MEDICATION OPTIMIZATION FOR SUSTAINABILITY IN INPATIENT CARE

Why • The Case for Change
What • The Tools for Change
How • The Strategy for Change

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The Canadian Coalition for Green Health Care
Coalition canadienne pour un système de santé écologique

NAVIGATION

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ABOUT

This playbook outlines strategies to address the environmental impacts of polypharmacy through medication optimization in inpatient care.

This playbook is intended for Canadian healthcare providers working in inpatient healthcare settings that are providing patient care, contributing to institutional policies and initiatives, and/or supporting electronic medical record systems. Background information, resources, and considerations have been included to guide healthcare teams and institutions to implement medication optimization and reduce their environmental impact. The content has been compiled from a review of literature and guidelines, interviews with experienced healthcare professionals, and guidance from academics in the field.

This document is not intended to provide or take the place of clinical guidance. Providers are encouraged to seek, appraise, and apply best-available evidence related to prescribing.

Suggested citation

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PLAYBOOK STRUCTURE

WHY
The Case for Change

WHAT
The Tools for Change

HOW
The Strategy for Change

WHY

The Case for Change

1. Environmental Consequences of Medications
2. Inappropriate Medication Use

Environmental Consequences of Medications

Medications are estimated to contribute over 8 million tons of carbon dioxide equivalent each year.

Healthcare providers can play a key role in **addressing the growing environmental impact of medications.** While medications are a necessary tool in healthcare, they paradoxically contribute to climate change and environmental pollution, both known to have negative impacts on human health (1–3). In Canada, medications are estimated to contribute over 8 million tons of carbon dioxide equivalents (CO_2e) each year, accounting for approximately a quarter of all healthcare greenhouse gas emissions (4). The life cycle of medications, from raw materials extraction to manufacturing, distribution, use, and destruction, adds up to significant energy use.

Medications may also be harmful to ecosystems when they are released into the air, water, and soil (5,6). Studies on active pharmaceutical ingredients (APIs) in water have been linked to the spread of antimicrobial-resistant bacteria, and changes in physiology, behaviour and feminization of aquatic organisms (7–9). The harmful presence of medications in rivers worldwide is worsened by the difficulty of removing APIs at wastewater treatment plants and high concentrations near pharmaceutical manufacturing sites (9,10). Furthermore, pharmaceuticals have been found in treated drinking water in Canada and source waters of First Nations communities (11–13). In response to the growing number of pharmaceuticals being used and detected in the environment, public agencies around the world have begun collecting information on the presence and impact of pharmaceuticals on the environment, such as the German Environment Agency's database on pharmaceuticals in the environment, and Stockholm's pharmaceuticals and environment database.

IT GOES BOTH WAYS!

Not only do medications pose risks to the environment, but climate change can also increase the risk of harm to Canadians on certain medications. Climate change is increasing the number of extreme heat events in Canada, potentially affecting people on medications known to interfere with thermoregulation (14) such as antipsychotic and anticholinergic medications (15). Individuals using these medications are then at a higher risk of heat related illnesses (14), thus ensuring patients are not taking unnecessary thermoregulatory medications can potentially reduce their vulnerability to heat-related adverse effects.

Inappropriate Medication Use

OPPORTUNITY

An opportunity for change in inpatient settings arises when focusing on patients who are on several medications, increasing the potential for harm and unnecessary use. An estimated **25% of Canadians over the age of 65 are prescribed 10 or more different drug classes of medications** (16). As the number of medications taken increases, so does the risk of being prescribed potentially inappropriate medications (PIMs), experiencing drug interactions, adverse drug effects, and putting unnecessary strains on resources and ecosystems. For older adults, polypharmacy, commonly defined as using 5 or more medications concurrently (17), has also been associated with an increased risk of severe adverse drug effects and hospitalization (18). One study estimated 42.3% of older adults across Canada have been prescribed one or more PIMs (19) resulting in a total estimated cost of $419 million annually based on 2013 data (20). Further, the cost of treating the harmful effects of these medications was estimated to be $1.4 billion every year (20).

MEDICATION OPTIMIZATION

To reduce the patient, health system, and environmental harms caused by inappropriate medication use, the principles of medication optimization should be implemented as a part of standard practice. **Medication optimization** is a patient-centred approach to improving the effectiveness, safety and adherence of a medication regimen (21).

Deprescribing is a key strategy to medication optimization. Deprescribing is the process of reducing a medication dose, stopping the medication, or switching the medication to a safer alternative (22). The primary goal of deprescribing is to improve patient outcomes, including the reduction of adverse effects, drug interactions, disability, pill burden, and financial costs related to medications (23). Medication optimization may also involve adding medications to a patient's medication regimen to improve outcomes by reducing the risk of hospital admissions and mortality, and improving patient wellbeing (24). Medication optimization requires clinicians to be familiar with deprescribing and clinical practice guidelines to make evidence-based care plans.

ENVIRONMENTAL IMPACTS

In addition to the patient care benefits of deprescribing, reducing unnecessary medication use will decrease emissions and other environmental impacts associated with medications, while also lowering costs to the healthcare system. These co-benefits have further environmental implications given that hospitalizations caused by preventable serious adverse drug reactions produce an estimated 50,282 tons CO2e* annually in Canada, equivalent to burning over 21 million litres of gasoline (25).

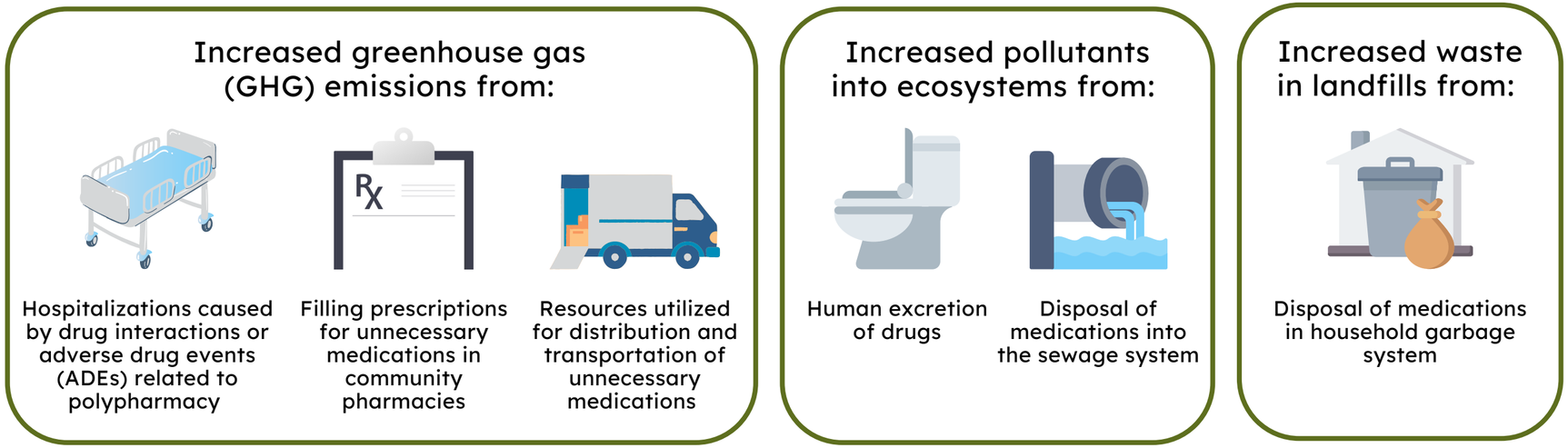
*Assumptions calculating greenhouse gas emissions (GHGE) of hospital admissions:

