[1]References...
These boards were placed outside of the conference room and participants were encouraged over the two days to contribute their ideas, with great specificity using post-it notes, on the following questions: 1. What organizations, groups or associations should we share the guidelines with? and 2. How would you share the guideline or information about the guideline with parents, teachers and sport groups? This format provided expert panel members an opportunity to expand on identifying knowledge users for the Living Guideline and channels for information sharing. A summary of ideas generated from the knowledge boards is presented in Table 5. Outputs affirmed suggested knowledge users and dissemination channels that emerged from the earlier dissemination planning activity (KT planning workshop activity 1).

Table 2. Summary of dissemination commitment form responses.

| Questions                                                                 | Responses                                                                                       |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| WHO will you inform (e.g. people, organizations)?                         | • Healthcare professionals<br>• Healthcare organizations<br>• Hospitals<br>• Professional colleges and organizations<br>• Sports community<br>• Organizations<br>• Personnel<br>• Athletes<br>• Education professionals and organizations (e.g. Ministries, teachers, school boards)<br>• Organizations/Networks<br>• Injury prevention<br>• Health promotion<br>• Brain injury<br>• Funding agencies<br>• General public (e.g. parents, youth) |
| HOW will you inform them (e.g. email, meeting, presentation)?             | • Clinic setting<br>• Communication (e.g. email, phone)<br>• Conferences<br>• Lectures/Teaching/Courses/Training initiatives<br>• Linking to other websites<br>• Meetings<br>• Networks (e.g. Extension for Community Healthcare Outcomes; ECHO)<br>• Journals<br>• Presentations/In-services<br>• Social Media (e.g. Twitter)<br>• Webinars |
| WHAT supports do you need to do this (e.g. template, letter, slides)?     | • Standardized slide decks to share the guideline<br>• Clinical scenarios/case studies applying the guideline<br>• Templates for communicating with schools<br>• Sample tweets for sharing the guideline<br>• Standardized email for sharing the guideline<br>• Short summary of the guideline<br>• Funding to attend conferences<br>• Description of future plans for the guideline |

Table 3. Facilitation prompts for implementation planning.

| Prompts                                                                 |
|------------------------------------------------------------------------|
| • Think about what you might have been part of that was similar and what they did. What worked or didn’t work? |
| • What will you do differently from previous experiences?               |
| • What modifications will you need to make?                            |
| • What resources will you need?                                        |

Product development

Workshop and knowledge board outcomes were subsequently used to guide KT product development to foster the dissemination of and prepare for guideline implementation. Product development was a collective
effort, with products created by the Living Guideline’s KT practitioner and the development team, with in-kind support from KT and project coordinator staff from the project co-leads’ organizations, and the ONF. An iKT philosophy continued to guide this phase of the work. Over ten individuals, including healthcare professionals, youth/young adults and families with lived experience of concussion, educators and coaches, were engaged as knowledge users via interviews, focus groups and/or email to foster exchange, inform product content and design, and provide feedback on draft versions. Three types of KT products were generated: 1) a guide for health professionals; 2) slide decks to deliver presentations; and, 3) a suite of community resources. Table 6 provides a full list of the eight products, their aim and how they were developed. All products are freely available for download from the Living Guideline website (https://pedsconcussion.com).

Table 4. Exemplar implementation strategies to foster Living Guideline use.

| Intervention Functiona | Clinical Settings |
|------------------------|-------------------|
|                        | Primary Care: Hospital | Primary Care: Community | Rehabilitation Care: Hospital | Rehabilitation Care: Community |
|                        | Exemplars: Implementation Strategies |
|                        | Extension for Community Healthcare Outcomes (ECHO) platform | Guideline education materials (e.g. videos for client waiting areas, printed education for target audiences, infographics) |
| Educationa (Imparting knowledge or enhancing understanding) | Patient-focused resources (e.g. guidelines) | Concussion education curriculum (e.g. schools) | Printed materials | Workshops | Webinars | Massive Open Online Courses |
| Incentivesa (Motivating action) | e-consults (e.g. ECHO) | Offering continuing education credits | Specialized billing codes for concussion |
| Enablementa (Providing ability/reducing obstacles to enhance opportunity) | Integration of guideline into Electronic Medical Record (EMR) | Integration of guideline into EMR | Modifiable templates (e.g. return to school form) | Engagement of champions | Development of a Community of Practice |
| Traininga (Teaching skills or providing instruction) | Providing training (e.g. case-based learning, videos, vignettes) | Providing training (e.g. case-based learning, videos, vignettes) | Modifiable templates (e.g. concussion care plan, return to school form) | Creation of guideline App for smart phone use |
| Persuasiona (Stimulating positive or negative feelings or influencing action through communication) | | Toolkit to support guideline use (e.g. strategies to adapt guideline to local context) | Integration of guideline into EMR |

