Technical Report

April 2017

Unnecessary Care in Canada

Choosing Wisely Canada™

Canadian Institute for Health Information

Institut canadien d'information sur la santé

Production of this document is made possible by financial contributions from Health Canada and provincial and territorial governments. The views expressed herein do not necessarily represent the views of Health Canada or any provincial or territorial government.

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ISBN 978-1-77109-583-9 (PDF)

How to cite this document:
Canadian Institute for Health Information. *Unnecessary Care in Canada: Technical Report*. Ottawa, ON: CIHI; 2017.

Cette publication est aussi disponible en français sous le titre *Les soins non nécessaires au Canada : rapport technique*.
ISBN 978-1-77109-584-6 (PDF)

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Acknowledgements

The Canadian Institute for Health Information (CIHI) wishes to acknowledge and thank the following individuals for their invaluable advice on *Unnecessary Care in Canada: Technical Report*:

- **Dr. Sacha Bhatia**, Evaluation Lead, Choosing Wisely Canada
- **Dr. Eric Bohm**, Associate Professor of Surgery, University of Manitoba; Director, Health System Performance, George and Fay Yee Centre for Healthcare Innovation
- **Jennifer Chadder**, Program Manager, System Performance, Canadian Partnership Against Cancer
- **Dr. Lara J. Cooke**, Associate Dean, Office of Continuing Medical Education and Professional Development, Cumming School of Medicine, University of Calgary
- **Dr. Noah Ditkofsky**, Assistant Professor, Sunnybrook Health Sciences Centre
- **Peter Froese**, Senior Operating Officer, Diagnostic Imaging, Alberta Health Services
- **Dr. Eddy Lang**, Professor and Department Head, Emergency Medicine, Cumming School of Medicine, University of Calgary, Alberta Health Services
- **Dr. Jerome A. Leis**, General Internal Medicine and Infectious Diseases, Sunnybrook Health Sciences Centre
- **Dr. Gabriela Lewin**, Canadian Task Force on Preventive Health Care
- **Jenny Liu**, Data Analyst, Analytics, Canadian Partnership Against Cancer
- **Suzanne McKenzie**, CHIM, Ouellette Campus; Data Analyst, Trauma Services, Windsor Regional Hospital
- **Rami Rahal**, Canadian Partnership Against Cancer
- **Ellen Sitler**, Manager, Projects and Initiatives, Diagnostic Imaging, Alberta Health Services
- **Dr. Christine Soong**, Director, Hospital Medicine Program, Sinai Health System and University Health Network
- **Dr. Cara Tannenbaum**, Director, Canadian Deprescribing Network
- **Dawn Traverse**, Lead, Health Services Measurement — External Partners, Alberta Health Services
- **Justin P. Turner**, Assistant Director, Canadian Deprescribing Network; Postdoctoral Fellow, Centre de recherche Institut universitaire de gériatrie de Montréal
- **Dr. Aikta Verma**, Assistant Director, Clinical Operations, Department of Emergency Medicine, Sunnybrook Health Sciences Centre
- **Dr. Kimberly Wintemute**, Primary Care Co-Lead, Choosing Wisely Canada

Please note that the analyses and conclusions in the present document do not necessarily reflect those of the individuals or organizations mentioned above.

Choosing Wisely Canada and the Canadian Institute for Health Information

Canadian Institute for Health Information

CIHI is an independent, not-for-profit organization that provides essential information on Canada's health systems and the health of Canadians.

We provide comparable and actionable data and information that are used to accelerate improvements in health care, health system performance and population health across Canada. Our stakeholders use our broad range of health system databases, measurements and standards, together with our evidence-based reports and analyses, in their decision-making processes. We protect the privacy of Canadians by ensuring the confidentiality and integrity of the health care information we provide.

Choosing Wisely Canada

Choosing Wisely Canada (CWC) is a campaign to help clinicians and patients engage in conversations about unnecessary tests and treatments and to make smart and effective choices to ensure high-quality care. As part of the campaign, Canadian national societies representing a broad spectrum of clinicians have developed a number of recommendation lists; these lists describe commonly used tests and treatments that are not supported by evidence and/or that could expose patients to unnecessary harm. There are currently more than 150 Canadian recommendations as well as a website, patient pamphlets and a mobile app to support clinicians and their patients.