- Number of serious adverse drug reactions (SADRs) = 73 944 (29)
- Number of preventable SADRs = 68% = 50 282 (30)
- Average number of hospital admission days = 8 (30)
- Total number of bed days for potentially avoidable SADRs = 402 256
- GHGE per bed per day = 125 kgCO2e per hospital bed per day (31)
- Total = 50 282 tCO2 per year.

As the evidence on the negative environmental impacts of medications mount, there is renewed interest in medication optimization as an important strategy to minimize the health sector's environmental impacts (26,27).

Deprescribing is a valuable tool given the connection between inappropriate medication use and hospitalizations, both contributing to greenhouse gas emissions and environmental pollution. Healthcare providers can be a part of the solution by assessing medication use and deprescribing when appropriate as part of their regular practice.

Figure 1: Environmental impacts of unnecessary medications.



WHAT

The Tools for Change

1. Clinical Medication Reviews
2. Use of Non-Pharmacological Strategies
3. Drug Use Evaluation (DUE)
4. Medicine Stewardship Programs
5. Electronic Decision Support

Clinical Medication Reviews

Medications can be optimized during clinical medication reviews, where concerns and deprescribing opportunities can be identified.

A clinical medication review is defined as a structured assessment of a patient's medication regimen accompanied by a review of relevant laboratory tests and medical notes to ensure the patient's medical conditions are being optimally managed with their medications (31). A clinical medication review is to be completed after a best possible medication history (BPMH) is gathered with the intention of identifying and resolving drug-therapy problems such as unnecessary medication, incorrect dosing, drug interactions and adverse drug effects (32).

CONDUCTING MEDICATION REVIEWS

There are different factors to consider when conducting medication reviews:

- DEPRESCRIBING
- PRESCRIBING CASCADES
- OPPORTUNITIES FOR REVIEWS

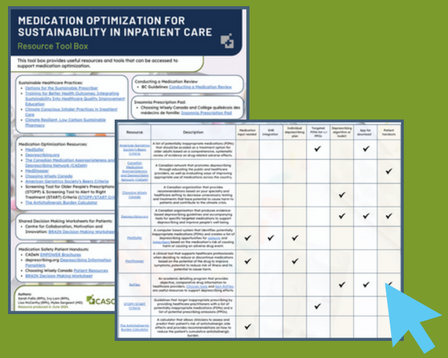
RESOURCES

Guidelines

- British Columbia Guidelines for Conducting a Medication Review

RESOURCE TOOL BOX

This tool box provides useful resources and tools that can be accessed to support medication optimization.



DEPRESCRIBING

While conducting medication reviews, healthcare providers should apply current, evidence-based medication optimization tools to identify potentially inappropriate medications (PIMs), potential prescribing omissions (PPOs) and medications that are not dosed appropriately (see Resource Tool Box).

Medication review programs in Canada include but are not limited to:

British Columbia

University of British Columbia's The Pharmacists Clinic offers support managing polypharmacy and starting and stopping drug therapies.

Ontario

GeriMedRisk is a telemedicine consultation service connecting clinicians with geriatric specialists to optimize medications for older adults.

Newfoundland & Labrador

Medication Therapy Services Clinic Desprescribing program is a pharmacist led program to help patients safely discontinue medications.

Canada

Each Canadian province has a Publicly Funded Medication Review Program where community pharmacists perform medication reviews and assessments based on program-specific eligibility criteria. The Canadian Foundation for Pharmacy CFP Services Chart lists services, fees and claims data for government-sponsored pharmacy programs, including medication review programs.

BARRIERS TO DEPRESCRIBING

During a medication review, the team may identify medications that may not be appropriate but decide to continue the medication regimen because they:

- Do not have time to address these non-urgent drug-therapy problems during an acute care hospital stay
- Are worried about the potential negative outcomes that may occur after deprescribing
- Are reluctant to deprescribe a medication initiated by another specialist

Despite these barriers, institutional healthcare professionals can promote deprescribing by communicating medication concerns and deprescribing opportunities to the patient's community healthcare providers on discharge summaries. For instance, a discharging pharmacist or physician can recommend a referral to a dedicated medication review program and/or document the medications that could be considered for deprescribing in their discharge summaries.

PRESCRIBING CASCADES

Another key strategy to promoting appropriate medication use is identifying and addressing prescribing cascades, which occur when a drug is prescribed to manage the side effects of another drug (33). Medications prescribed to treat adverse side effects may be necessary in some cases where a medication is essential without acceptable alternatives. However, prescribing cascades can be problematic if an adverse drug event is inadvertently identified as a new medical condition or if a healthcare provider is not aware of more suitable alternatives. Multiple medications are then continued instead of resolving adverse drug events by reducing the dose of the offending medication, discontinuation of the agent, or switching to an alternative medication (34).

METHODS TO PREVENT PRESCRIBING CASCADES (40,41)

1. Question if a new sign or symptom could be an ADE of a current medication therapy.
2. Use the lowest effective dose of all medications.
3. Use non-pharmacological strategies to manage new symptoms until the possibility of it being an ADE is ruled out.