*aDefinitions of intervention functions have been adapted from Michie et al. (2011).27
Executing the dissemination plan

The immediate goals of the dissemination plan were to raise awareness and promote reach of the Living Guideline and related KT products to foster use. The plan was executed by the development team, with in-kind support from communication experts from the ONF and co-lead representative organizations. Expert panel members from the consensus meeting, in addition to internal and external networks, were invited to help share the Living Guideline. Drawing from the information gathered during the KT workshop and knowledge boards, a variety of dissemination channels were leveraged to share the guideline. Sharing mechanisms were selected based on resources to support their execution, and included media and social media profiling, events, and a network email strategy. Reach of the guideline was evaluated through participant attendance at in-person dissemination activities, as well as tracking website hits and KT product downloads. Details of these activities and associated metrics are described below.

Media and social media

Creation of a media and social media strategy was a joint effort of communication and KT experts to drive spread. The guideline website https://pedsconcussion.com was launched in September 2019. A press release was launched by the ONF in collaboration with the project co-leads’ partnering organizations. Organized by their respective communication departments, the project leads were engaged in newspaper (n = 9), radio (n = 3) and television (n = 1) interviews. Living Guideline development team members, expert panelist members, collaborating organizations and colleagues created Twitter posts to share and highlight different aspects of the guideline. Post-guideline launch, tweets were pre-written and entered in an auto-scheduling programme to highlight Living Guideline recommendations, tools, resources and KT products in a scheduled manner, and were also written to align with internationally recognized days or events (e.g. Brain Injury Awareness Week). Tweets were shared monthly via ONF’s Twitter account (reach of 894 followers) and the Living Guideline Twitter account (@PedsConcussion, reach of 350 followers). Many individual posts received over 3000 impressions (@PedsConcussion account) on social media. Expert panel members used social media in real time at events, and created their own posts via Twitter and LinkedIn.

Events

The guideline development team and expert panel members engaged in activities ranging from presentations at conferences and community practice groups, to the delivery of seminars, webinars and workshops. These events were delivered at a local, national, and international level. A variety of knowledge user groups were targeted including healthcare professionals, policy makers, lawyers, researchers, educators (e.g. teachers), sport experts (e.g. coaches), students (e.g. high-school, undergraduate, graduate), and the general public (e.g. parents). Details of the events, targeted knowledge user groups and reach were reported to the funder for the September 2019-March 2020 time period and are outlined in Table 7.

Targeted email and network strategy

Expert panel members were also invited to share the Living Guideline with their networks. ONF distributed guideline information to 234 subscribers who identified having an

| Knowledge board question | Exemplars |
|--------------------------|-----------|
| **Q1. What organizations, groups or associations should we share the guideline with?** | • Healthcare professionals (e.g. local healthcare teams)  
• Healthcare groups and organizations (e.g. Centers for Disease Control and Prevention, College of Family Physicians of Canada, International Brain Injury Association, American College of Sports Medicine)  
• Research groups (e.g. Pediatric Research in Sports Medicine Organization)  
• Sport and injury prevention groups and organizations (e.g. Parachute Canada, American Football Coaches Association, Canadian Concussion Collaborative)  
• Education (e.g. schools, school boards and associations, education personnel)  
• Government groups (e.g. Education and Tourism Ministries, Public Health Agency of Canada)  
• Other (e.g. Juvenile Justice Organizations) |
| **Q2. How would you share the guideline or information about the guideline with parents, teachers and sport groups?** | • Social media (e.g. Twitter, Instagram)  
• Media (e.g. radio, television, newspaper)  
• Network (e.g. events, meetings)  
• Digital and paper-based communication (e.g. websites, Apps, handouts)  
• Integration into curriculum (e.g. open online courses, continuing education) |

Table 5. Knowledge board summary.
Table 6. Living guideline KT products.