The CWC campaign has generated broad interest across Canada, with many groups working toward reducing low-value testing. CIHI began its support for the CWC initiative in November 2014 with the goal of providing comparable pan-Canadian information. While the report *Unnecessary Care in Canada* includes analyses performed by organizations other than CIHI, the methodology outlined here pertains to only the analytical work performed at CIHI.

Recommendations for analysis

Recommendations were selected for analysis and included in this report based on the following parameters:

- CIHI has the data required to provide comparable analysis across multiple health systems.
- The recommendation is of high value to stakeholders, as determined by
  - The recommendation appearing on a number of lists; or
  - Consultation with CWC and stakeholders.
- CIHI has the ability to provide actionable information to decision-makers. Low volumes, lack of granularity in codes (i.e., inability to identify specific procedures or diagnoses) or data quality issues are considered barriers to actionable analysis.

Based on these criteria, 8 recommendations are included in this report.

Table 1 List of selected recommendations

Recommendation	Source of recommendation
Don't do imaging for lower-back pain unless red flags are present	College of Family Physicians of Canada/Canadian Medical Association and Canadian Association of Radiologists
Don't use atypical antipsychotics as a first-line intervention for insomnia in children and youth	Canadian Academy of Geriatric Psychiatry, Canadian Academy of Child and Adolescent Psychiatry and Canadian Psychiatric Association
Don't use benzodiazepines and/or other sedative–hypnotics in older adults as the first choice for insomnia, agitation or delirium	Canadian Geriatrics Society and Canadian Society of Hospital Medicine
Don't routinely do screening mammography for average-risk women age 40 to 49	College of Family Physicians of Canada/Canadian Medical Association
Don't perform preoperative testing before low-risk surgeries*	Canadian Society of Internal Medicine, Canadian Anesthesiologists' Society and Canadian Cardiovascular Society
Don't do imaging for minor head trauma unless red flags are present	Canadian Association of Radiologists and Canadian Association of Emergency Physicians
Don't routinely obtain head CT scans in hospitalized patients with delirium in the absence of risk factors	Canadian Society of Hospital Medicine
Don't transfuse red blood cells for arbitrary hemoglobin or hematocrit thresholds in the absence of symptoms	Canadian Society of Internal Medicine

Note

* The wording varied among the recommendations of these 3 societies. The decision was made to focus on cardiac testing to align with analysis previously conducted for Ontario.

CIHI data sources

Discharge Abstract Database/Hospital Morbidity Database

The **Discharge Abstract Database (DAD)** captures administrative, clinical and demographic information on hospital discharges from facilities in all provinces and territories outside Quebec. Data from Quebec is submitted to CIHI directly by the ministère de la Santé et des Services sociaux du Québec. This data is appended to the DAD to create the **Hospital Morbidity Database (HMDB)**. The DAD/HMDB uses ICD-10-CA/CCI[i] to code diagnoses and interventions.

National Ambulatory Care Reporting System

The **National Ambulatory Care Reporting System (NACRS)** captures information on client visits to hospitals and community-based ambulatory care. NACRS currently collects data on day surgeries, emergency department use and other ambulatory care visits; data varies by region (see the NACRS metadata for details). NACRS uses ICD-10-CA/CCI to code diagnoses and interventions.

Patient-Level Physician Billing

The **Patient-Level Physician Billing (PLPB)** data is derived from the **National Physician Database (NPDB)**, which contains physicians' billing data (fee codes) that provincial and territorial medicare programs submit to CIHI. The NPDB provides information on demographic characteristic of physicians, physician payments and physicians' level of activity within Canada's health care systems. For each physician visit, the PLPB has additional visit information such as health care number, reason for visit (ICD-9 codes[ii]), service billed for and location of service provided. CIHI currently collects PLPB data from Saskatchewan and Alberta.

National Prescription Drug Utilization Information System Database

The **National Prescription Drug Utilization Information System (NPDUIS) Database** contains drug claims–level data collected from publicly financed drug benefit programs in 9 Canadian provinces. The NPDUIS Database houses pan-Canadian information related to public program formularies, drug claims, policies and population statistics. It was designed to provide information that supports accurate, timely and comparative analytical and reporting requirements for the establishment of sound pharmaceutical policies and the effective management of Canada's public drug benefit programs.

i. International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canada/Canadian Classification of Health Interventions.
ii. International Classification of Diseases, Ninth Revision.