STEPS TO IDENTIFY AND MANAGE PRESCRIBING CASCADES

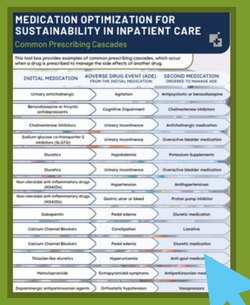
1. Recognition and Awareness:
   a. Become familiar with common ADEs and when the ADE is most likely to occur (40,41)
   b. Become familiar with common prescribing cascades

2. Investigate Possible Prescribing Cascades:
   a. Ensure each medication has a reason for use
   b. Review the sequence of symptom development and medication prescribing. If this information is not readily available, consider a trial of deprescribing and monitor the patient's response
   c. Use drug information resources to see if the new sign or symptom could be related to a current medication

3. Management Options:
   a. Deprescribe the first medication if it no longer has a reason for use and monitor the patient's response (i.e., for adverse drug withdrawal effects)
   b. If stopping the first medication is not an option or is poorly tolerated, consider whether it could be prescribed at a lower dose
   c. Consider non-pharmacological strategies for managing the ADE as alternatives to the second medication

4. Monitor Patient Response:
   a. Regardless of management strategy employed, monitor to see if the patient's symptom or sign improves, worsens, or stays the same.

COMMON PRESCRIBING CASCADES



View this resource to become more familiar with common prescribing cascades.

OPPORTUNITIES FOR REVIEWS

Managing medications not related to the patient's primary reason for admission is challenging. However, there are also compelling reasons to deprescribe in the inpatient setting including:

- Availability of a multiprofessional collaborative team
- Around the clock monitoring for new signs or symptoms
- Lack of primary care access
  - Approximately 6.5 million Canadians do not have a family doctor or nurse practitioner they see regularly (42)

In inpatient settings, a clinical medication review should be completed when: (22)

- A patient changes care setting
- A patient is being discharged from hospital
- There is a significant change in the patient's medication regimen or health status
- A healthcare professional sees fit based on their judgement

NEW OPPORTUNITY: ALTERNATE LEVEL OF CARE (ALC)

Although medication reconciliation is a priority at transition points (38), medication optimization can be addressed when a patient has been transitioned to an **Alternate Level of Care (ALC).** A patient is identified as ALC when they no longer need the more intense level of care provided at the care institution but still occupy a bed. These patients are often stable and no longer at risk of rapid medical decline, and the healthcare team is not investigating new diagnoses or treatment options (39). When a patient is identified as ALC, healthcare teams should review their acute care medication management to the same extent they would during a transition of care (i.e. disposition to a long-term care home).

To take sustainable medical practices a step further, healthcare teams can also assess the patient's entire management plan and decrease the frequency of blood tests, vitals, and physical assessments if appropriate. In addition to improving patient comfort, unnecessary blood tests have financial, labour and environmental costs, with a common set of bloodwork investigations estimated to generate 332g CO_2e (40).

Use of Non-Pharmacological Strategies

Non-pharmacological strategies can have environmental co-benefits, and potentially prevent the use of chronic medications

Non-pharmacological strategies may represent a more environmentally friendly approach to care. Some of these strategies may already be employed at hospitals by healthcare professionals. Their involvement can improve health outcomes through addressing social determinants of health such as access to housing and improving the ability to independently perform activities of daily living, with a potential co-benefit of reducing healthcare needs and improved resilience to climate change (41). A community is growing across Canada to recognize and expand on these strategies, collectively known as **social prescribing.**

Other non-pharmacological strategies can address medical issues and be used independently or as an adjunct to medication use. Examples include using exercise therapy for pain (42,43), dietary modifications and exercise recommendations for hypertension (44), and addressing inpatient sleep disturbances, with a discussion of the latter on the next page.

RESOURCES

For more information on social prescribing:

- CASCADES and Canadian Institute for Social Prescribing: Environmentally Sustainable Opportunities for Health Systems Primer Series: Social and Green Prescribing
- Centre for Effective Practice: Social Prescribing: A Resource for Health Professionals

ACTION ITEM CHECKLIST

This checklist provides actions that healthcare providers can take to reduce the environmental, patient and institutional consequences of polypharmacy.


MEDICATION OPTIMIZATION FOR SUSTAINABILITY IN INPATIENT CARE

Action Items for Institutional Healthcare Providers

This checklist provides actions that institutional healthcare providers can take to optimize the medication prescribed to patients to reduce the environmental, patient and institutional consequences of polypharmacy.

- ☐ Enhance your clinical medication reviews:
  - ☐ Review deprescribing guidelines and prescribing tools
    - ☐ Download the deprescribing.org app for deprescribing algorithms
  - ☐ Become familiar with common adverse drug events to avoid prescribing cascades
  - ☐ Partner with patients and caregivers to make medication decisions
  - ☐ Consult stewardship teams and specialists when appropriate
  - ☐ Consider completing a medication review when a patient is moved to ALC status
- ☐ Implement non-pharmacological strategies for insomnia in hospital
- ☐ Provide patient handouts to promote medication discussions with primary care providers
- ☐ Communicate and document rationale for medication changes and share this information with primary care providers and patients
- ☐ Suggest medications or programs for deprescribing to community healthcare providers in discharge summaries if unable to make changes during admission

For more resources, view the Medication Optimization for Sustainability in Inpatient Care playbook at: cascadescanada.ca/action-areas/pharmacy-and-prescribing

Authors: Sarah Fallis (RPh), Ivy Lam (RPh), Lisa McCarthy (RPh), Myles Sergeant (MD). Resource produced in June 2024.

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SPOTLIGHT SLEEP DISTURBANCES

An important issue to address during hospitalizations is reliance on medication for sleep disturbances. Poor sleep is a common issue faced by approximately 47 to 67% of hospitalized patients (45). Sleep disturbances may be caused by the unfamiliar and noisy environment (46) or the initiation of new medications, such as betablockers, corticosteroids, or loop diuretics (47). A point prevalence survey in Nova Scotia reported 35% of patients were started on a new sedative medication for poor sleep during their hospital stay (48). Medications for insomnia can cause cognitive impairment, and increase the risk of falls, hip fractures, and car accidents (49). In addition to the patient risks associated with their use, psychotropic drugs such as benzodiazepines have also been shown to have ecotoxicological effects when present in the environment, impacting the behaviour, feeding, and mating of wildlife and disrupting food chains through interactions with plants and microorganism (50).

Healthcare teams should evaluate the use of sedatives and benzodiazepines on their units (see Leveraging Quality Improvement) while also recognizing the impact the institution's environment may have on sleep. This evaluation should include consideration of non-pharmacological strategies as a first-line management approach to inpatient insomnia due to their safety and relatively low resource requirements. The environmental and order modifications outlined in Table 1 can be implemented by institutional healthcare teams to improve sleep quality and duration for their patients (51).

