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CANADIAN PRIMARY CARE TODAY

Clinical Insights, Perspectives, and Disease Management

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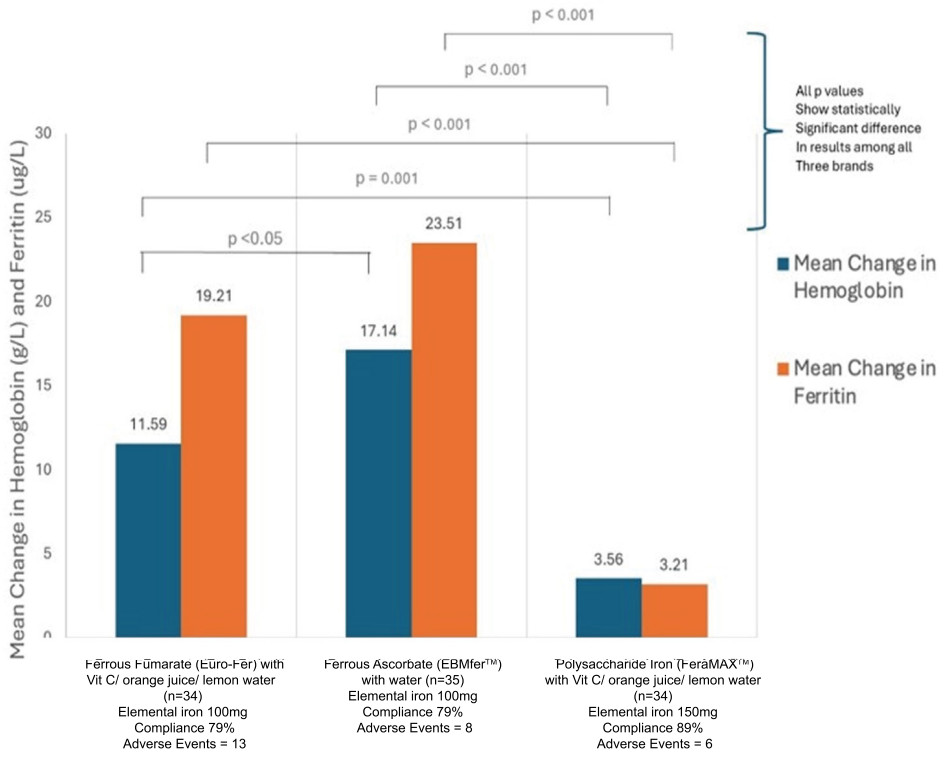

- A randomized, open-label, parallel group trial in 111 patients in the Toronto and Peel region occurring over 12 weeks.
- This study received no external funding, and the authors declared no financial relationships or conflicts of interest related to this work.
- "Notably, ferrous ascorbate (EBMfer™) was superior to ferrous fumarate (Euro-fer) in increasing hemoglobin.
- EBMfer™ demonstrated a statistically significant higher increase in hemoglobin and ferritin level as compared to polysaccharide iron (FeraMAX™) taken with vitamin C/ orange juice/ lemon water.

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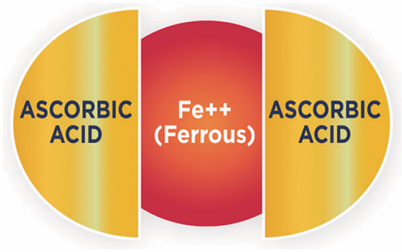

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*Comparative study of Ferrous Fumarate, Ferrous Ascorbate, and Polysaccharide Iron for treating iron Deficiency Anemia in Adults Anil Gupta, MD, CCFP, FCFP, Amisha Gandhi, Ind. Elec. Eng., Vishwas Kini, MD, CCFP, Kira Gupta-Baltazar, BSc (Hons), Karen Tu, MD, CCFP, FCFP. Canadian Primary Care Today, Volume 3, Issue 2, Summar 2025 available at https://canadianprimarycaretoday.com/issue/view/vol-3-2/pdf_en

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Continuous Glucose Monitoring: A Practical Overview for Primary Care Providers in Canada

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Jeremy Gilbert, MD, FRCPC

Continuous glucose monitoring (CGM) is transforming diabetes care, yet its use in type 2 diabetes (T2DM) remains underutilized in primary care. Given that most individuals with diabetes in Canada have T2DM and are managed primarily by primary care providers, the ability to interpret and apply CGM data is essential. This review provides an overview of CGM technology, key metrics, benefits and limitations, and offers practical tips for implementation in primary care.

Background

In Canada, approximately one in seven adults is affected by diabetes, with type 2 diabetes mellitus (T2DM) accounting for 90–95% of all cases.[1] Studies have shown that that up to 70% of individuals living with T2DM receive their diabetes care exclusively from primary care providers.[2] These statistics underscore the pivotal role of primary care in the delivery of diabetes management in Canada.

Over the past decade, continuous glucose monitoring (CGM) has emerged as a transformative advancement in diabetes care. Originally developed for people living with type 1 diabetes (T1DM), CGM improves glycemic control and quality of life by increasing time in range (TIR), reducing rates of clinically significant hypoglycemia, and lowering HbA1c, independent of the mode of insulin delivery.[3-5] Evidence continues to emerge supporting the use of CGM in the care of people living with T2DM, making CGM an important tool for primary care providers who are often the first point of contact for diabetes care.

Understanding CGM and Key Metrics

CGM systems are broadly categorized as real-time CGM (rtCGM) or intermittently scanned CGM (isCGM). rtCGM devices, such as Dexcom G6/G7 and FreeStyle Libre 2/3 Plus, provide continuous glucose data and alerts, an advantage for individuals with hypoglycemia unawareness. In contrast, isCGM systems, such as FreeStyle Libre 1/2, require users to scan the sensor at least every 8 hours to access glucose readings.

All CGM systems generate standardized data. Key CGM metrics include[6]:

- **Time in Range (TIR):** 3.9–10.0 mmol/L (goal ≥70%; though individual goals may apply for factors such as pregnancy, older age, or frequent hypoglycemia)
- **Time Below Range (TBR):** <4% below 3.9 mmol/L, <1% below 3.0 mmol/L
- **Time Above Range (TAR):** <25% above 10 mmol/L
- **Glucose Management Indicator:** An estimated HbA1c based on mean glucose
- **Glycemic variability:** Coefficient of variation <36%

In addition, an ambulatory glucose profile shows overall trends of glycemic control over a 24-hour period and can unmask patterns of hypoglycemia or hyperglycemic episodes that can be used to help guide therapeutic interventions.

Benefits of CGM in Primary Care

In Canada, CGM is commonly used in people living with T2DM receiving insulin therapy, but its use is expanding to broader populations, including those on non-insulin therapies or newly-diagnosed individuals not yet on therapy. CGM offers complementary insight to HbA1c and provides an alternative form of glucose monitoring from the traditional self-monitoring of blood glucose (SMBG) by providing real-time or scanned glucose data that supports better therapy titration, pattern recognition, and reduction of glycemic variability.

Meta-analyses of numerous randomized controlled trials have consistently demonstrated that CGM use in individuals with T2DM is associated with modest HbA1c reductions of 0.2–0.3%, improved TIR, and increased patient satisfaction.[7,8] Recent studies continue to expand the evidence base to individuals with T2DM on non-insulin therapy. For example, the IMMEDIATE study showed that providing isCGM (FreeStyle Libre) alongside diabetes education to individuals with T2DM not on insulin led to a 9.9% increase in TIR (equivalent to 2.4 additional hours per day), an 8.1% reduction in TAR (1.9 fewer hours), and a mean HbA1c reduction of 0.3% compared to diabetes education alone.[9] A large real-world study involving over 24,000 adults with T2DM reported a 1.6% greater reduction in HbA1c among those using a glucagon-like peptide-1 receptor agonist (GLP-1RA) combined with FreeStyle Libre compared to GLP-1RA alone.[11] Notably, nearly half of participants in both treatment arms were not using insulin, demonstrating that CGM benefits extend beyond individuals using insulin as their primary anti-glycemic therapy. Finally, CGM has also been shown to be both safe and effective in older adults. In the WISDM trial, adults aged ≥60 years with T1DM who used CGM experienced sustained improvements in TIR and HbA1c over 12 months, without an increased risk of hypoglycemia, providing reassurance for its use in older populations.[12]

Beyond glycemic endpoints, CGM can also drive meaningful behavioural and psychological changes. A systematic review of 54 qualitative studies identified recurring themes including greater confidence, increased awareness, improved self-management, reassurance, and a sense of control among people living with diabetes.[13] Interviews with Dexcom G6 users found that CGM "made the invisible visible," helping users better understand how their behaviour affects effects glucose levels and enabling improved lifestyle and medication decisions.[14]

Clinical guidelines are evolving to reflect this growing evidence. The 2021 Diabetes Canada guidelines recommend CGM for people with T1DM on multiple daily insulin injections or insulin pump therapy and considers its use for those with T2DM on basal-bolus insulin who are not meeting targets.[15] More recently, the 2025 American Diabetes Association guidelines recommend use of CGM for all youth and adults with diabetes on any insulin therapy and advise considering its use for those on non-insulin regimens.[16]

Potential Limitations

The main challenges and barriers associated with the use of CGM in people living with T2DM in Canada, especially for those not on insulin regimens, include high cost and limited coverage, device-related adverse effects, psychosocial and usability concerns, data overload, and factors affecting device accuracy.

Cost and coverage are the most significant barriers. Public funding for CGM in Canada varies by province and territory, with most jurisdictions restricting coverage to people with T1DM or those on intensive insulin regimens. Adults with T2DM who are not on insulin often face substantial out-of-pocket expenses unless they have private insurance, leading to inequitable access and lower uptake among those with lower socioeconomic status.

Meta-analyses report that CGM use is associated with higher rates of local skin reactions compared to SMBG, including irritation, dermatitis, sensor adhesion difficulties, and, rarely, site infections.[7] These complications may lead to premature sensor removal or discontinuation of CGM. Strategies to mitigate these effects include cleansing the skin with alcohol, ensuring the site is completely dry prior to sensor placement, applying a topical corticosteroid (e.g., fluticasone) before insertion, and using barrier films or adhesives to improve sensor adhesion and reduce irritation.[17]

Alert fatigue generated by frequent or false alarms from rtCGM devices can cause distress and reduce user satisfaction.[13] This may be mitigated by individualizing alarm thresholds in collaboration with healthcare providers. Additionally, the visible nature of CGM devices can contribute to stigma or self-consciousness, particularly among younger adults or those with active lifestyles.[18] Increasing public awareness and involving media representation of diabetes technologies may help reduce this stigma over time.