Other data sources

Canadian Community Health Survey Public Use Microdata File (2012)

The public use microdata file (PUMF) from Statistics Canada's Canadian Community Health Survey (CCHS) provides data for health regions across Canada. Data is based on interviews with approximately 65,000 respondents age 12 and older residing in households in all provinces and territories. See Statistics Canada's website for sampling, weighting and other survey details.

The PUMF includes information on a wide range of topics, including physical activity, height and weight, smoking, exposure to second-hand smoke, alcohol consumption, general health, chronic health conditions, injuries and use of health care services. It also provides information on the socio-demographic, income and labour force characteristics of the population.

Diagnostic imaging in Canada

Diagnostic imaging is an essential, specialized health care service and a focus of many CWC recommendations, yet there is incomplete data on it across Canada. There are a few circumstances in which patient-level diagnostic imaging data is available so we may investigate CWC's recommendations:

- In Ontario, magnetic resonance imaging (MRI) scans, computed tomography (CT) scans and angiographies performed in hospital are mandated to be reported to the DAD.
- In all provinces, imaging is mandatory to report when performed in a main operating room or cardiac catheterization laboratory. These imaging procedures are reported to the DAD or NACRS (depending on location; see Table 2).
- In all provinces, imaging in ambulatory care settings is mandatory for conditions where it informs case mix grouping.[iii]
- Additionally, imaging services are billable, so data is available through the PLPB.

The appropriateness of using diagnostic imaging data was decided on a recommendation-by-recommendation basis.

iii. Case mix is a methodology that categorizes patients into statistically and clinically homogeneous groups based on clinical and administrative data.

Table 2 Overview of CIHI coverage by service

Service	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T., N.W.T., Nun.
Acute care	DAD	DAD	DAD	DAD	HMDB	DAD	DAD	DAD	DAD	DAD	DAD
Day surgery	DAD	DAD	NACRS	DAD	—	NACRS	DAD	DAD	NACRS	DAD	DAD
Emergency care*	—	—	—	—	—	NACRS	—	—	NACRS	—	—
Medication claims data	NPDUIS	NPDUIS	NPDUIS	NPDUIS	—	NPDUIS	NPDUIS	NPDUIS	NPDUIS	NPDUIS	—
Physician billing	—	—	—	—	—	—	—	PLPB	PLPB	—	—

Notes

* Only provinces with mandatory Level 3 (clinical) coverage are included.

— This service was not included in that jurisdiction.

Table 3 Summary of data sources used by recommendation

Recommendation	DAD/HMDB	NACRS	PLPB	NPDUIS	Other
Don't do imaging for lower-back pain unless red flags are present	2010–2011 to 2012–2013	2010–2011 to 2012–2013	2010–2011 to 2012–2013	—	—
Don't use atypical antipsychotics as a first-line intervention for insomnia in children and youth	—	—	—	2007–2008 to 2013–2014	—
Don't use benzodiazepines and/or other sedative–hypnotics in older adults as the first choice for insomnia, agitation or delirium	—	—	—	2011–2012 to 2014–2015	—
Don't routinely do screening mammography for average-risk women age 40 to 49	—	—	—	—	CCHS PUMF, 2012
Don't perform preoperative testing before low-risk surgeries	2012–2013	2012–2013	2012–2013	—	—
Don't do imaging for minor head trauma unless red flags are present	2014–2015 to 2015–2016	2014–2015 to 2015–2016	—	—	—
Don't routinely obtain head CT scans in hospitalized patients with delirium in the absence of risk factors	2010–2011 to 2014–2015	—	—	—	—
Don't transfuse red blood cells for arbitrary hemoglobin or hematocrit thresholds in the absence of symptoms	2006–2007 to 2013–2014	—	—	—	—

Note

— The data source was not used in the listed recommendation.

Primary Care

Don’t do imaging for lower-back pain unless red flags are present

Operationalizing the recommendation

CIHI partnered with CWC and the Institute for Clinical Evaluative Sciences (ICES) to develop a methodology for identifying patients in Alberta with lower-back pain. CWC and ICES had previously started work on this type of analysis in Ontario, and efforts were made to ensure that the analyses of Alberta rates were comparable.