Table 1: Non-pharmacological methods to promote sleep for hospitalized patients

Surroundings	Care Processes	Medications
• Offer ear plugs and eye masks (52–54) • Close patient room doors • Implement nocturnal lighting and quiet hours • Reduce volumes of medical equipment and entertainment devices • Reduce nuisance alerts from equipment by adjusting alarm settings	• Delay nocturnal vital checks (55) ◦ State "Delay vitals until patient is awake" • Delay non-urgent blood work until the next scheduled draw or later in the day and reduce daily blood draws (56)	• Set institutional standard medication administration times outside of quiet hours • Reduce nocturnal medications by moving medication to another time if appropriate (56) • Reschedule stimulating medications to the morning • Taper medications with withdrawal risks

PATIENT RESOURCES

- Choosing Wisely Canada (CWC) and Collège Québécois des Médecins de Famille created a template for prescribing non-pharmacological strategies for insomnia that can be used during a hospital stay and/or provided at discharge: Insomnia Prescription Pad (57).
- Sleepwell is a patient focused resource developed by Dalhousie University that healthcare providers may find helpful for patients hesitant to stop their sleep medications.
- Long-time sleeping pill user Faye's experience discontinuing sleeping pills after long-term use to manage insomnia is influential, detailing improvements in cognition, mood, and energy levels.

Drug Use Evaluation (DUE)

INCORPORATING SUSTAINABILITY INTO MEDICATION EVALUATIONS

Drug use evaluation (DUE) is defined as a system of ongoing, criteria-based evaluation of medication use that will help ensure medications are being used appropriately within a healthcare setting. Traditionally, DUE services include evaluating medications based on a set of criteria, such as efficacy, availability, cost, potential harms, and volumes of usage (58). As the evidence of the negative impact medications have on the environment increases, there is an opportunity for DUE teams to **incorporate sustainability as another pillar of medication evaluation for formulary inclusion, thereby systematically optimizing medication selection for an entire institution.**

ACTION ITEM CHECKLISTS

This checklist provides actions that DUE Individuals or Teams can take to reduce the environmental, patient and institutional consequences of polypharmacy.

MEDICATION OPTIMIZATION FOR SUSTAINABILITY IN INPATIENT CARE

Action Items for DUE Individuals or Teams

This checklist provides actions that drug use evaluation (DUE) individuals or teams can take to optimize the medication prescribed to patients to reduce the environmental, patient and institutional consequences of polypharmacy.

- Evaluate medication effectiveness
- Create criteria for medication use
- Implement mandatory medication stop or review dates for target medications
- Provide education on deprescribing tools and non-pharmacological sleep solutions
- Perform cost-impact analyses
- Monitor medication use trends, cost, and wastage
- Benchmark medication use against internal and external comparators
- Perform quality improvement (QI) studies
- Review frequency of prescribing
- Formulary Management:
  - Remove medications from formulary
  - Replace medications on formulary
  - Add medications to formulary
  - Review extent of off label medication use
  - Review non formulary drugs
  - Review drugs with potential for error
  - Review drugs with potential for harm

For more resources, view the Medication Optimization for Sustainability in Inpatient Care playbook:
cascadescanada.ca/resources/medication-optimization-playbook

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LIFE CYCLE ASSESSMENTS

One approach to understanding the environmental impacts of medications is to review life cycle assessments (LCAs). LCAs are an internationally standardized method of quantifying the environmental impacts of a product or a process over its life cycle. The life cycle of a product includes material extraction, processing, manufacturing, assembly, use, and end-of-life (59). LCAs are used in many industries including healthcare, however LCAs on pharmaceuticals are limited due in part to pharmaceutical industry restrictions on sharing production processes (60).

While the ability harness LCA data in prescribing decisions is currently limited, more studies are emerging. These are being added to the Healthcare LCA database, which compiles available LCAs of various products, including pharmaceuticals, in the healthcare sector. The platform is the result of a collaboration between the Healthy Populations Institute at Dalhousie University, CASCADES Canada, and the Brighton and Sussex Medical School. As more studies and data become available, DUE teams may be able to apply such information to determine formulary inclusion based on environmental sustainability if two products are otherwise clinically equivalent.

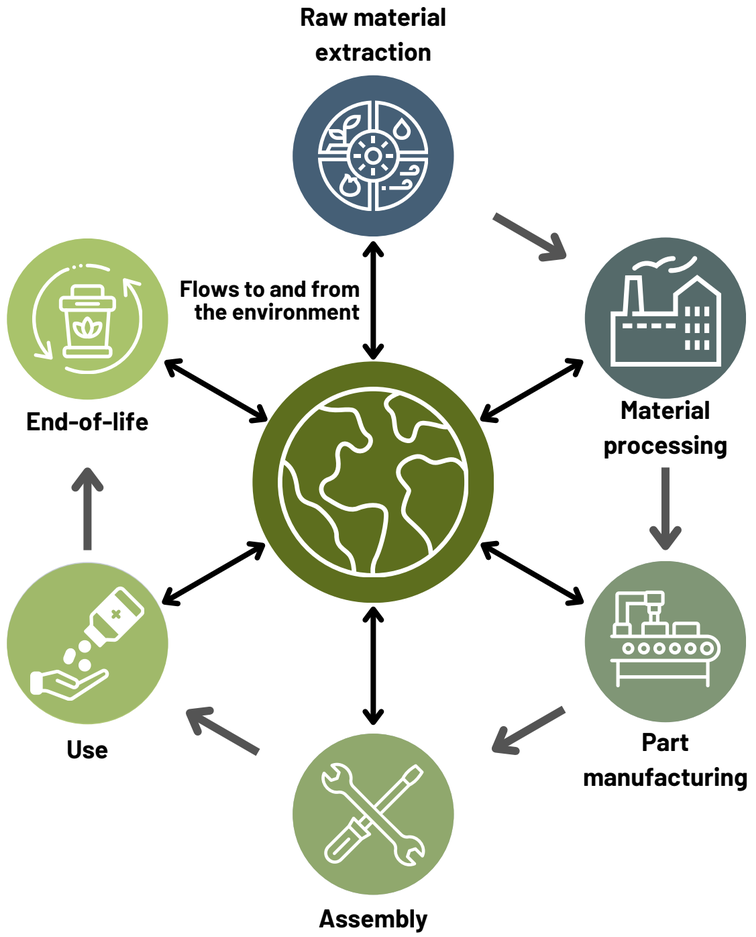


Figure 1: Stages considered in a life cycle assessment. Adapted from McAlister S, et al. Incorporating Carbon into Health Care: Adding Carbon Emissions to Health Technology Assessments. Lancet Planet Health. 2022 Dec 1;6(12):e993–9.