CGM accuracy can be affected by certain medications or clinical conditions. High doses of vitamin C and acetylsalicylic acid (ASA) have been shown to interfere with FreeStyle Libre 1 readings,[19] while Dexcom sensors may be affected by hydroxyurea or high doses of acetaminophen,[20] necessitating caution in patients using these medications. Furthermore, MRI and CT imaging compatibility varies among CGM devices, often requiring sensor removal or replacement following imaging to ensure continued accuracy.[19] Users and healthcare providers should consult product

monographs and manufacturer guidance to avoid potential device damage or inaccurate readings. Although newer models such as Dexcom G7 and FreeStyle Libre 3 Plus have shown improved accuracy compared to older models, CGM performance can still decline during glucose extremes (severe hypoglycemia or hyperglycemia) or when physical pressure is applied to the sensor site, underscoring the need to confirm suspicious readings with fingerstick glucose measurements.

Practical Considerations

To effectively implement CGM in primary care, providers can take several practical steps.

First, identify suitable patients. CGM is particularly beneficial for people with diabetes who are on insulin or other therapies associated with hypoglycemia risk (e.g., sulfonylureas), those experiencing recurrent hypoglycemia or marked glycemic variability, and newly-diagnosed patients with diabetes where early insights may support education and behavioural change. CGM is also valuable for those on non-insulin regimens who are struggling to meet glycemic targets. Consider offering a CGM trial in collaboration with support from a local diabetes educator or pharmacist.

Second, become familiar with interpreting the ambulatory glucose profile reports that can be generated using the manufacturer platforms (e.g., Dexcom Clarity, LibreView), sensor readers, or associated smartphone applications. A step-by-step guide to assist in interpreting the ambulatory glucose profile data is as follows:

1. Assess for data sufficiency: aim for 10–15 days of wear with at least 70% data capture.
2. Review standardized metrics: focus on TIR, TAR, TBR, mean glucose, and glucose variability.
3. Examine the 24-hour ambulatory glucose profile: assess for trends of hypoglycemia or hyperglycemic episodes where treatment adjustments could be made.

Third, address access barriers early. Inquire about public and private coverage options and assist patients in applying for provincial or manufacturer-based support programs.

Finally, engage patients in shared review of CGM data. Identify patterns, link them to lifestyle or medication timing, and reinforce goals such as improving TIR, and minimizing hypo- or hyperglycemia episodes, and reducing glycemic variability.

Conclusion

CGM is a transformative advancement in diabetes management within primary care. By providing detailed, real-time insights into glycemic patterns beyond traditional measures such as HbA1c and SMBG, CGM empowers both people living with diabetes and clinicians to make more informed, personalized treatment decisions. This patient-centred technology not only supports improved clinical outcomes but also fosters positive behavioural changes and enhances patient engagement and confidence in self-management. With appropriate education, workflow adaptation, and patient support, CGM has the potential to significantly enhance the quality of diabetes care, ultimately improving health outcomes and quality of life for people living with diabetes.

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* Comparative clinical significance is unknown.
† This landing page is open to the general public.
‡ Comparative clinical significance not established.
BMI, body mass index; CVD, cardiovascular disease; GLP-1 RA, glucagon-like peptide-1 receptor agonist.

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Applications of *Canada's Guidance on Alcohol and Health* in Primary Care

Bryce Barker, PhD

Key Points
Given that alcohol is a leading preventable cause of death and social problems in Canada, it is important that primary care clinicians are empowered to provide the best advice to patients on alcohol use and health.
For long-term health, when it comes to consuming alcohol, the core message primary care clinicians should communicate to patients is "less is better."
The health and safety risks associated with alcohol use are determined by the number of standard alcoholic drinks consumed per week and per occasion. A standard alcoholic drink contains approximately 13.5 grams of alcohol.
To foster supportive conversations or potentially screen for and treat alcohol use disorder when necessary, it is crucial for primary care clinicians to take a non-judgmental, equitable approach to advising patients about alcohol and health.
Anchor conversations about alcohol to the risk zones in *Canada's Guidance on Alcohol and Health*: consuming 1–2 standard drinks per week is low risk, 3–6 standard drinks per week is moderate risk, and seven or more standard drinks per week is increasingly high risk. For drinks per occasion, more than two standard drinks increases short-term health risks.
Take into account special considerations about alcohol for young people under the legal drinking age, people who are pregnant, planning to become pregnant, or breastfeeding, as well as older adults.
Best practices for treating high-risk drinking and alcohol use disorder include prescribing anti-craving medications such as naltrexone and acamprosate, providing psychosocial counselling, and maintaining ongoing follow-up with patients.

Introduction

Canada's Guidance on Alcohol and Health by the Canadian Centre on Substance Use and Addiction (CCSA) provides evidence-based advice on alcohol to support people in making informed decisions about their health. The guidance is based on the principle of autonomy in harm reduction and the fundamental idea behind it that people living in Canada have a right to understand that all alcohol consumption carries risk.[1]

In Canada, alcohol remains a leading preventable cause of death, disability, and social problems, including certain cancers, cardiovascular disease, liver disease, unintentional injuries, impaired driving, gender-based and intimate partner violence, and fetal alcohol spectrum disorder.[1]

Alcohol is a leading preventable cause of death and social problems in Canada, making it important for primary care clinicians to be equipped with the knowledge to provide the best advice to patients on alcohol use and its health impacts.

Drawing on *Canada's Guidance on Alcohol and Health*, this article will outline the risks associated with alcohol use, define what constitutes a standard alcoholic drink, and describe best practices for primary care clinicians in Canada when discussing alcohol and health with patients — emphasizing the core message that drinking less alcohol is better for long-term health.

The Core Message: Less Is Better

Shortly after the release of *Canada's Guidance on Alcohol and Health*, an editorial published in the *Canadian Medical Association Journal* noted that the clearest, most correct advice clinicians can offer patients is that "less is better" regarding alcohol use.[2]

The key message of *Canada's Guidance on Alcohol and Health* based on the best available evidence is "To reduce the risk of harm from alcohol, it is recommended that people living in Canada consider reducing their alcohol use."[1] More succinctly: less is better.

As noted by Dr. Sheila Wijayasinghe in a 2025 *Globe and Mail* article, "The evidence shows that even small amounts of alcohol carry health risks, including seven types of cancer, heart disease, liver damage, mental health effects, and disrupted sleep."[3]

Alcohol and Risk

The risks associated with consuming alcohol are determined by both the number of standard alcoholic drinks consumed per week and per occasion.

A standard alcoholic drink contains approximately 13.5 grams of alcohol. That corresponds to a 341 mL container of beer, cider, or ready-to-drink cocktail at 5% alcohol, a 142 mL serving of wine at 12% alcohol, or a 43 mL serving of spirits at 40% alcohol (refer to **Figure 1**).

Consuming two or fewer standard drinks per week is considered low risk for negative long-term health outcomes. Consuming three to six standard drinks per week increases the risk of some long-term health outcomes, including breast and colon cancers. Drinking seven or more standard drinks per week further increases peoples' risks of cancer, as well as heart disease and stroke (refer to **Figure 2**).[1]

In terms of short-term risks, consuming more than two standard drinks per occasion increases the risk of injuries, accidents, and violence.[1]

The risk of harm from drinking alcohol begins at lower levels of consumption and increases gradually with greater intake. Reducing alcohol use by drinking less per occasion and fewer drinks per week can have positive impacts. This includes making changes that still fall within the high-risk category, such as cutting back by consuming seven drinks per week instead of 14 per week.

Discussing Alcohol and Health with Patients

When discussing alcohol use with patients, it is important that primary care clinicians adopt a non-judgmental and supportive approach to effectively share information, screen for risks, and provide guidance. Explaining the concept of a standard drink, sharing practical tips for reducing alcohol use, and providing tailored advice for specific groups of people can further support patients in making informed decisions about their alcohol consumption that support their health.[4]

Use Stigma-Free Language

Due to the stigma surrounding alcohol use, patients can feel singled-out when confronted with questions about their alcohol consumption, which can make it challenging to have supportive conversations or potentially screen for and treat alcohol use disorder when necessary.

Figure 1. Measurements of a standard alcoholic drink in Canada; *courtesy of Canadian Centre on Substance Use and Addiction.*

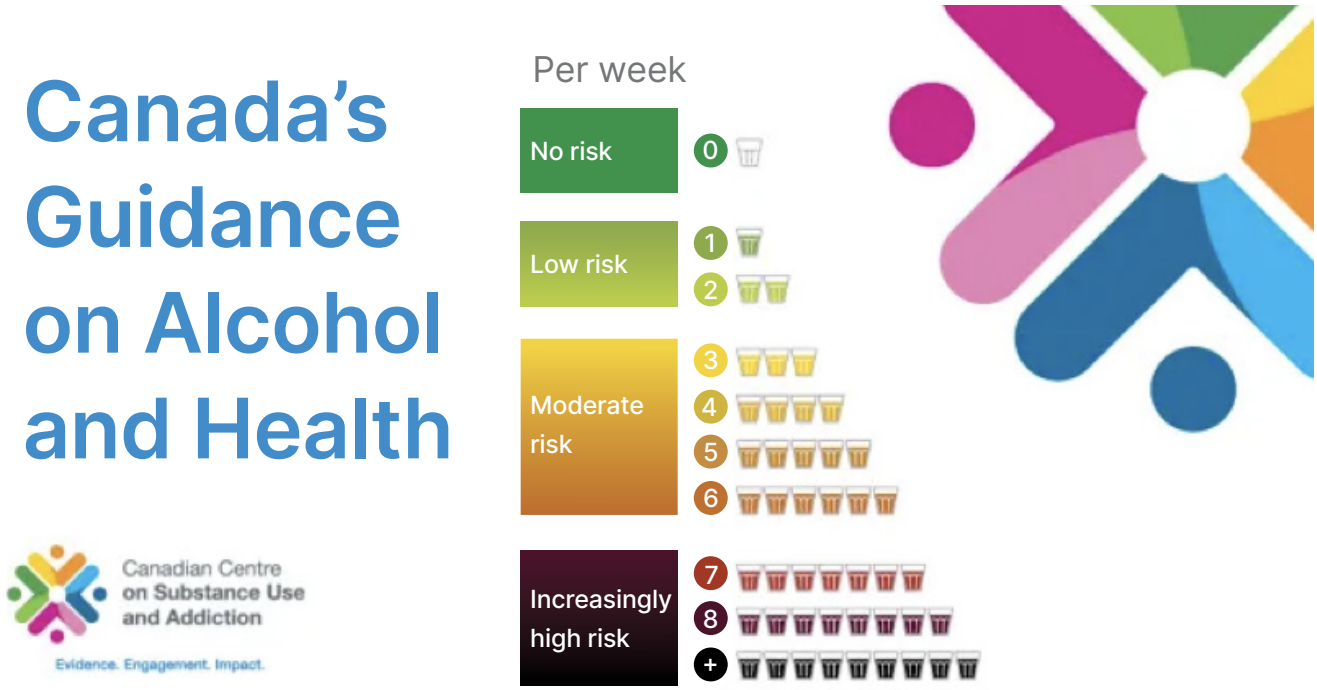

Figure 2. Continuum of risk associated with weekly alcohol use; *courtesy of Canadian Centre on Substance Use and Addiction.*