| KT products                  | Target audience              | Aim (s)                                                                 | Development process                                                                                                                                 |
|------------------------------|------------------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| **Guide**                    | Healthcare professionals    | 1. Assist healthcare professionals with sharing the guideline          | • Creation of this resource was informed by:                                                                                                        |
|                              |                              | 2. Assist healthcare professionals with reviewing and prioritizing     | • knowledge transfer framework²¹                                                                                                                   |
|                              |                              | recommendations key to their practice                                | • checklist for guideline implementation planning¹⁰                                                                                               |
|                              |                              | 3. Foster use of the guideline in practice                           | • The resource provides:                                                                                                                           |
|                              |                              |                                                                        | • Key principles for effective dissemination                                                                                                     |
|                              |                              |                                                                        | • Reflection questions to guide implementation efforts (e.g.                                                                                      |
|                              |                              |                                                                        | How can the environment support practice change?                                                                                                 |
|                              |                              |                                                                        | How can other stakeholders be involved?                                                                                                           |
|                              |                              |                                                                        | What are barriers to practice change?)                                                                                                           |
|                              |                              |                                                                        | • Links to tools and information to guide implementation practice                                                                               |
| Slide decks                  | Healthcare professionals    | 1. Assist healthcare professionals with sharing the guideline in a     | • The guideline rationale, development process, domains and examples of tools were extracted and synthesized for inclusion                           |
|                              |                              | standardized way                                                     | • Co-leads of the Living Guideline reviewed and approved content                                                                               |
| Community resources          | Family member, parent or   | 1. Raise awareness about concussion and the Living Guideline         | • The following knowledge user groups were independently engaged:                                                                                 |
|                              | caregiver                    |                                                                        | • An in-person interview was held with a parent (n = 1) of a child with lived concussion experience                                                 |
|                              | Educators                   | 2. Share and build knowledge about concussion                        | • Independent in-person interviews were held with teachers (elementary = 1; high school = 1)                                                        |
|                              |                              | 3. Enable knowledge users to advocate for the care and support         | • An in-person focus group was held with coaches (n = 11)                                                                                         |
|                              |                              | a child/adolescent may need                                           | • Guideline recommendations were reviewed with each group who: 1. identified what recommendations and information are important to them; and 2. specified how (channels) and in what format (products) they would like to receive this information |
|                              |                              |                                                                        | • Short, user-friendly handouts were created, with feedback provided by each group on content and design                                            |
| Family Version of the        | Family member, parent or    | 1. To summarize the most important information that a family member,  | • Guideline development team members transformed the                                                                                                 |
| Living Guideline             | caregiver                    | parent or caregiver of a child/adolescent may need                    | (continued)                                                                                                                                      |
interest in acquired brain injury. Organizations representing healthcare professionals likely to be involved in the diagnosis and/or management of pediatric concussion were also targeted, with emails sent to 14 provincial (e.g. Ontario Society of Occupational Therapists, Ontario Association of Social Workers) and 14 national (e.g. Canadian Association of Emergency Physicians, Canadian Psychological Association) organizations.

**Table 6. Continued.**

| KT products | Target audience | Aim (s) | Development process |
|-------------|----------------|--------|---------------------|
| I have a concussion: Where do I start? | Youth | 1. Raise awareness about concussion and the Living Guideline | - The following knowledge user groups were independently engaged:  
  - Independent virtual interviews were held with young adults ($n = 2$) and a youth ($n = 1$) who have had a concussion  
  - A virtual consultation was held with the youth advisory council at one of the project co-leads’ organization  |
| I have a concussion: How do I get back to school? | Youth | 1. Raise awareness about concussion and the Living Guideline | - The youth/young adults were asked the following questions:  
 1. What information from the guideline is important to you? (What do you care about?);  
2. How would you use this information?; and 3. How would you want this information? (e.g. format, ease of use) |

Push efforts including media, social media, and network activities were heavy in the first six months of the Living Guideline release, resulting in nearly 12,000 page views during that time period. See Figure 2 for a visual description of page views per 6-month period from September 2019 to August 2021. Data was also captured regarding the KT products. Table 8 offers a summary of KT product downloads during this 2.5-year period.

**Website and download metrics**

From September 2019 to January 2022, there were nearly 42,000 page views, with international reach to over 105 countries. Push efforts including media, social media, and network activities were heavy in the first six months of the Living Guideline release, resulting in nearly 12,000 page views during that time period. See Figure 2 for a visual description of page views per 6-month period from September 2019 to August 2021. Data was also captured regarding the KT products. Table 8 offers a summary of KT product downloads during this 2.5-year period.