EXAMPLES

LCA data driven decision making examples:

- A cradle-to-grave LCA comparison of anesthetic drugs showed desflurane GHG emissions were 15 to 20 times higher than other anesthetic gases (61), leading to reduction or removal of its use from a growing number of Canadian operating rooms (62–64). See CASCADES Project charter: Eliminate Desflurane for more information.
- Looking at the LCAs of inhalers revealed the main contributor to the total carbon footprint of metered dose inhalers (MDIs) is due to the propellant. A comparison of MDIs to dry powder inhalers and soft mist inhalers containing similar APIs revealed MDIs have a carbon footprint approximately 20 times greater (65). In response, the Canadian Thoracic Society issued a position statement on climate change, recommending the environmental impact of inhalers be considered when choosing an inhaler with a patient (66). See CASCADES Climate Conscious Inhaler Prescribing in Inpatient Care playbook for more information on implementing sustainable inhaler practices.

ENVIRONMENTAL IMPACT & CARBON FOOTPRINT

In addition to LCAs, other information that can be used in the environmental assessment of medications include environmental toxicity and carbon footprint. Attempts are being made to assemble literature into usable databases. Caution should be taken when applying/interpreting data generated by private for-profit enterprises; nevertheless, such data may inform on emerging trends or areas of focus in medication evaluation efforts.

Environmental Impact (toxicity or presence):

- Pharmaceuticals and Environment site: Stockholm Region's database on the environmental impact of pharmaceuticals. Where available, information is provided on environmental hazards, defined as persistence, bioaccumulation, toxicity, and risk of pharmaceutical products.

Carbon Footprint Databases:

- Medicine Carbon Formulary (MCF): A searchable carbon footprint ratings database measured by process mass intensity for medications in tablet and capsule form commonly prescribed in the United Kingdom. The content creator, Yewmaker, has public and private industry ties. While the validity of whether medication recommendations can be made based on this rating method remains to be determined, the MCF database may be able to bolster existing concerns regarding medication classes that are targets for change, such as antimicrobials (67).
- Inhalers Carbon Footprint: PrescQIPP collated sustainability information on inhalers, including life cycle assessments where available, into a spreadsheet. Metered dose inhalers can be seen to have a larger carbon-footprint than other inhaler devices.

SPOTLIGHT STOCKHOLM REGION WISE LIST

An example of a medication formulary incorporating environmental considerations into their decision-making is The Wise List. This list was developed by the Stockholm Pharmaceutical Committee and recommends medications for common diseases with the aim of improving the quality of medication prescribing. Factors that affect the inclusion of medications on the list include efficacy, safety, suitability, cost-effectiveness, and environmental impact. While not all medications have environmental considerations, ciprofloxacin, diclofenac, estradiol and ethinyl estradiol have been highlighted as specific pollutants in surface water by the Swedish Agency for Marine and Water Management (68).

SPOTLIGHT SUNNYBROOK FORMULARY MANAGEMENT

The Medication and Information Pharmacy Team at Sunnybrook Hospital in Toronto, ON, completed the following DUE related initiatives with the goal of improving sustainable medication practices and evidenced-based patient care throughout their hospital.

Examples of Sustainable Formulary Management at Sunnybrook Hospital:

1. Reduce waste:
   - Remove medications with low clinical value from formulary:
     - Docusate sodium (69)
     - Acyclovir ointment (70)
   - Remove medications not used in the past 3 years from formulary.
   - Reduce the number of chemicals in inventory by standardizing compounded medications on formulary.
   - Adjust inventory based on data of most wasted medications.
2. Change to low carbon alternatives with similar clinical efficacy:
   - Switch from high global warming potential (GWP) anesthetic gas to low GWP anesthetic gases (71).
3. Add low carbon alternatives to formulary.
4. Add non-MDI inhalers to formulary (66).

Medicine Stewardship Programs

Medicine stewardship programs are structured, often interprofessional programs, with the goal of improving quality use of medications and addressing challenges within a specific therapeutic specialty, ensuring appropriate and efficient use of resources. Stewardship teams and programs are particularly useful in improving medication use in specialties where there is a high risk of significant adverse effects and/or inappropriate prescribing (72).

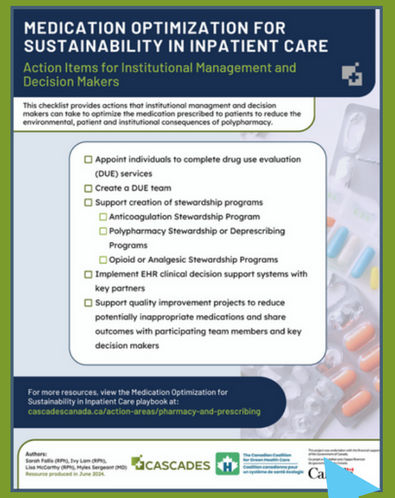
IMPORTANCE OF ANTIMICROBIAL STEWARDSHIP

Antimicrobial resistance is recognized as a global threat, accelerated by misuse and overuse of antimicrobial medications. High use of antimicrobials worldwide is leading to rising levels of drug-resistance, making it harder to treat infections and threatening food security through reduced productivity on farms (73,74). Antimicrobials also pollute our environment from usage, runoff from farms, hospitals, sewage, and manufacturing sites (73–75). Climate change is contributing to the rise in antimicrobial resistance through increased spread of infectious diseases, including drug-resistant infections (75). Importantly, a standardized comparison of the carbon footprint of 2,214 medicines regularly prescribed in the United Kingdom showed 3 antibiotics accounted for an outsized 15% of carbon emissions (67), highlighting the need for judicious use of antimicrobials.

Antimicrobial stewardship programs are examples of medicine stewardship programs that address inappropriate antibiotic prescribing and increasing antibiotic resistance, demonstrating benefits in clinical outcome, adverse events, treatment cost, and resistance rates (76). Their recognized value of reducing antimicrobial resistance, expenditure and length of stay (77) have led to these programs being a required organizational practice by Accreditation Canada (78).

ACTION ITEM CHECKLIST

This checklist provides actions that institutional managment and decision makers can take to reduce the environmental, patient and institutional consequences of polypharmacy.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Action Items for Institutional Management and Decision Makers

This checklist provides actions that institutional managment and decision makers can take to optimize the medication prescribed to patients to reduce the environmental, patient and institutional consequences of polypharmacy.