It is crucial for clinicians to take a non-judgmental and equitable approach to conversations about alcohol. Here are a few examples for opening the conversation:

- "I talk to all my patients about alcohol and other substance use. Would it be alright for us to talk about this now?"[5]
- "Canada has guidance about drinking and its impacts on health. Would you be interested in hearing their recommendations? I try to inform all my patients on how to prevent health issues related to alcohol."[4]

Sample dialogue when discussing drinking less:

- "Alcohol at almost any level may have negative impacts on health, but that these effects occur along a spectrum and it is up to every individual to decide for themselves how much they will consume."[5]
- "This isn't all-or-nothing. The guidance outlines a continuum of risk. Even moving from seven drinks a week to three or four can improve energy, sleep and long-term health."[3]
- "You can make changes gradually; every drink counts, and any reduction has benefits."[1]

Explain the Concept of a Standard Drink and Share Resources

Before discussing alcohol and health, clinicians can begin by asking a few simple screening questions during the collection of information at intake, such as how much alcohol a patient consumes per week and per occasion. Note that many people in Canada are not familiar with the concept of a standard alcoholic drink.[1] Showing patients visual aids, such as the figures in this article from CCSA's **Drink Less Live More campaign** can help clarify this concept.

Provide key messages about alcohol and health regularly and via diverse methods of communication including at the point of care.

Here are some resources:

1. CCSA's **Communications Toolkit: Canada's Guidance on Alcohol and Health** contains several resources that provide key messages about alcohol, including practical steps for cutting back on alcohol consumption.
2. The Help With Drinking website by the British Columbia Centre on Substance Use provides **point of care tools for healthcare providers**.
3. Campaign materials: Whether through digital displays in your location, shared via patient emails, or posted on your healthcare team's social media accounts, well-considered key messages can effectively communicate important information about alcohol and health. Here are some examples below:
    - CCSA's **Drink Less Live More** campaign helps explain concepts such as standard drink measurements, risk zones, and the risks associated with drinking alcohol.
    - The New Brunswick Medical Society's **It's your Choice. Know the Risks** campaign educates patients about the risks associated with alcohol and cannabis use.
    - The Southwest Polysubstance Workgroup's **Rethink Your Drinking** website focuses on recent alcohol research from *Canada's Guidance on Alcohol and Health*.
    - Help With Drinking also includes **point of care resources** for physicians to share information about alcohol, including tips for drinking less.
    - The Government of New Brunswick's **Health risks of alcohol webpage** has short videos featuring Dr. Yves Léger, Chief Medical Officer of Health, explaining *Canada's Guidance on Alcohol and Health* for the public.

Advise that Less Is Better

While best practice suggests that primary care clinicians provide brief interventions to patients who screen as high-risk for alcohol use disorder, providing concise advice is also appropriate for patients with increasingly high-risk drinking levels. Patients who are not at high risk for alcohol use disorder may still benefit from this advice and may be able to modify their drinking in a straightforward manner.

Common tips for reducing alcohol consumption include:

- Set limits for intake per week and per occasion.
- Alternate between alcoholic and non-alcoholic drinks.
- Eat before and while drinking.
- Choose lower-alcohol or non-alcohol alternatives in place of regular alcoholic drinks.
- Plan alcohol-free days and weeks.
- Plan activities that do not involve alcohol.
- Seek support from family and friends, and ask them to avoid drinking alcohol around you.
- Practice refusing alcoholic drinks.[1,6-8]

There are several tools to share with patients that can support them to consider reducing their alcohol consumption:

1. CCSA's **Knowing your Limits with Alcohol: A Practical Guide to Assessing your Drinking** provides tips and guidance for individuals considering changing their alcohol consumption.
2. **Know Alcohol** is a web resource that patients can use to explore how alcohol impacts their health, financial costs, and calorie intake.
3. **Help with Drinking** offers information and resources for the public and for healthcare providers based on the **Canadian Clinical Guideline: High-Risk Drinking and Alcohol Use Disorder**.

Advise Based on Special Considerations

Discussions about alcohol should be tailored for different patients:

- Adolescents and young adults are at increased risk of negative outcomes from their drinking and should therefore be encouraged to delay drinking as long as possible.[1]
- People who are pregnant, planning to become pregnant, or breastfeeding should avoid alcohol, since alcohol is a teratogen and can be present in breastmilk following consumption.[1,4]
- Older adults should consider reducing or eliminating alcohol if they have comorbid conditions, frailty, or are taking medications that may interact harmfully with alcohol.[1,9]
- People experiencing mental health challenges, illnesses, or cognitive impairment should consider reducing or abstaining from alcohol.[1,4,9]
- Conversations about alcohol may also be appropriate when discussing various other areas such as nutrition and Canada's Food Guide, sleep, and mental health, especially since alcohol can affect each of these areas and cutting back on alcohol or changing drinking patterns can help.[1,4,10]

High-Risk Alcohol Use and Alcohol Use Disorder

Alcohol use disorder is estimated to affect approximately 18% of the population, while increasingly high-risk drinking, defined as consuming seven or more standard drinks per week, is estimated to occur in approximately 34% of the population aged 15 years and older.[4,11]

Developed by the British Columbia Centre on Substance Use and the Canadian Research Initiative in Substance Matters, the Canadian Guideline for the Clinical Management of High-Risk Drinking and Alcohol Use Disorder recommends using *Canada's Guidance on Alcohol and Health* in initiating discussions with patients about alcohol use. In addition, the guideline suggests:

1. Routine screening once per year using a validated screener.
2. When appropriate, diagnose alcohol use disorder using criteria from the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision.
3. Brief interventions for patients at high risk of alcohol use disorder.
4. Screening for and supporting patients at risk for acute withdrawal symptoms.
5. Administration of anti-craving medications such as naltrexone and acamprosate.
6. Appropriate psychosocial supports.[4]

Conclusion

To summarize, "less is better" remains an appropriate message for patients regarding alcohol consumption and its impact on their health and well-being.

There are several ways to help patients understand the risks associated with alcohol and health, including point-of-care communication. Clinicians can begin by screening patients for alcohol use patterns and engage in supportive, non-judgmental conversations about alcohol and risk. These interactions can also serve as part of a more comprehensive approach for identifying and treating alcohol use disorder.[2,3]

To be effective, these discussions should be consistent, stigma-free, and tailored to the needs of specific populations, while including evidence-based interventions for people at high risk or living with alcohol use disorder.

With alcohol remaining one of the leading preventable causes of death and social harms in Canada, empowering primary care clinicians to share accurate information with compassionate care is a vital step toward reducing alcohol-related harms and improving overall health outcomes.[1,12]

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  - metformin and a sulfonylurea, or
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HbA1c=glycated hemoglobin; T2D=type 2 diabetes.
* Fictitious patient. May not be representative of the general population.
‡ The landing page of mounjaro.ca is open to the general public. To access healthcare provider-directed information, you will need to log in. Patients will require a DIN to access patient-directed information.

Reference: Current Mounjaro Product Monograph. Eli Lilly Canada Inc.

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Harnessing Artificial Intelligence (AI) Tools in Primary Care: The Promise of Being Smarter, Safer, and More Present

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Why Consider a Shift to Using AI Now?

Primary care clinicians (PCCs) are increasingly overwhelmed by the rising number of tasks, expanding patient rosters, and the ever-growing volume of new data and studies. Artificial Intelligence (AI) has captured the attention of many clinicians for both personal and professional use. The College of Family Physicians of Canada (CFPC) AI Working Group has highlighted the growing role of AI in family medicine.[1] These applications are emerging across prevention, decision support, and efficiency. However, most remain largely insufficiently tested in or validated for clinical practice, making careful implementation essential to maximize benefits and minimize harm.[2] In the U.S., AI is already helping to reduce clerical burdens by drafting letters, simplifying forms, or explaining results, yet clinicians are cautioned against its unsupervised use in direct clinical decision-making due to risks such as bias and hallucination.[2]

This article focuses on exploring the evolving AI options available to PCCs. We aim to provide a practical framework for evaluating these tools, highlight key features worth considering, and suggest strategies for effective and safer implementation.

Understanding the Basics of AI

AI differs from traditional technology because it does not follow fixed, pre-programmed rules. Instead, AI systems learn from data, allowing them to recognize patterns, make predictions, and generate responses.[2]

The foundation of today's most widely used AI tools are **Large Language Models (LLMs)**. These models, such as ChatGPT, are trained on vast amounts of text to learn the statistical relationships between words and concepts.[3] When asked a question, an LLM does not "recall" facts. Instead, it constructs an answer by predicting the most likely sequence of words, essentially functioning as a sophisticated form of predictive text.[3]

Why understanding the basics of AI matters in clinical care:

- **Training data quality matters.**
  - Specialized AI tools (e.g., OpenEvidence) rely on vetted medical sources for their training, whereas general LLMs trained on broad internet data are more prone to errors and bias.
- **Responses can vary significantly.**
  - The same question may yield different outputs depending on the model or AI agent used. Even the same agent can generate different responses to similar questions because of the randomness in text prediction.
- **Hallucinations can occur.**
  - AI can produce plausible but factually incorrect statements. This may happen when training data is incomplete or biased, leading the agent to 'fill in the gaps' with confabulated associations. This poses a key safety concern in healthcare, where even small inaccuracies can have serious consequences.

To Use or Not to Use AI?

Clinicians should follow three key principles when considering the use of AI. They should only use AI as a tool to augment their work.

1. **Never first:** Clinicians should use AI only after applying their own clinical knowledge and experience.
2. **The assistant not the professor.** Think of AI as an assistant or student that produces a draft, rather than providing the final answer to a question.
3. **Always question and verify.** Always verify outputs against one's clinical judgment, knowledge of current guidelines, and evidence before applying them to patient care.