Non-persistent lower-back pain

Patients with lower-back pain were defined as adults (age 18 and older) who visited a family physician in Alberta with a concern of lower-back pain. When identifying lower-back pain, the first 3 digits of the ICD-9 diagnosis codes were used. This was done for 2 reasons:

1. To maintain comparability with Ontario data (as the Ontario Health Insurance Plan data holds 3 digits only); and
2. To provide consistency in the detail available in the Alberta billing data (40% of patient diagnosis codes were 3 digits only). Where fourth and fifth digits were available, we found that 80% of the 3-digit selected codes were for lower-back pain (see Appendix A for a full list and description of ICD-9 codes).

For each patient, the first family physician visit with a diagnosis of lower-back pain in the fiscal year was selected as the index visit.

Diagnostic imaging

CIHI selected 3 types of diagnostic imaging for inclusion: X-rays, CT scans and MRI scans (see Appendix B for a full list of codes). X-rays performed in emergency departments or hospital clinic settings are reported to NACRS, while X-rays performed in clinics are captured through billing data (PLPB).[iv] CT and MRI scans are reported to NACRS. As with the data used to identify lower-back pain, there is a lack of specificity in the billing data. We could identify an image of the back but not the exact segment of the back.

Red flags

Red flags are indications (or conditions) that imaging for lower-back pain may be appropriate. These red flags were defined by CWC experts. CIHI defined red flags as those appearing in the 365 days prior to the index visit; they include cancer, neurological problems, specific infections and vertebral compression fractures (see Appendix C for a detailed list). Patients with these red flags were removed from the estimates of unnecessary imaging.

Methodology

No time frame from physician visit to scan is mentioned in the CWC recommendation; therefore, 3 time intervals were explored: 3, 6 and 12 months after the index visit. Once the index visit was established, rates were calculated based on the different time frames and combinations of imaging (i.e., X-ray, CT or MRI).

Modelling

To help predict drivers of scans for lower-back pain, odds ratios were calculated for the following variables:

- Age (18–44; 45–64; 65–84; 85+)
- Sex
- Annual volume of lower-back pain patients seen by family physician per year (fewer than 50; 50 or more)
- Patient health zone based on residential postal codes

iv. Any X-ray that was reported to both NACRS and PLPB was counted only once.

Data sources

- DAD, 2010–2011 to 2012–2013
- NACRS, 2010–2011 to 2012–2013
- PLPB, 2010–2011 to 2012–2013

Calculation

$$\text{Rate of lower-back pain imaging} = \frac{\text{Patients with at least one diagnostic image and lower-back pain}}{\text{Patients with lower-back pain}}$$

Exclusions

- Records with invalid health card numbers
- Patients with persistent lower-back pain in the 12 months prior to the index visit (see Appendix D for definition)
- Patients with non–Alberta issued health cards
- Encounters with physicians in an acute care facility (where the billing system is not comparable with that in primary care settings)

Limitations

Lower-back pain may be over-estimated due to the use of 3-digit ICD-9 diagnosis codes; however, this over-estimation is estimated to be minor.

Similarly, scan rates may be over-estimated due to the lack of specificity or inclusion of non–lower back scans. Again, this is estimated to be minor, as most of the lower-back pain diagnoses were made by family physicians and these scans were most likely to be performed on the lower back (80%, as mentioned above).

In Alberta, a small number of private clinics provide diagnostic imaging services (CT or MRI scans only). Since only services provided using public funding could be captured by the PLPB and NACRS, there could have been a slight under-estimation of MRI and CT scan rates.

Administrative data does not capture the clinician's decision process and may not capture a patient's full clinical history. While efforts were made to identify and exclude patients with any indication for receiving an imaging scan, it is possible that some patients who were included required a scan from a clinical perspective and that this was not reflected in the data.

Appendix A: ICD-9 codes used to identify family physician visits for lower-back pain in the PLPB

Definition	ICD-9 codes
Spondylosis and allied disorders	721
Intervertebral disc disorders	722
Other and unspecified disorders of back	724
Sprains and strains of sacroiliac region	846
Sprains and strains of other and unspecified parts of back	847

Appendix B: CCI and billing codes used to identify diagnostic imaging

Type of diagnostic imaging scan	PLPB (billing codes)	NACRS (CCI codes)
X-ray	X55, X56, X57, X57A, X58E, X58, X59, X60, X61, X62, X63, X64, X65, X66, X67	3.SC.10.^ ^, 3.SC.12.^ ^, 3.SE.10.^ ^, 3.SE.12.^ ^, 3.SF.10.^ ^, 3.SF.12.^ ^
CT	n/a	3.SC.18.^ ^, 3.SC.20.^ ^, 3.SF.18.^ ^, 3.SF.20.^ ^
MRI	n/a	3.SC.40.^ ^, 3.SF.40.^ ^

Note
n/a: Not applicable.