- Appoint individuals to complete drug use evaluation (DUE) services
- Create a DUE team
- Support creation of stewardship programs
  - Anticoagulation Stewardship Program
  - Polypharmacy Stewardship or Deprescribing Programs
  - Opioid or Analgesic Stewardship Programs
- Implement EHR clinical decision support systems with key partners
- Support quality improvement projects to reduce potentially inappropriate medications and share outcomes with participating team members and key decision makers

For more resources, view the Medication Optimization for Sustainability in Inpatient Care playbook at: cascadescanada.ca/action-areas/pharmacy-and-prescribing

EMERGING STEWARDSHIP PROGRAMS

There is an opportunity to expand stewardship programs into other clinical areas. Possible stewardship models include **Analgesic Stewardship** (79), **Polypharmacy Stewardship** (80) and **Anticoagulation Stewardship.** While collecting the clinical, workload and economic benefits of stewardship programs, teams are encouraged to calculate the environmental co-benefits.

SPOTLIGHT ANTICOAGULATION STEWARDSHIP PROGRAM AT ST. PAUL'S HOSPITAL

- Heparin is dependent on the global porcine industry, which emits an estimated 668 million tons of CO2e annually (81). In the past, disruptions of the pork industry have led to shortages of heparin, an event that may be more likely to occur given growing global demand, dependence of many countries solely on porcine intestinal mucosa for heparin production (82), and increasing risks to supply chains from extreme weather events due to climate change (83). Attention should thus be given to the judicious use of heparin products.

- St. Paul's Hospital in British Columbia started an **Anticoagulation Stewardship Program (ACSP)** with the goal of reducing unnecessary heparin use to improve patient outcomes and comfort, reduce medication costs, nursing time, and improve the hospital's environmental footprint.

- A 0.5 full-time equivalent (FTE) pharmacist assessed the venous thromboembolism (VTE) risk of selected patients using the validated IMPROVE risk score (84). Recommendations were made for patients with discrepancies between their risk category and thromboprophylaxis regimen, which were reviewed with an ACSP physician and provided to the admitting team.

- During the first 6 months of this study, 889 patients were screened, leading to 236 recommendations, of which 60-70% were accepted.

- Of the 232 low-risk patients who discontinued or did not receive VTE prophylaxis, a single low-risk patient developed a VTE within 30 days.

Electronic Decision Support

MANDATORY STOP OR REVIEW DATES FOR MEDICATIONS

Institutions can promote medication optimization by requiring healthcare providers to set a stop date for select medication orders to ensure the therapy is stopped when necessary. The medications targeted for this intervention should not be chronic medications and would ideally have evidence-based durations guiding the choice of the stop date. Alternatively, institutions can make healthcare providers set a mandatory medication review date where healthcare professionals then reassess the medical condition and determine if medication therapy is still needed. Some medications for which mandatory stop or review dates may be implemented include:

- Opioids
- Sedatives and hypnotics
- Antimicrobials
- Proton pump inhibitors (PPIs)
- Venous thromboembolism prophylaxis

ELECTRONIC HEALTH RECORD (EHR) POP-UP ALERTS

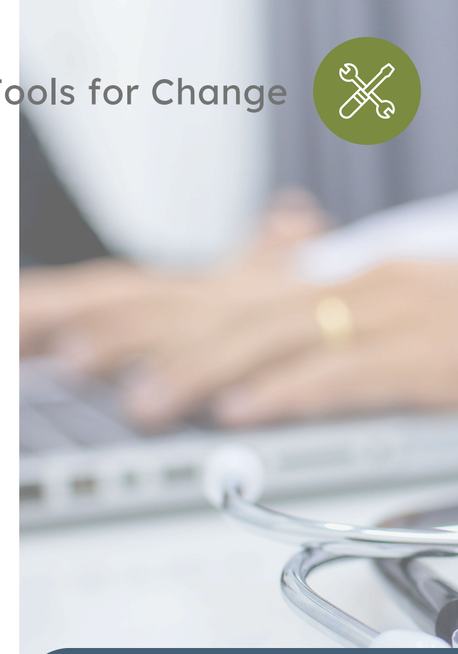
Institutions may consider creating their own clinical practice alerts within their electronic health record (EHR) to support healthcare providers with medication optimization. Such alerts can notify healthcare providers of opportunities to review indications and dosing for a prescribed medication, or when a medication has reached its duration. Alerts can be mandatory across specific units, or they can be an EHR feature clinicians choose to opt into. Alerts in electronic health records alone have not been demonstrated to definitively improve prescribing habits (85,86) or reduce mortality (87); they should be used in conjunction with other strategies, such as stewardship programs and education modules.

DEPRESCRIBING AIDS

Electronic tools exist to help healthcare providers with finding medications to deprescribe. These tools are for information only and clinical judgement should always be used.

deprescribing.org created a mobile phone application that allows providers to follow their guideline algorithms and can be downloaded at IAM Medical Guidelines App.

MedSafer and **MedStopper** allows users to input patient medication lists into their program, after which deprescribing opportunities are identified generated based on the medication's risk of causing harm or causing an adverse drug event (88). In the cluster randomized clinical trial, the deprescribing opportunities generated by MedSafer resulted in a statistically significant increase in deprescribing (29.8% in the control group and 55.4% in the intervention group) with no difference in adverse drug withdrawal events between the two groups (89). While MedSafer and MedStopper do not include environmental considerations in its assessments, the deprescribing opportunities it presents can enhance the sustainability of prescribing practices.



RESOURCES

For institutions that use Epic as their EHR, Epic Earth is a space to collaborate with other health care providers across organizations and gain insight on what others have done to resolve problems within their institution. Consider sharing and searching for Epic projects that add a sustainability aspect, such as alerts for deprescribing opportunities.

HOW

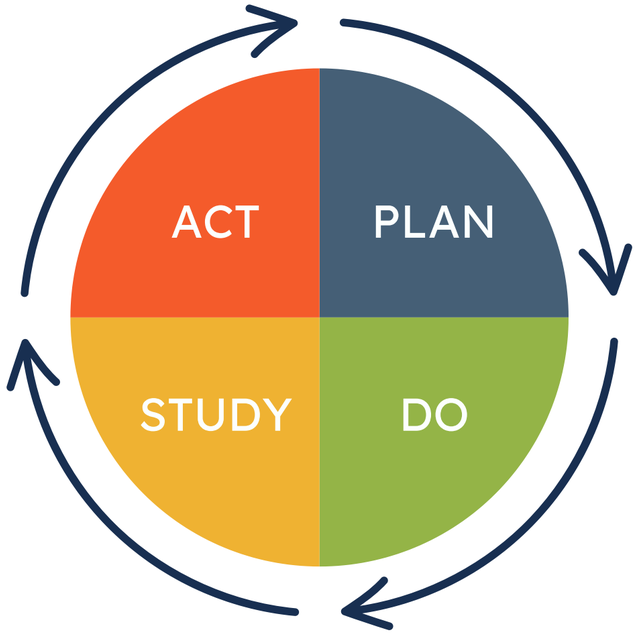
The Strategy for Change

1. Leverage Quality Improvement (QI) Projects
2. Engage Patients in Decision Making
3. Collaborate with Multidisciplinary Team
4. Communicate with Circle of Care

Leverage Quality Improvement (QI)

Quality improvement (QI) projects in healthcare settings focus on testing change ideas to achieve improvements in one or more quality domains; for example, QI projects aimed at enhancing efficiency might focus on reducing healthcare costs or shortening hospital admissions, while those aimed at safety might focus on reducing postoperative infection (90). Provincial regulatory bodies across Canada are moving towards including QI work in physician requirements (91).