The Hidden Cost of AI in Healthcare: Is Clinical Thinking at Risk?

Some experts are concerned that over-reliance on AI could lead to cognitive atrophy. Early data from some exploratory projects suggest that using AI for cognitive offloading may hinder the development of problem-solving skills.[4] Concerns regarding skill atrophy and over-reliance on AI are widespread.[5]

A second perspective is that AI, when applied thoughtfully, can help clinicians manage cognitive overload and improve care.[6] Evidence indicates that tools such as scribes and AI-driven workflow automation can reduce clerical burdens, enhance efficiency, and allow clinicians to spend more time in direct patient care, potentially reducing burnout and improving the quality of care.[6,7]

In summary, the long-term effect of AI on human cognition is unknown. Relying on AI to perform all cognitive tasks could potentially lead to atrophy of these skills. For clinicians, it is important to view AI as a tool to complement their knowledge and training.

Safe Use of AI for Clinicians – A Framework

Canadian regulatory and professional organizations have provided guidance on the safe use of AI in clinical practice. The Canadian Medical Protective Association (CMPA) highlights both the opportunities and medico-legal risks associated with AI, emphasizing that clinicians remain responsible for patient care decisions.[8] Similarly, the College of Physicians and Surgeons of British Columbia (CPSBC) has issued interim guidance stressing privacy, informed consent, transparency, and accountability when integrating AI tools into medical care.[9] Collectively, these advisories underline that AI can complement, but never replace, clinical judgment. In addition, its use must align with professional, ethical, and legal standards.

When integrating AI into practice, clinicians should begin with two essential principles:

- **Protect patient privacy:** Never input identifiable patient information into general-purpose AI tools. Use only information that is de-identified, anonymized, or publicly available (e.g., guideline PDFs, published articles).
- **Apply a structured framework for queries:** Consider the following framework (Role, Risk) when deciding how to use AI in clinical settings (**Table 1**).[4]

AI Scribes Have Highlighted a Potential Role for AI

AI medical scribes are among the first AI tools being adopted by Canadian clinicians.[10] These technologies are modernizing documentation workflows and have changed clinician-patient interactions.[11] These tools utilize ambient speech recognition and natural language processing to passively listen to visits, generate notes, and reduce the administrative burdens of documentation.[12] AI scribes provide cognitive support, enabling clinicians to shift their focus from documentation to actively listening and engaging with patients,[12] which, allows clinicians to focus on goal-directed therapy and/or planned, proactive preventative care whilst remaining more engaged during encounters. Patients may also benefit from AI-generated patient summaries and the potential enhanced face-to-face time with their clinician.[12] AI scribes are not without risks, including potential errors, bias, and privacy concerns. As frontline tools, AI scribes play a direct role in supporting clinician presence and performance.[11,12]

AI as a Support Tool Across Primary Care Roles

PCCs often manage diverse roles beyond direct patient treatment, including clinical and administrative tasks, as well as educational duties.

Risk	• Each task performed by AI carries some risk. • There are three key risk categories for the use of AI: ◦ **Low-stakes tasks:** Where potential errors carry minimal risk, which includes tasks such as drafting emails or creating educational materials. ◦ **Medium-stakes tasks:** These require increased clinician oversight due to increasing ramifications, such as summarizing research for clinician review. ◦ **High-stakes tasks:** These carry significant consequences if AI makes mistakes. It is unsafe for AI to perform these tasks without direct clinician control. These include tasks such as diagnostic and prescribing decisions.
Role	• The perspective from which the question is asked depends on what role the clinician is playing in their multiple roles including: ◦ 1:1 clinical care ◦ Seeking evidence-based guidance ◦ Development of patient education material ◦ Clinic administration optimization workflows.

Table 1. Concepts of Risk and Role in the Clinical Use of AI; *courtesy of Daniel Ngui, MD, FCFP and Michael Boivin, Rph, CDE, CBE.*

The integration of AI can help to transform how these roles are managed, offering new ways to enhance efficiency, support professional development, and improve patient care. **Figure 1** illustrates how AI can support the many roles of clinicians.

Choosing the Correct AI Tool

Healthcare professionals should evaluate different AI tools based on their training context and original design intent, as these factors may influence the likelihood of bias or the risk of hallucinations (**Table 2**). Each tool has its own strengths and weaknesses, therefore, clinicians are encouraged to experiment with multiple AI agents to determine which works best for the task at hand.

Examples of Everyday AI Uses in Primary Care

The role for AI in clinical practice is evolving rapidly, extending beyond tools such as AI scribes. Clinicians can now consider a variety of use cases where AI adds value. The current roles for AI can be categorized into three main groups:

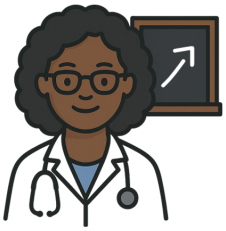
- Simplifying time consuming tasks such as drafting and revising letters for patients, or for clinic management tasks such as writing internal memos, formatting complex meeting minutes, or developing office manuals.
- Assisting PCCs in improving daily practices and workflows.
- Assisting with the synthesis and review of large volumes of data, such as from journal articles, clinical practice guidelines, or medical presentations.

Practice pearls for AI use in clinical care may include:

- **Use voice-to-text:** Dictate queries directly to speed up interactions.
- **Track projects and tasks:** Many AI tools can function as project trackers or maintain running to-do lists.
- **Upload or drag and drop context:** Share snippets of documents, full PDFs, URLs, or images (e.g., guidelines, patient handouts, research articles). Please ensure any patient information is fully redacted before uploading. The AI can then summarize, generate action items, or generate patient-friendly materials.
- **Work across multiple windows:** Keep separate AI windows open for different tasks or AI agents (e.g., one for clinical summaries, one for teaching preparations, and one for administrative work).

Clinician: Direct patient care tasks such as writing letters or reviewing and summarizing the latest clinical practice guidelines

Learner: AI can assist in continuing professional development and keep track of latest guidelines and trial data



Educator: Teaching residents, creating CME content, keeping track and sharing for your trainee

Consultant: Preparing for meetings by using AI for clinical trial summaries and gap analysis literature synthesis

Leader: Developing clinic policies, meeting summarization and creating team newsletters or communications

Figure 1. The Potential of AI to Support the Many Roles of Primary Care Clinicians; *courtesy of Daniel Ngui, MD, FCFP and Michael Boivin, Rph, CDE, CBE.*

- **Personalize the settings:** Provide the AI with context on who you are and what you value (e.g., "I am a Canadian primary care clinician who prefers evidence-based, guideline-relevant material"). This helps improve the consistency and relevance of its responses.

AI tools can also support interprofessional collaboration. Teams should first agree on the ways AI should be used. For example, tasks such as drafting summaries of guidelines, generating links to patient education materials, or sharing overviews of new clinical trials should be treated as starting points for team discussion and review, not as final authority. This approach strengthens teamwork while ensuring clinical efficiency. Additional examples of AI-supported tasks that clinicians can consider are listed in **Table 3**.

Improve Your AI Results by Improving Your Prompt

The quality of an AI-generated response largely depends on **asking the right question**. The more detailed and specific the prompt, the more relevant and applicable the output will be. One helpful method is the **Context, Task, Output** and **Requirements** framework, which guides users in structuring their AI questions based on the nature of the task. Applying this method can help improve the results. However, not every task requires all four features.

For many **low-stakes** tasks, a simple prompt such as:

"Create an infographic for patients with type 2 diabetes that provides practical, culturally sensitive dietary recommendations during Ramadan fasting."

For **moderate** or **high-stakes** tasks, providing more detail and context to the prompt is often necessary. While the ideal prompt may be longer than a simple question, the added specificity and direction helps produce more reliable and useful results. To further enhance the quality of the response, clinicians can upload supporting resources (e.g., PDFs) to the LLM. Of course, these resources should not contain any confidential patient information. An example of this type of prompt with an uploaded guideline chapter:

"I am a family physician in New Brunswick. I would like you to summarize the Diabetes Canada Guidelines on hypoglycemia management. Can you return points that I can consider using when educating my patients. The guidelines are attached. Use only content from this source."

Table 4 provides some considerations when entering a prompt into an LLM such as ChatGPT, Gemini, or Claude.

Different AI Tools	Potential role	Cost
Specialized AI tools		
OpenEvidence (openevidence.com)	• Specifically designed for use by licensed clinicians • Trained on vetted medical literature • Partnered with journals such as the *New England Journal of Medicine* and *The Journal of the American Medical Association* for direct access • **Bottom line:** ◦ Best for clinical decision-making support, high-risk evidence retrieval, and compliance-required environments ◦ Can only be used for queries on clinical information; not a multi-purpose tool	Currently available at no cost and with unlimited access exclusively for healthcare professionals with a medical licencing identifier
Perplexity (perplexity.ai)	• Designed as an AI-powered search engine with real-time web access and clearly cited sources • Unlike a 'typical' internet search, its goal is to provide the most accurate answer to your question • **Bottom line:** ◦ Excellent for rapid literature reviews, confirming facts, or finding up-to-date resources	**Standard plan:** free **Pro plan:** $20 USD/month
General AI large language models		
ChatGPT (chatgpt.com)	• These AI platforms are built on generalized LLM models • They serve as a repository of everything stored on the internet, encompassing both correct and incorrect information • **Bottom line:** ◦ These tools should be thought of as a "Swiss army knife/multi-tool' versus as a single instrument for a specific task ◦ Most suitable for low-to-medium risk work ◦ One can keep track of projects. These tools can be customized and adapted for different roles, such as drafting referral letters, translating medical knowledge, summarizing research, or supporting complex communication needs	**Standard plan:** free **Pro plan:** $20 USD/month
Gemini (gemini.google.com)		**Standard plan:** free **Pro plan:** $20 USD/month
Claude (claude.ai)		**Standard plan:** free **Pro plan:** $20 USD/month

Table 2. Different AI Tools/Agents; *courtesy of Daniel Ngui, MD, FCFP and Michael Boivin, Rph, CDE, CBE*.