**Discussion**

This article describes an iKT approach and application of KT frameworks and principles in the creation and dissemination
of KT products for the Living Guideline. The primary aim of this work was to develop a dissemination plan informed by knowledge users to raise awareness of this newest evidence-based clinical practice guideline across different audiences.

Knowing the target audience, aligning messaging and dissemination efforts with said audience, and using personal (e.g. interactive education, engagement of opinion leaders) and non-personal (e.g. journals, social media) activities for information sharing are key elements of a dissemination plan. The development team applied an iKT approach to create a meaningful dissemination plan which ensured that a ‘big picture’ of varied knowledge users and contexts were considered in designing key messages, identifying accompanying products, and selecting appropriate dissemination channels. The intensive push efforts by the development team and the expert panel members fostered global reach of the Living Guideline to over 105 countries. Their efforts resulted in almost 12,

Table 7. KT events, knowledge user groups and reach.

| Activity type                        | Number of activities | Type of knowledge users                                                                 | Number of participants |
|--------------------------------------|----------------------|----------------------------------------------------------------------------------------|------------------------|
| Seminar                              | 12                   | Students (undergraduate, medical, nursing, physiotherapy, nurse practitioner)           | 457                    |
| Presentation                         | 3                    | Clinical professionals                                                                  | 225                    |
| Invited speaker                      | 9                    | Healthcare professionals                                                                 | 635                    |
|                                      |                      | Coaches                                                                                |                        |
|                                      |                      | Students                                                                               |                        |
|                                      |                      | Researchers                                                                            |                        |
|                                      |                      | Policy makers                                                                          |                        |
| Keynote presentation                 | 3                    | Healthcare professionals                                                                 | 500                    |
|                                      |                      | Lawyers                                                                                |                        |
|                                      |                      | Policy makers                                                                          |                        |
|                                      |                      | Researchers                                                                            |                        |
|                                      |                      | Coaches                                                                                |                        |
|                                      |                      | Teachers                                                                               |                        |
| Webinar                              | 1                    | Healthcare professionals                                                                 | 150                    |
|                                      |                      | Researchers                                                                            |                        |
|                                      |                      | Administrators                                                                         |                        |
| Stakeholder request for information  | 1                    | School-based professionals                                                              | Unknown                |
| Conference presentation              | 6                    | Healthcare professionals                                                                 | 2490                   |
|                                      |                      | Lawyers                                                                                |                        |
|                                      |                      | Community members                                                                       |                        |
|                                      |                      | Researchers                                                                            |                        |
|                                      |                      | Patient representatives                                                                  |                        |
| Conference workshop                  | 1                    | Healthcare professionals                                                                 | 200                    |
|                                      |                      | Administrators                                                                         |                        |
|                                      |                      | Government                                                                             |                        |
| Workshop                             | 1                    | Parents                                                                                | 35                     |
| Consultations /stakeholder engagement meetings | 4 | Family and youth representatives                                                        | 127                    |
|                                      |                      | Senior hospital management                                                              |                        |
|                                      |                      | Researchers                                                                            |                        |
|                                      |                      | Healthcare professionals                                                                 |                        |
| Communities of Practice              | 7                    | Researchers                                                                            | 225                    |
|                                      |                      | Healthcare professionals                                                                 |                        |
000 page views in the first 6 months of guideline release and nearly 42,000 page views over a 2.5-year period (September 2019 – January 2022). Push efforts are ongoing, using social media, virtual and in-person platforms to continue to promote the Living Guideline.

Healthcare professionals were the primary audience for this guideline; however, community resources were created to provide education, tips and strategies to help those impacted by concussion have conversations with healthcare professionals and make decisions about concussion care. Family products, specifically the parent handout and lay version of the guideline had the highest number of downloads throughout the 2.5-year period. These metrics demonstrate that parents are active knowledge users of guidelines and seek evidence-based information to inform their child’s concussion care. Vernooij, Willson, Gagliardi and the members of the Guidelines International Network Implementation Working Group’s (2016) exploration of patient focused resources accompanying guidelines highlights that such resources can enhance understanding of a health issue, prompt action for managing a health issue, and foster healthcare-patient communication.29 As demonstrated in the current KT efforts, guideline developers should consider the importance of creating patient-centred resources in tandem with guideline development to promote the improved health of patients. Future efforts to better understand who is downloading resources (e.g. types of healthcare professionals, youth, sport organizations) and for what purpose (e.g. improving knowledge) should be explored to understand the needs of the concussion community and tailor resources appropriately.