A common approach for conducting a QI project involves the **Plan-Do-Study-Act** (PDSA) cycle. In this process, evaluators set a goal, identify change ideas, and outline steps to implement their test intervention (92,93). The evaluators then assess their intervention by observing the outcome and identifying potential adjustments that could be made to increase the likelihood of achieving the outcome (93). Undertaking medication optimization as a QI project could offer an established pathway to engage other healthcare providers and obtain institutional support.



RESOURCES

Plan-Do-Study-Act Cycle for QI:

- Healthy Quality Ontario PDSA Cycles and Toolkit
- Healthy BC PDSA Cycle Worksheet

Physician Practice Improvement:

- College of Physicians and Surgeons of Alberta Practice-Drive Quality Improvement
- Doctors of British Columbia: Physician Quality Improvement (PQI)
- The College of Physicians and Surgeons of Ontario (CPSO) : 2
  - Quality Improvement Program for Individuals
  - Quality Improvement Partnerships for Hospitals
  - Quality Improvement Webinar Recording

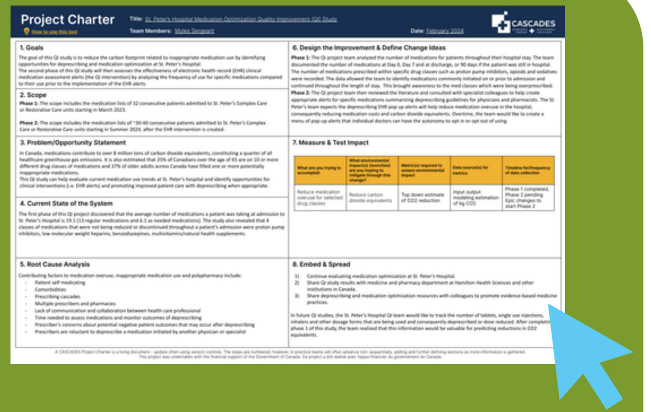
SPOTLIGHT A DEPRESCRIBING QI PROJECT AT ST. PETER'S HOSPITAL

Inspired to tackle deprescribing as an opportunity to reduce both GHGs and costs (94), the rehabilitation and complex care physicians at St. Peter's Hospital started a CPSO QI project to evaluate current medication use trends and identify areas of improvement. The goal of the project was to optimize medications by standardizing medication reviews earlier in a patient's admission. The hypothesis was that earlier medication reviews would result in patients taking less medications throughout their length of stay, thereby improving patient safety and comfort.

Additional expected benefits include reduction of resources used, including medication cost and nursing administration time, and decreased impact of medications on the environment.

PROJECT CHARTER

For more information about St Peter's Hospital Quality Improvement Project, see the Project Charter.



SPOTLIGHT SUSTAINABILITY IN QUALITY IMPROVEMENT

Healthcare professionals looking to integrate sustainability into their QI projects or undertake a sustainability-focused QI project may review previous sustainable quality improvement projects for examples of project goals, methods, measurements, barriers, and results. CASCADES' Quality Improvement playbook provides tools and strategies for incorporating sustainability into QI work and can help guide efforts to enhance sustainability through medication optimization practice.

Change ideas to improve medication optimization can include assessing the effectiveness of:

- Integrated electronic clinical decision support interventions
- Drug use evaluation formulary modifications
- Medication stewardship programs

Metrics that may be collected in medication optimization projects include:

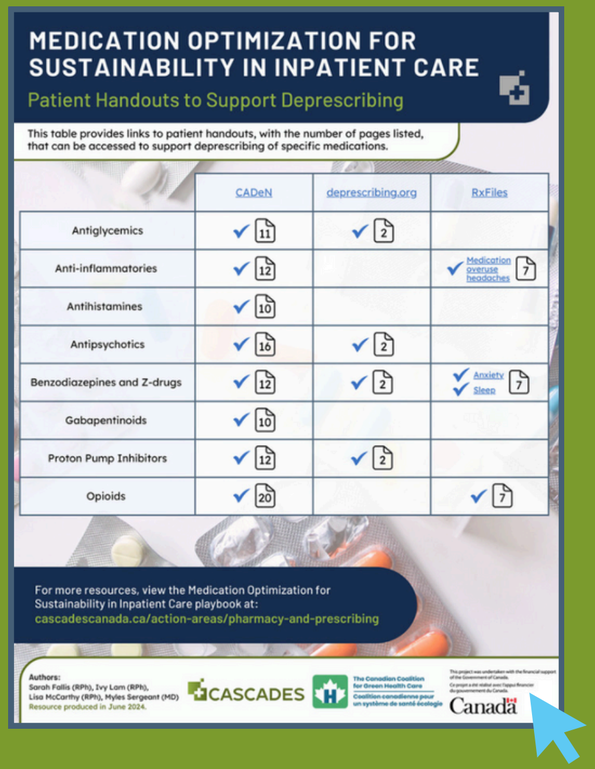
- Average number of medications patients are prescribed on a specific unit
- Most prescribed regularly scheduled and as-needed medications
- Number of medications commonly discontinued at discharge
  - Average number of days on discontinued medications during admission
- If available, calculate the environmental impacts (by unit) associated with change

Engage Patients in Decision Making

Medication reviews and deprescribing should be done in partnership with patient and caregivers and include discussions about the concerns most important to them, such as the risk and benefits of the medications, what to monitor, tapering plans, and when to contact a healthcare provider. Discussion points can include cost and environmental benefits where relevant. Patients who are included in the decision-making process are better positioned to understand their treatment plan, medication regimen, and the rationale for changes in their medication therapy.

Explaining the rationale for a medication change to patients and caregivers can improve adherence and minimize the likelihood of the discontinued medication being restarted unintentionally after discharge (95). Providing patients with handouts can also empower them to speak with their primary care provider after discharge if deprescribing plans are not implemented during their admission.