Category	Suggestions
Summarize and provide insight for clinicians	• **Guideline Analysis:** Rapidly generate concise summaries of guidelines (e.g., Diabetes Canada, Hypertension Canada) for quick reference. • **Research appraisal:** Produce structured summaries of recent journal articles that include methodology, results, and clinical implications.
Improving patient education or messaging	• **Patient handouts:** Create patient-friendly handouts for explaining conditions, test results, or medications, or to locate reliable links to existing materials online. • **Tailored lifestyle handouts:** Generate dietary, exercise, or sleep suggestions adapted to cultural or religious needs (e.g., managing diabetes during Ramadan). • **Visual aids:** Design simple infographics or icons for explaining common conditions (e.g., hypertension zones, insulin titration charts). • **Shared decision-making tools:** Produce lists of patient-centred questions to guide discussions. • **Difficult conversations:** Draft suggestions for patient centric and simplified messages when delivering difficult news, discussing adherence, or addressing vaccine hesitancy.
Clinical risk calculation tools	• **Generate structured, guideline-based risk scores:** Use patient-specific variables to calculate scores (e.g., FIB-4, ASCVD 10-year cardiovascular risk, or CKD staging with eGFR/ACR). • **Provide concise outputs for clinicians:** Include key elements such as risk category, referral thresholds, treatment triggers, and simplified summaries to support patient discussions.
Continuing education support	• **Multiple choice or short answer quizzes:** Develop brief case-based questions for self-assessment after reading an article or attending a webinar. • **Clinical scenarios:** Simulate short vignettes with multiple-choice management questions to reinforce guideline updates.
Practice management	• **Referral letters**: Accelerate the drafting of referral letters for specialists using redacted patient information. • **Employer notes:** Generate clear, professional documentation for medical absence or workplace accommodations, guided by specific prompts. • **Clinic protocols workflow optimization:** Analyze current clinic operations manuals such as triage procedures, refill requests, or job descriptions, and create communiques and suggest improvements. • **Team role optimization:** Analyze team-based care interactions to identify opportunities for role-specific support (e.g., pharmacists for titrations, nurses for patient education).

Table 3. Examples of Clinical Uses of AI in Primary Care; *courtesy of Daniel Ngui, MD, FCFP and Michael Boivin, Rph, CDE, CBE*.

Abbreviations: ACR: albumin-to-creatine ratio; **ASCVD:** atherosclerotic cardiovascular disease; **CKD:** chronic kidney disease; **eGFR:** estimated glomerular filtration rate; **FIB-4:** Fibrosis-4 Index

Component	Reason and example
Context	• Include your role, the patient's condition, and care setting. For example: ◦ ***"I am a nurse practitioner in Alberta preparing a handout for a newly diagnosed patient with type 2 diabetes."***
Task	• Specify the exact deliverable (e.g., guideline summary, patient letter, clinical research synthesis, clinic operating manual, or meeting agenda). For example: ◦ ***"Summarize the 2025 Diabetes Canada chapter listing the A1C, BP and LDL-C targets and proven agents for adults with diabetes and CKD."***
Output	• Indicate the type of report or output and the desired length. For example: ◦ ***"Return as a bullet-point summary under 200 words with citations."*** ◦ ***"Give me 5 action items for daily practice as a pharmacist."***
Requirements	• List the requirements that should be included in the response. For example: ◦ **Sources and citations:** Provide working full URLs only after verifying they open to the correct document. If a link cannot be confirmed, state 'No working link found.' ◦ **Limit to specific sources:** The references should come from only reputable organizations (e.g., Diabetes Canada, U.K. NICE guidelines, WHO, or major U.S. medical organizations).

Table 4. Components and Structure of a Well-Designed AI Prompt; *courtesy of Daniel Ngui, MD, FCFP and Michael Boivin, Rph, CDE, CBE.*

Abbreviations: BP: blood pressure; **CKD:** chronic kidney disease; **LDL-C:** low-density lipoprotein cholesterol; **NICE:** National Institute for Health and Care Excellence); **WHO:** World Health Organization

Using AI to Perform a Quality Check

Techniques to improve the quality of the AI response for moderate- to high-stakes tasks:

AI Audit and Quality Improvement Cycle

A. Ask the AI to help refine your prompt by requesting suggestions. For example: ***"How can I improve my prompt"*** to improve the overall results.
B. Ask AI to self-analyze the results. For example: ***"Show your analysis step by step including assumptions and citations. Keep it concise and show me the final reasoning steps and sources."***

When to Use the Advanced Research Button

This is a feature available for many AI tools that directs the search to include an extended, multi-step reasoning model that processes information for more sophisticated analysis. This is especially important for medium- and high-stakes queries. Consider using this feature when you need to:

- Gather information from multiple sources
- Cross-check claims
- Include citations and alternative perspectives
- Deliver a comprehensive, evidence-based response

Figure 2 provides some recommendations on when clinicians should consider using advanced research and when it is best avoided.

So... Truly Smarter... Safer, and More Present?

The evidence is emerging: AI tools ranging from specialized platforms such as OpenEvidence to general-purpose LLMs such as ChatGPT can enhance efficiency, support evidence-based decision-making, and preserve the precious commodity of clinical bandwidth. However, these benefits depend on using AI within an appropriate role and risk framework, crafting high-quality prompts, and directing the AI model to perform self-checks. Clinicians must be able to match the technique to each task. For low-stakes tasks such as locating patient education URLs, AI offers immediate value with minimal risk. For high-stakes

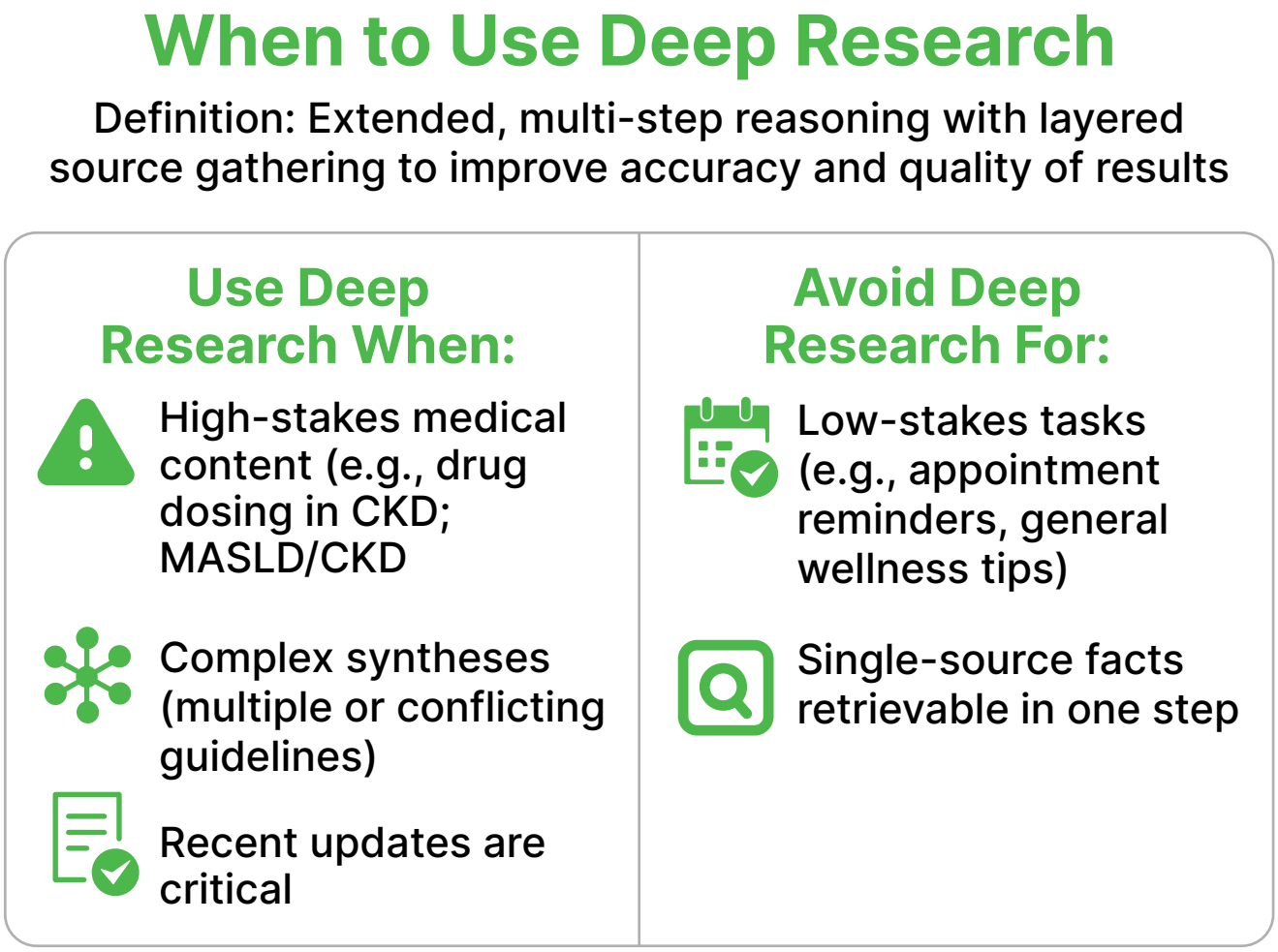


Figure 2. When to Use and Not Use Deep Research; *courtesy of Daniel Ngui, MD, FCFP and Michael Boivin, Rph, CDE, CBE.*

Abbreviations: CKD: chronic kidney disease; **MASLD:** metabolic dysfunction-associated steatotic liver disease

tasks, such as clinical decisions, AI requires continued human oversight.

AI literacy has become a new professional competency in today's era of continuous professional development and growing clinical and administrative burdens. With the surge in data and tasks, clinicians must learn to use AI effectively and safely, always as an assistant, never as a replacement for clinical judgment.

When applied thoughtfully, AI can help us work smarter, by rapidly synthesizing evidence, generating insights, and supporting continuous learning. It can help us be safer, by connecting clinicians to validated clinical tools and by helping with the creating and sharing of standardized operating procedures and visit templates based on new studies or clinical practice guidelines. Most importantly, AI can help us be more present, by reducing clerical burdens so that clinicians can focus on listening and engaging with patients, and to be better able to deliver goal-directed therapy at the point of care.

Suggested Next Steps for Clinicians Who Want to Start Using AI in Clinical Practice

- **Stay informed:** Keep current with professional guidelines and regulatory updates as standards for AI use continue to evolve.
- **Choose appropriate tools:** Align specialized AI platforms with clinical decision-making needs, and use general LLMs for administrative or educational tasks.
- **Patient consent:** Inform patients when AI tools are used, ensure they consent, and document appropriately.
- **Start small:** Begin with low-stakes applications, such as drafting patient education materials or summarizing guidelines.
- **Selecting the AI agent:** Every AI agent has strengths and limitations and can excel at different tasks. Clinicians are encouraged to try different agents to determine which is the most effective for the task at hand.
- **Establish verification workflows:** Always review AI outputs, especially for medium- and high-stakes clinical applications.
- **Experiment safely:** Build confidence and safe practices by first applying AI to non-patient-facing tasks.
- **Document AI use:** Document when AI contributes to patient care (e.g., copy and paste evidence from OpenEvidence into the patient's chart).