Identifying effective products and channels for guideline dissemination to patients is also important to ensure KT efforts reach the right people and provide them with the right information in a way that meets their needs. Creating a dissemination plan in tandem with guideline development that identifies the target audience, scope and dissemination methods is essential for an efficient and effective KT approach.30 A multi-strategy approach that accounts for the needs of knowledge users and a given context can raise awareness of guideline recommendations and improve the health and wellbeing of patients.8,30 Guideline developers need to be mindful of these factors while also considering barriers (e.g. health literacy, trustworthiness of content, internet access, personal needs) to disseminating knowledge to recipients of healthcare.8 Addressing these considerations must be done in partnership with patients to achieve success. In using an iKT approach, youth, families and others with lived experience were engaged in creating these community resources to foster concussion care, alongside planning for and executing dissemination efforts.

Applying an iKT approach to create a multi-user dissemination plan, develop evidence-based and patient-centred resources, and to prime for implementation required tremendous effort. Investing in KT expertise from the original 2014 guideline to the 2019 Living Guideline was deemed necessary by the development team to execute this plan. Guideline developers should consider engaging a designated KT practitioner knowledgeable in KT science to bring evidence-based KT approaches to fruition. KT practitioners (i.e. knowledge brokers, knowledge translation specialists) play a critical role in enhancing the uptake of evidence into practice.31
function and impact of engaging knowledge brokers in driving research into practice has been explored in health-related contexts. The insight and expertise brought by KT practitioners is unique and should not be overlooked as part of engagement and collaboration efforts, KT product development, evidence gathering and synthesis, and dissemination and implementation efforts during the guideline development process. Further, evaluating the impact of the KT practitioner role in driving evidence into care should also be explored.

**Future considerations**

Understanding the impact of dissemination efforts is critical to assessing the effectiveness of the plan that was created. The primary outcome within the scope of the current work focused on reach of the Living Guideline and accompanying resources. However, guideline development teams would be well served by advocating for resources necessary to explore added indicators such as usefulness (e.g. satisfaction with the guideline, value of knowledge gained), use (e.g. intention to use the information), and partnerships (e.g. number of products created with partners) in order to deepen understanding of broader impacts. Seeking continued feedback from the concussion community will be essential to developing and optimizing KT products for knowledge users.

While sharing and making guidelines available to health-care professionals is essential, it does not ensure their use in practice. Implementation of recommendations and accompanying tools (e.g. algorithms) from the Living Guideline is critical for optimal diagnosis and management of pediatric concussion. Creating a plan, assessing intervention needs and using strategies to implement that are informed by implementation science is a critical next step in implementation of this Living Guideline.

**Conclusion**

Guideline dissemination does not guarantee practice change and should not be an afterthought. Effective dissemination of evidence-based resources is however a necessary step toward uptake and use of evidence in practice. Dissemination planning should occur synchronously with guideline development and be informed by appropriate theories, models, frameworks and approaches, and engage varied perspectives in its design.

In the Living Guideline, a KT philosophy to guideline development was supported by the clinician co-leads and development team. Applying an iKT approach allowed for thoughtful interaction and partnership building during the KT planning workshop and community resource building activities. Knowledge user engagement is powerful and can shape and influence the creation of evidence-based products and how these products are shared and used in practice. By demonstrating the breadth and impact of the KT activities accomplished in this work, it is hoped that concussion and other communities will explore how KT practices can bolster efforts to raise awareness and drive evidence into practice, with the goal of enhancing pediatric concussion outcomes.

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**Table 8. KT product reach metrics.**

| Knowledge translation products | Date of availability | Downloads |
|--------------------------------|----------------------|-----------|
| Guide                          |                      |           |
| Sharing and Using the Guideline for Diagnosing and Managing Pediatric Concussion | September 2019 | 215       |
| Slide decks                    |                      |           |
| Sharing the Guideline: Slide Deck | June 2020  | 239       |
| Community resources            |                      |           |
| Supporting a Child/Adolescent with a Concussion: Your role as a Coach | September 2019 | 350       |
| Supporting a Student with concussion: Your role as a Teacher | September 2019 | 326       |
| Supporting a Child/Adolescent with a Concussion: Your role as a Parent | September 2019 | 554       |
| Living Guideline for Diagnosing and Managing Pediatric Concussion: Family Version | June 2020 | 882       |
| I have a concussion: Where do I start? | April 2021 | 344       |
| I have a concussion: How do I get back to school? | April 2021 | 313       |
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