PATIENT HANDOUTS



This resource provides links to patient handouts, with the number of pages listed, that can be accessed to support deprescribing of specific medications.

Collaborate with Multidisciplinary Teams

Collaborative medication reviews (CMRs) can reveal opportunities for medication optimization. CMRs typically involve a pharmacist reviewing the patient's medications in close collaboration with other healthcare professionals such as the physician or nurse practitioner (96). In cases where the indication for or benefits of ongoing therapy are unclear, healthcare teams can consult specialists or stewardship teams within their institution for guidance.

A group in Northeastern British Columbia successfully implemented a program to reduce medication use through a team-based model.

Communicate with Circle of Care

If a medication review results in medication change, it is important to document the changes and rationale and share these with the circle of care, including outpatient healthcare providers. One barrier to successful sustained deprescribing is a lack of communication with the circle of care (97). As a result, medications may be restarted after discharge by a patient's primary care provider during their next appointment.

COMMUNICATION STRATEGIES TO PROMOTE DEPRESCRIBING

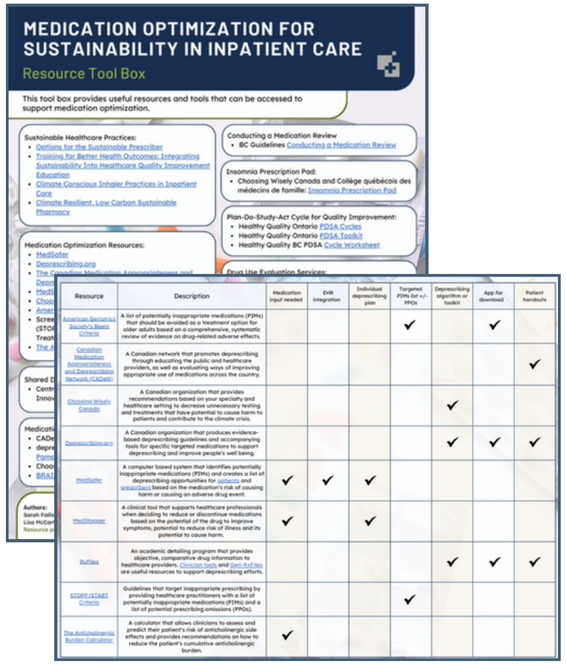
- Document the rationale for medication changes in:
  - Healthcare provider's notes when medication changes occur during hospital stay.
    - E.g., physician progress notes, pharmacist medication assessment notes.
  - Discharge summary provided to patient and others involved in care (e.g., primary care provider).
  - Discharge prescription for patients.
    - Explicitly list the medications that have been discontinued and state the rationale for discontinuation to avoid inadvertent refills at the community pharmacy. Patient handouts can help.

- Provide detailed tapering or deprescribing plans to:
  - Patients and/or caregivers.
  - Primary care providers involved in community care.
  - Community pharmacists.

RESOURCES

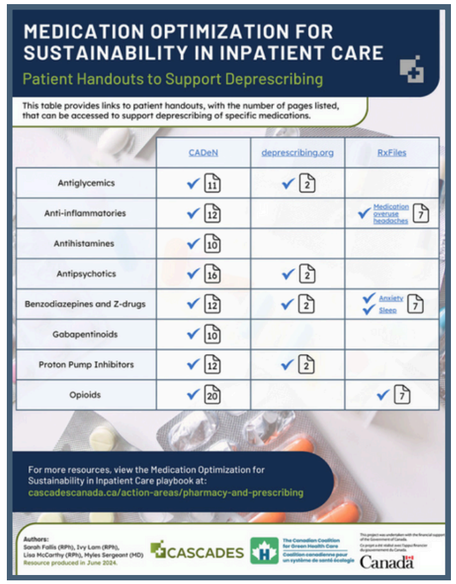
- Medication Patient Handouts
- University Health Network Discharge Summary Best Practices

Playbook Resources



RESOURCE TOOL BOX

This tool box provides useful resources and tools that can be accessed to support medication optimization.



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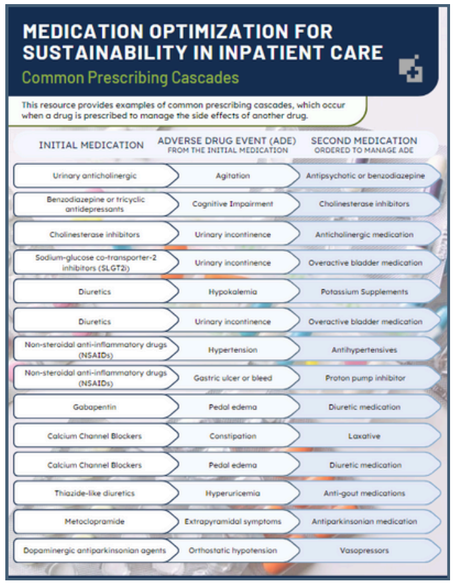
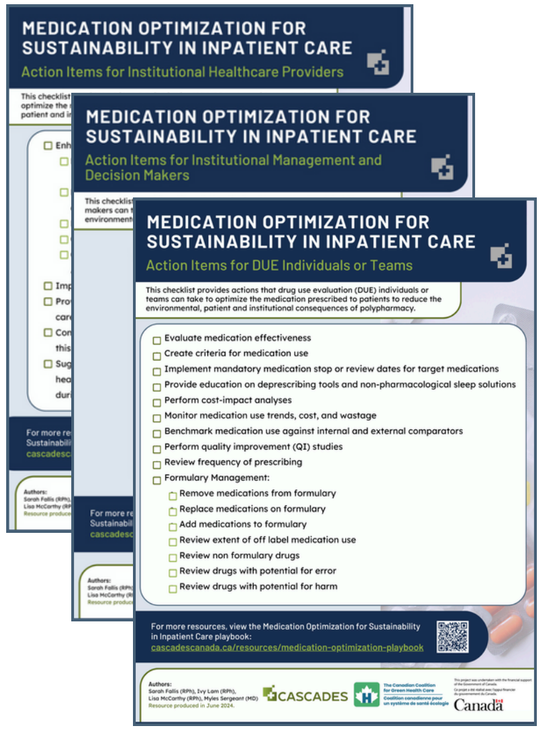


PRESCRIBING CASCADES

This resource provides examples of common prescribing cascades, which occur when a drug is prescribed to manage the side effects of another drug.



ACTION ITEM CHECKLISTS

These checklists provide actions that institutional managment and decision makers, healthcare providers, and DUE Individuals or Teams can take to reduce the environmental, patient and institutional consequences of polypharmacy.

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