Bottom line: The question is not if clinicians will use AI, but when, and how safely and skillfully they integrate it into clinical practice to enhance patient care while preserving the human connection.

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D.N.: Speaking Fees/Honoraria, Medical Consultant, and Shareholder: Empathia AI Scribe
M.B.: None declared.

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Adult Immunization in 2025

Angel Chu, MD

Introduction

Immunization represents one of the most significant achievements in medicine. Over the past 50 years, vaccines have prevented more deaths in Canada than any other public health intervention.[1] Routine childhood immunization programs have dramatically reduced the incidence of highly transmissible infections, such as measles, mumps, rubella, and varicella. Furthermore, vaccination efforts have led to the global eradication of smallpox and the near elimination of poliomyelitis.[1] However, declining vaccination coverage has facilitated the re-emergence of vaccine-preventable diseases, as evidenced by the ongoing resurgence of measles outbreaks worldwide.[2]

Vaccination is the most effective and durable intervention for the prevention of numerous infectious diseases.[1] Immunization programs provide substantial benefits for patients and communities from potentially life-threatening infectious diseases. Early-life vaccination is essential for children to develop robust immunity. Furthermore, immunization remains a critical preventive measure in older adults who exhibit increased vulnerability to infection and a higher likelihood of severe outcomes, including complications, hospitalizations, and deaths. The objective of this review is to provide information on immunization across all age groups and at-risk populations.

Pneumococcal Vaccines

Streptococcus pneumoniae is a bacterium that colonizes the nasopharynx.[3] Transmission occurs primarily via direct contact or respiratory droplets, although indirect exposure through contaminated respiratory secretions is also possible. This pathogen remains the leading cause of community-acquired pneumonia in adults. However, in addition to non-invasive disease, *Streptococcus pneumoniae* can cause invasive infections such as meningitis or bacteremia, oftentimes associated with high mortality rates.[3]

Children, older adults, and individuals with underlying medical, social, behavioural, or environmental risk factors represent populations at increased risk for pneumococcal disease[3] (**Figure 1**). In Canada, two recently authorized pneumococcal conjugate vaccines, Pneu-C-20 and Pneu-C-21, are recommended for adult immunization.[3] Additional pneumococcal vaccines currently available include Pneu-C-13, Pneu-C-15 and Pneu-P-23.[3] These vaccines differ in their serotype coverage,[3] which has implications for clinical decision making regarding these vaccines.

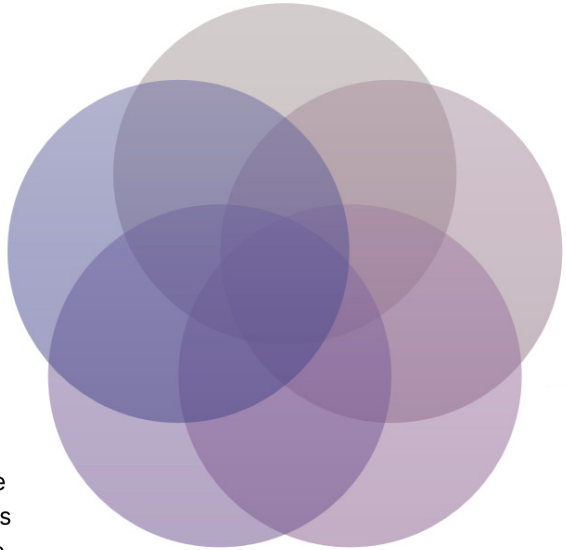
According to current Canadian guidelines, a single dose of either Pneu-C-20 or Pneu-C-21 is recommended for all adults aged >65 years as well as for adults aged <65 years who are at increased risk of invasive pneumococcal disease regardless of prior pneumococcal vaccination history.[3] In adults aged >65 years who have previously

Risk factors for pneumococcal disease in adults

Immunocompromised Individuals

- HIV
- Cancer (solid, hematologic)
- Solid organ transplantation
- Autoimmune diseases
- Immunosuppressive therapy, corticosteroids
- Primary immunodeficiency

Age ≥65 years



Medical comorbidities

- Chronic heart disease
- Chronic lung disease
- Diabetes
- Functional or anatomic asplenia
- Chronic liver disease
- Cerebrospinal fluid leak
- Cochlear implants
- Chronic renal failure, nephrotic syndrome*

Behavioural

- Smoking
- Alcohol abuse
- Homelessness
- Illicit drug use

External

- Socioeconomic
- Environmental
- Prior viral respiratory infection (e.g., influenza)
- Long-term care resident

	Serotypes in pneumoccal vaccines																														
Vaccine	**1**	**4**	**6B**	**9V**	**14**	**18C**	**19F**	**23F**	**5**	**7F**	**3**	**6A**	**19A**	**22F**	**33F**	**8**	**10A**	**11A**	**12F**	**15B**	**2**	**9N**	**17F**	**20**	**15A**	**16F**	**20A**	**23B**	**24F**	**31**	**35B**
PNEU-C-10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																					
PNEU-C-13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																		
PNEU-C-15	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																
PNEU-C-20	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓											
PNEU-C-21										✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
PNEU-C-23	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							

Figure 1. Pneumococcal vaccines: Canadian Immunization Guide; *courtesy of* ***Canada.ca***.

*Unless immunosuppressed by long-term corticosteroids. PHAC. Canadian Immunization Guide. October 2016.

received pneumococcal vaccines, administration of Pneu-C-20 or Pneu-C-21 should occur at least one year after the most recent dose of Pneu-C-13, Pneu-C-15, or Pneu-P23.[3] When Pneu-C-20 or Pneu-C-21 are unavailable or inaccessible, an alternate schedule consisting of Pneu-C-15 followed by Pneu-P-23, separated by at least 8 weeks, may be used.[3]

Respiratory Syncytial Virus Vaccines

Respiratory syncytial virus (RSV) is a major cause of lower respiratory tract infection in infants, young children, and older adults.[4] In Canada, RSV activity typically begins in late fall and continues until early spring.[4] For optimal protection, RSV vaccines should be administered just before the onset of the RSV season. The highest disease burden occurs among infants and older adults, especially those with underlying comorbidities.[4] In older adults, RSV infection is associated with increased rates of hospitalization, intensive care unit admission, and death.[4]

Currently, three vaccines are available for preventing RSV in adults >60 years: RSVPreF3 (Arexvy), RSVpreF (Abrysvo™), and mRNA-1345 (mRESVIA®).[4] Additionally, RSVpreF is indicated for adults 18 to 59 years of age at increased risk for RSV disease and pregnant individuals 32 to 36+6 weeks gestation for infant RSV protection from birth to 6 months.[5] RSVPreF3 is indicated for adults 50 to 59 at increased risk for RSV disease (**Table 1**).[4]

Current Canadian recommendations advise RSV immunization for adults aged ≥75 years, particularly those at increased risk of severe RSV disease (**Table 2**), as well as for adults aged ≥60 years who reside in nursing homes or other chronic care facilities.[4] For adults aged 50 to 74 years, vaccination may be considered on an individual basis following consultation with a health care provider. In this age group, a single dose of RSVPreF3, RSVpreF, or mRNA-1345 may be administered to adults aged 60 to 74 years.[4] At present, the need for a subsequent RSVpreF, RSVPreF3, and mRNA-1345 vaccine dose in adults aged ≥50 years, as well as an optimal strategy for booster administration, are not yet clear. Furthermore, adults who live in or are part of certain First Nations, Métis, and Inuit communities might consider RSV vaccination at a younger age, given the evidence for an increased burden of illness due to social, environmental, and economic factors rooted in historical and systemic inequities.[4]

Shingles Vaccine

The National Advisory Committee on Immunization (NACI) continues to recommend the recombinant zoster vaccine (RZV) for all adults aged ≥50 years who do not have contraindications. However, NACI now strongly recommends that individuals aged >18 years who are, or will become, immunocompromised receive two doses of RZV to prevent herpes zoster and its associated complications[6] (**Table 3**). For an optimal immune response, the two-dose RZV series should ideally be completed at least 14 days before the start of immunosuppressive therapy.[6]

For those who are or will be at an increased risk of herpes zoster due to immunodeficiency or immunosuppression may benefit from an accelerated schedule, the second dose can be administered at a minimum interval of at least 4 weeks following the first dose.[6]

COVID Vaccines

COVID vaccine recommendations continue to evolve; however, for 2025 through summer 2026, vaccination is recommended for both those previously vaccinated and unvaccinated individuals who are at increased risk of SARS-CoV-2 infection or severe COVID-19 disease.[7] This includes all adults aged ≥65 years, as well as those aged ≥6 months of age and older who meet one or more of the following criteria[7]:

- Residents in long-term care homes and other congregate living settings
- Individuals with underlying medical conditions that place them at higher risk of severe COVID-19, including children with complex health needs
- Pregnant women and individuals who are pregnant
- Individuals with membership in or who are from First Nations, Métis, and Inuit communities
- Belonging to racialized or other equity-denied populations
- Employment as health care workers or other care providers in institutional facilities or community settings

Measles Vaccine

Measles is among the most highly transmissible infectious diseases, with secondary attack rates approaching 90% in susceptible individuals.[8] In late 2023, a global increase in

	RSVPreF3 (Arexvy)	RSVpreF (Abrysvo)	mRNA-1345 (mRESVIA)
Type of vaccine	Recombinant adjuvanted RSVPreF3 (RSV-A)*	Recombinant RSVPreF A and preF B (bivalent)	mRNA encoding for stabilized prefusion F protein (RSV-A)*
Adjuvanted?	Yes	No	No
Administration	Single dose, IM Fridge stable	Single dose, IM Fridge stable	Single dose, IM Frozen
Indications	60+ 50–59yo at increased risk	60+ 18-59yo at increased risk Pregnant individuals 32–36+6wks	60+
RSV targets	RSV-A, RSV-B	RSV-A, RSV-B	RSV-A, RSV-B
Amount of antigen delivered per dose	120 µg RSVPreF3 (RSV-A)*	60 µg RSVPreF-A 60 µg RSVPreF-B	N/A

Table 1. RSV Vaccines Approved in Canada; *information derived from respective product monographs.*
J. S. McLellan et al. Structure of RSV fusion glycoprotein trimer bound to a prefusion-specific neutralizing antibody. Science 240, 1113-1117 (2013).

*Since the F proteins of RSV-A and RSV-B are about 90% similar, the immune system largely does not distinguish between them. Therefore, the current RSV-A pref vaccines are able to generate antibodies to both subtypes.

Abbreviations: IM: intramuscular, **RSV:** respiratory syncytial virus; **RSVpref:** respiratory syncytial virus prefusion F; **UK:** United Kingdom; **USA:** United States of America.

Chronic Health Conditions In Older Adults that Lead to Increased Risk for Severe RSV Disease
• Cardiac or pulmonary disorders (includes chronic obstructive pulmonary disease [COPD], asthma, cystic fibrosis, and conditions affecting ability to clear airway secretions)
• Diabetes mellitus and other metabolic diseases
• Moderate and severe immunodeficiency (refer to the list of immunocompromising conditions developed for COVID-19)
• Chronic renal disease
• Chronic liver disease
• Neurologic or neurodevelopmental conditions (includes neuromuscular, neurovascular, neurodegenerative [e.g., dementia], neurodevelopmental conditions, and seizure disorders, but excludes migraines and psychiatric conditions without neurological conditions)
• Class 3 obesity (defined as BMI of 40 kg/m^2 and over)

Table 2. Respiratory syncytial virus (RSV) vaccines: Canadian Immunization Guide; *courtesy of* ***Canada.ca***.

Immunocompromising Conditions to Consider for RZV Vaccination
• Primary immunodeficiencies affecting innate, humoral, and T-cell-mediated immunity
• HSCT
• SOT
• Hematological malignancies
• Solid tumour malignancies on immunosuppressive treatment
• HIV infection
• Chronic or ongoing immunosuppressive therapy: ◦ Immunosuppressive chemotherapy ◦ Immunosuppressive radiation therapy ◦ Calcineurin inhibitors ◦ Cytotoxic medications ◦ Anti-metabolites ◦ Immune effector cell therapies (e.g., CAR T-cell therapy) ◦ Biological response modifiers, targeted therapies and antibodies that target lymphocytes and immune pathways (e.g., anti-CD20, ant-TNF-α, JAK inhibitors, etc.) ◦ Long-term, high-dose systemic corticosteroids (prednisone equivalent of ≥ 2 mg/kg/day, or 20 mg/day if weight >10 kg, for ≥14 days)

Table 3. Immunocompromising Conditions to Consider for RZV Vaccination; *courtesy of Angel Chu, MD.*

Abbreviations: CAR T: chimeric antigen receptor T-cell therapy; **HIV:** human immunodeficiency virus; **HSCT:** hematopoietic stem cell transplantation; **JAK:** Janus kinase; **SOT:** solid organ transplantation; **TNF-α:** Tumour necrosis factor alpha

measles activity was reported, including a more than 30-fold increase in cases in Europe since 2022.[8] In Canada, immunization coverage has declined below the threshold needed to sustain herd immunity, resulting in localized measles outbreaks across the country.[8]

Individuals with prior infection, those born before 1970 in Canada, or those who have completed the recommended measles immunization series are generally considered to have adequate protection against measles.[8]

For susceptible adults born in or after 1970, a single dose of measles-mumps-rubella (MMR) vaccine is recommended.[8] However, those who are at the greatest risk of measles exposure (travellers to destinations outside of Canada, health care workers, students in post-secondary educational settings, and military personnel) should receive two doses of MMR vaccine, administered at least 4 weeks apart.[8]

Conclusion

Maintaining high immunization coverage is essential to protect vulnerable populations from highly transmissible diseases such as *Streptococcus pneumoniae*, measles, RSV, and to mitigate the threat of COVID-19 in communities at increased risk. The global resurgence of measles and declining herd immunity in Canada highlights the urgent need for robust vaccination strategies tailored to at-risk groups, including health care workers, immunocompromised individuals, and certain demographic populations. Evidence-based public health initiatives, ongoing surveillance, and targeted outreach can collectively strengthen immunization rates and reduce morbidity and mortality. Continued vigilance is essential to prevent outbreaks and safeguard population health across all age groups.

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A.C: Merck, Pfizer, Sanofi Pasteur, Astra Zeneca, Moderna, AVIR, Invivyd, Ferring

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Approach to Inflammatory Arthritis for Primary Care Physicians

John P. Wade, MD, FRCPC
Ali Shams, MD, FRCPC

Introduction

Inflammatory arthritis is a common condition encountered in primary care clinics but its diagnosis can be challenging because of the many conditions that can present with similar clinical features. As the differential diagnosis is broad, clinicians need to consider the most common entities and adopt a structured approach to establish the most likely diagnosis to help with initiating appropriate investigations and treatment.

Rheumatoid arthritis (RA), observed in 0.9% of the population, and psoriatic arthritis (PsA) affecting 0.5–2%, are the most common types of inflammatory arthritis. Ankylosing Spondylitis (AS) occurs at approximately half the frequency, with a prevalence of approximately 0.5% in the general population.[1,2]

In recent years, the term spondylarthritis (SpA) has been adopted to describe the range of inflammatory conditions with either peripheral or axial joint involvement and inflammatory arthritis. These conditions often overlap, with axial spondylarthritis (axSpA) and peripheral spondylarthritis (pSpA) co-existing in up to 70% of patients. It should also be appreciated that a subset of patients with inflammatory back symptoms may not show sacroiliac changes on X-ray, yet still meet criteria for AS. These patients are classified as having non-radiographic spondylarthritis (nrSpA). Although this term can be confusing, most of these patients usually exhibit changes in the sacroiliac joints on magnetic resonance imaging (MRI).

Additional subsets of SpA include reactive arthritis, which usually follows infections in the intestinal, urinary or genital tracts. These cases can often be treated with antibiotics with full resolution, although symptoms may persist for several months. Another subset, enteropathy arthritis, is associated with inflammatory bowel diseases, such as Crohn's disease and ulcerative colitis. Peripheral joint symptoms in enteropathy arthritis usually mirror the activity of bowel inflammation and rarely result in joint destruction. In contrast, axial involvement may follow an independent course, and the treatment may need to be distinct from that of bowel disease.

Connective tissue diseases such as systemic lupus erythematosus (SLE), myositis, and scleroderma are relatively rare conditions that can also present with inflammatory arthritis. Among these, lupus is the most frequent, affecting approximately one in a thousand individuals, with a female-to-male ratio of 10:1. Diagnosis is often guided by obvious features such as skin inflammation, muscle weakness, serositis, or involvement of major organs such as the kidneys or central nervous system. However, we often see patients who exhibit limited features of these diseases who have incomplete disease, referred to as undifferentiated connective disease. It is important to recognize these cases, as they may be associated with potentially life-threatening complications, warranting urgent or emergent referrals.

Occasionally crystal-induced arthritis, such as gout, calcium pyrophosphate deposition disease (CPPD), or hydroxyapatite, can exhibit features of symmetric or asymmetric polyarthritis, posing a challenge for clinicians. While these conditions typically present as acute monoarthritis, they may occasionally present as gout, pseudogout, and hydroxyapatite disease, but they may sometimes manifest as inflammatory arthritis involving multiple joints. Maintaining a high index of suspicion, along with bloodwork and characteristic X-ray findings, will often help make the correct diagnosis.

Lastly, the co-existence of osteoarthritis can complicate and delay the diagnosis of inflammatory arthritis. Patients with longstanding degenerative arthritis symptoms often attribute joint pain of their neck, back and peripheral joints as the natural history of osteoarthritis. As a result, elderly-onset RA or polymyalgia rheumatica (PMR) may be overlooked. A marked increase in joint complaints should prompt early blood testing to assess for elevated inflammatory markers.

History

For clinical history taking, **Box 1** provides useful questions to ask the patient. **Table 1** provides information to help distinguish between mechanical and inflammatory joint disorders.

Examination

Inspection

Table 2 provides guidance regarding joints to be assessed on examination. On inspection, affected joints will have synovial distention. Involved joints are typically not erythematous unless the underlying cause is secondary to an infection or crystal arthropathy. Of note, joint swelling can also be observed in non-inflammatory conditions such as osteoarthritis. See **Table 3** for findings that can help differentiate RA from osteoarthritis. One common example is knee swelling secondary to effusion associated with mechanical knee pathology.

See **Table 4** for information on joint involvement between RA and osteoarthritis. To evaluate the metacarpophalangeal (MCP) joints, ask the patient to make a fist and assess for the loss of "valleys" between the metacarpals. Synovitis at these joints will cause an effacement of these valleys. A similar finding may be noted at the metatarsophalangeal (MTP) joints. At the elbows, look for the loss of the sulcus between the olecranon and lateral epicondyle. At the knees, look for loss of the sulcus medial to the patella. Additionally, splaying of the toes may be observed in synovitis of the MTP joints.[3]

Palpation

Using a two-finger technique, palpate along the MCP joint lines to assess for fullness secondary to synovitis. Then, with both thumbs, palpate distal to the metacarpal heads. For the proximal interphalangeal (PIP) joints, use a four-finger technique to palpate for fullness along the joint capsule. Document which joints are tender and/or swollen, and be sure to palpate for warmth of the joints.[4]

Document findings by noting the number of tender joints and the number of swollen joints, specifying which joints are involved. For example: Tender joint count: 2 (Right second and third MCP), Swollen joint count: 1 (Right second MCP).

Questions to ask the patient:
Which joints are involved?
Is there any associated pain and or swelling?
Are there any precipitating factors such as trauma, infections, or new medications?
Is morning stiffness present, and if so, how many minutes does it typically last?
Does stiffness improve with activity?
Are there any constitutional symptoms such as fever, weight loss, or fatigue?
Are there any systemic symptoms such as rashes, mucocutaneous ulcers, chest pain, or shortness of breath?
Which therapies have been tried, including pain medication and glucocorticoids? Which of these have been effective?

Box 1. Clinical history: Questions to ask the patient; *courtesy of John P. Wade, MD, FRCPC and Ali Shams, MD, FRCPC.*

Clinical Feature	Inflammatory	Mechanical
Morning stiffness	Often more than 1 hour	Often less than 30 minutes
Activity	Can improve stiffness	May worsen pain
Rest	Can worsen stiffness	May improve pain
Systemic involvement	Can be present	Not present
Glucocorticoid responsiveness	Yes	No

Table 1. Differences between mechanical and inflammatory joint disorders; *courtesy of John P. Wade, MD, FRCPC and Ali Shams, MD, FRCPC.*

Hand: CMC, MCP, DIP and PIP	Foot: IP and MTP
Wrist	Ankle
Elbow	Knee
Shoulder	Spine: cervical, thoracic, lumbar
Hip	Temporomandibular
Sacroiliac	

Table 2. Joints to be assessed on examination; *courtesy of John P. Wade, MD, FRCPC and Ali Shams, MD, FRCPC.*

Abbreviations: CMC: carpometacarpal; **DIP:** distal interphalangeal; **IP:** interphalangeal; **MCP:** metacarpophalangeal; **MTP:** metatarsophalangeal; **PIP:** proximal interphalangeal

Finding	Rheumatoid Arthritis	Osteoarthritis
Symmetry	Often	Occasional
Synovitis	Yes	Rarely
Bone hypertrophy	No	Yes

Table 3. Findings which can help differentiate between rheumatoid arthritis and osteoarthritis; *courtesy of John P. Wade, MD, FRCPC and Ali Shams, MD, FRCPC.*

Joint	Rheumatoid Arthritis	Osteoarthritis
DIP	No	Yes
PIP	Yes	Yes
MCP	Yes	No
Wrist	Yes	No

Table 4. Joint Involvement between rheumatoid arthritis and osteoarthritis; *courtesy of John P. Wade, MD, FRCPC and Ali Shams, MD, FRCPC.*

*Of note, seronegative inflammatory arthritis, also known as PsA, can involve the DIP joints and is often asymmetric in nature making it more difficult to differentiate from osteoarthritis.

Abbreviations: DIP: distal interphalangeal; **MCP:** metacarpophalangeal; **PIP:** proximal interphalangeal

Investigations

Laboratory investigations are important in establishing a diagnosis and excluding other diseases. They may also be valuable for assessing disease activity, monitoring therapeutic response, and ensuring medication safety.

Baseline laboratory tests may include a complete blood count (CBC), c-reactive protein (CRP), urinalysis, creatinine, liver enzymes, serum protein electrophoresis (SPEP), rheumatoid factor, anti-cyclic citrullinated peptide (anti-CCP), and antinuclear antibody (ANA). It is also advisable to screen for hepatitis B, hepatitis C, and HIV at baseline, as these infections may influence treatment decisions. Genetic testing for RA and PsA is currently not useful. If the diagnosis of inflammatory back disease is suspected, testing for HLA B27 status can support the diagnosis, although its presence alone is not diagnostic. HLA B27 is present in 5–7% of the general population and in approximately 85% of patients with SpA.

Additional laboratory tests that could be considered include serum ferritin, calcium, and uric acid levels, which can help exclude diseases such as hemochromatosis and crystal-induced arthritis.

Rheumatoid factor is present in up to 5% of the general population and in up to 60–70% of patients with RA, making it neither sensitive nor specific. Anti-CCP antibodies offer greater specificity for RA. The combination of being both RF positive and anti-CCP positive greatly increases the likelihood of RA.

Currently, there are no specific blood tests for diagnosing PsA, and a normal CRP should not rule out a diagnosis as the CRP may remain in the normal range.

If a connective tissue disease such as SLE is suspected and the ANA is positive, further testing, including extractable nuclear antigen panel, anti-double-stranded DNA, and complement levels (C3, C4) are appropriate. Unfortunately, many current ANA test kits are less sensitive than earlier versions to help screen for a connective tissue disease with sensitivity falling below 90%, making diagnosis more challenging. In addition, a positive ANA result alone is not diagnostic, as up to 5% of the general population may test positive. The lack of sensitive and specific tests underscores the importance of the clinical history; clinical symptoms should drive the diagnosis, with laboratory tests serving to help confirm the diagnosis.

Imaging

X-ray imaging is often of limited value in early disease but may be performed to establish a baseline for future comparison. In cases with more longstanding symptoms, X-rays may help in confirming a correct diagnosis and evaluating whether there is advanced joint damage, which may inform decisions when surgery is a consideration.

In RA, radiographic features include symmetric joint space narrowing and characteristic joint erosions; however, these changes often take months to years to appear. X-rays of the lumbar spine and sacroiliac joints help in diagnosing SpA, though they are not sensitive in early disease.

Ultrasound is a tool that may be helpful in assessing joint swelling and inflammation, but may yield both false-positive and false-negative results. Its most useful application is in assessing the rotator cuff of the shoulder, where clinical assessment is poor. Additionally, ultrasound may help in guiding corticosteroid injections when this is a treatment consideration.

CT scanning is typically not considered useful; however, it may be highly informative when performed by an experienced radiologist using dual energy CT (DECT) technology. This imaging technique may confirm the presence of uric acid deposits in soft tissues, detect characteristic erosions, and identify CPPD.

CT scanning of the sacroiliac joints offers more sensitivity than plain radiographs in looking for changes suggestive of SpA. However, it is limited to specialized centres where the radiologists have the expertise and access to advanced imaging techniques, which helps to make an earlier diagnosis.

MRI is the most sensitive imaging technique for assessing early synovitis and joint damage but is expensive and not readily available in most communities. Studies show that artificial intelligence (AI) is as reliable as radiologists in interpreting MRI scans. As AI technology becomes more affordable and available, it will likely have an increasing role in both diagnosing and monitoring disease.

Treatment

Initial treatment for inflammatory arthritis includes nonsteroidal anti-inflammatory drugs (NSAIDs), prescribed at the lowest dose to control symptoms. Patients must be counselled on the risks associated with these medications. Gastrointestinal (GI) side effects such as dyspepsia are common, but more serious complications, including perforations, ulcers, and bleeds occur in 1–2% of patients annually. The risk of these events can be reduced by approximately 50% with the concomitant use of medications to reduce gastric acidity. It is important to note that GI bleeding may present as the first manifestation of a complication. Patients need to be educated on the safe use of these medications. Additional concerns of NSAIDs include increased blood pressure, renal dysfunction, and cardiovascular events, particularly in older adults.[5]

Topical NSAIDs offer a safer but less effective treatment for inflammatory arthritis, though they can be used as an adjuvant to therapy. Higher-concentration formulas, such as diclofenac 10–20% cream, are helpful but often require compounding by a pharmacy and are expensive.

Targeted steroid injections into the most active joints are very effective, though their benefit is limited to 1–2 months. These injections may also exert a systemic effect, and help to reduce overall inflammation.

Oral prednisone is very effective in the short term, both for helping to confirm a diagnosis of inflammatory arthritis and to treat symptoms. Unfortunately, oral prednisone is effective in the short term, but tapering can be difficult. Common early side effects include increased appetite, weight gain, poor sleep, GI complaints, and sometimes agitation. More serious long-term concerns are thinning of the skin and bruising, elevated blood glucose, elevated blood pressure, muscle weakness, serious infections, and osteoporotic fractures. If a patient responds well to prednisone, it is important to begin tapering early and introduce steroid sparing agents.

If the patient continues to experience persistent symptoms, early introduction of a disease-modifying anti-rheumatic drug (DMARD) should be considered to slow or stop inflammation and prevent joint damage. These medications take weeks to months to take effect, so they are most appropriate when a chronic inflammatory condition is likely. Their goal is to suppress or modify the immune system and prevent damage. Conventional first-line DMARDs include methotrexate, sulfasalazine, leflunomide, and hydroxychloroquine. Combination therapy with DMARDs in addition to NSAIDs is an effective approach for managing RA and PsA. Primary care physicians should feel comfortable starting these

medications prior to specialty referral, provided they are familiar with dosing and side effects. National arthritis association websites provide valuable patient information to help support informed consent by outlining both the benefits and side effects of treatment.

Methotrexate is commonly prescribed as an oral weekly dose of 15 mg. If well tolerated and disease activity persists, the dose can be increased to 25 mg weekly, administered either orally or subcutaneously. Folic acid can be co-prescribed at a dose of up to 1–5 mg daily (or 6 days per week) to minimize side effects. Monthly monitoring should include blood tests for CBC, creatinine, and liver enzymes. Women of childbearing potential must be informed that methotrexate can cause birth defects; effective contraception should be discussed, and alternate medications considered for those wanting to conceive. Leflunomide, taken orally at 10–20 mg daily, is also absolutely contraindicated during pregnancy and should be discontinued 6–24 months prior to conception. Sulfasalazine is initiated orally starting at 500 mg daily, with gradual weekly increases up to 2000–3000 mg daily. Hydroxychloroquine is a less effective agent but has fewer side effects and can be safely started at 200–400 mg orally per day. Baseline ophthalmologic testing should be arranged promptly, followed by annual eye exams after 5 years of continuous therapy.

For patients with very active disease or those who do not respond to combination therapy or DMARDs, escalation to a biologic DMARD or a targeted DMARD should be considered. These therapies are typically started by a rheumatologist; however, primary care providers should understand the rationale for their use and be aware of potential concerns, as they will be involved in ongoing patient care.

Common biologic DMARDs for RA include tumour necrosis factor (TNF) inhibitors (etanercept, adalimumab, infliximab, golimumab, certolizumab), interleukin (IL)-6 inhibitors (tocilizumab), B-cell depleting agents (rituximab), T-cell modulators (abatacept). These medications are administered either by self-injection on a weekly to monthly schedule or via intravenous infusion every month to 6 months.[6,7]

Biologic therapies for PsA and SpA may include TNF inhibitors at the same doses used for RA, as well as additional agents such as IL-17 inhibitors (secukinumab, ixekinumab, bimekizumab). Other options include IL12/23 inhibitors (ustekinumab) and IL-23 inhibitors (guselkumab risankizumab), although these latter agents are more commonly prescribed for psoriasis and inflammatory bowel disease and have limited efficacy in treating inflammatory back disease.[8-10]

In addition to injectable biologics, targeted oral therapies known as Janus kinase inhibitors (tofacitinib, baricitinib, upadacitinib) have been approved for the treatment of inflammatory arthritis. These agents are administered as daily oral tablets and are effective for a variety of inflammatory conditions.[11]

Summary

Inflammatory arthritis is commonly encountered in primary care and may present either acutely or insidiously, posing a major challenge for clinicians. A logical approach to history-taking and physical examination is important to establish the most likely differential diagnosis and guide further investigations. Joint inflammation results in pain and swelling, which over time can lead to joint destruction and poor quality of life. Early diagnosis and treatment are important to ensure that correct treatment is started. Advances in therapy have had a major impact in controlling joint inflammation thereby reducing cartilage destruction and maintaining joint function.

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