Appendix C: Red flag exclusion criteria

Red flag category	ICD-9 codes (PLPB)	ICD-10-CA codes (NACRS and DAD)
Cancer/history of cancer	140–208, 230–239, V10, V580, V581	C00–C97, D00–D09, D37–D48, Z51.0, Z51.1, Z85, Z86
Neurological problems	323, 331, 332, 333, 334, 337, 340, 341, 342, 344, 345, 348, 349, 350, 351, 353, 357, 358, 359, 728, 781, 787, 788	G04, G05, G11, G20–G26, G30, G31, G32, G35, G37, G40, G50, G51, G54, G61, G62.0, G62.1, G62.2, G70, G71, G72, G81, G82, G83, G90, G93, G96.1, G96.8, G96.9, G97, G98, M62.9, R15, R29.8, R32, R56
Specific infections/ fever 3 months prior to back pain visit	010–018, 038, 730, 997, 998, 720	A15–A19, A40, A41, G06.1, G06.2, M46.2, M46.3, M46.5, M86, M89.6, T87.4, T81.4
Vertebral compression fracture	733	M80.0–M80.9 (with a 5th digit of 8), M84.48, M90.7

Appendix D: Definitions of persistent lower-back pain

Indicator of persistent lower-back pain	Definition
Previous visit to a family physician	Visit to a physician for lower-back pain 1 to 365 days prior to the index visit ICD-9 codes: 721, 722, 724, 846, 847
Previous admission to an acute or emergency facility	Admission to an acute or emergency facility 1 to 365 days prior to the index visit ICD-10-CA codes: M43.27, M43.28, M43.9, M43.96, M43.97, M43.98, M46.36, M46.37, M46.46, M46.47, M47.86, M47.87, M47.88, M47.96, M47.97, M47.98, M48.06, M48.07, M48.96, M48.97, M51.1, M51.2, M51.3, M51.9, M53.26, M53.27, M53.28, M53.3, M53.86, M53.87, M53.88, M54.3, M54.4, M54.5, M54.8, M54.9, M99.03, M99.04, M99.83, M99.84, M99.93, M99.94, S33.5, S33.6, S33.7
Previous visit to a neuro- or orthopedic surgeon for spinal surgery	Visits to neurosurgeons or orthopedic surgeons or visits for spine surgeries 1 to 365 days prior to the index visit Visits to neurosurgeons or orthopedic surgeons (PLPB codes): • Neurosurgeon or orthopedic surgeon visits (specialty for the claim: 280, 335) • Billing code starting with 16 Spine surgeries (NACRS and DAD CCI codes): 1.AW.^ ^.^ ^, 1.SC.^ ^.^ ^, 1.SE.^ ^.^ ^, 1.SF.^ ^.^ ^, 1.SG.^ ^.^ ^, 1.SH.^ ^.^ ^, 1.SI.^ ^.^ ^, 1.SJ.^ ^.^ ^
Previous diagnostic imaging of the spine	Spinal imaging 1 to 365 days prior to the index visit (see Appendix B for codes)

Don’t use atypical antipsychotics as a first-line intervention for insomnia in children and youth

Operationalizing the recommendation

The NPDUIS Database does not include diagnostic information that corresponds with drug prescriptions. Therefore, the rate of atypical antipsychotic use provides a baseline for monitoring changes in potentially inappropriate use. Quetiapine has been prescribed most frequently for off-label use and makes up the majority of reports on the use of atypical antipsychotics for insomnia. Olanzapine is more sedating than quetiapine; however, there are fewer reports of olanzapine for pharmacologic management of primary or secondary insomnia.[1]

Children and youth

Children and youth were defined as those age 5 to 24 at the time of the index drug claim.

Atypical antipsychotics

The NPDUIS Database was used to identify quetiapine prescriptions that were filled and accepted by a provincial drug plan, either toward a deductible or for reimbursement. The analysis included data from Manitoba, Saskatchewan and British Columbia, the 3 provinces with the most comprehensive data for children and youth in the database. Claims were identified using the drug identification numbers assigned by Health Canada and using the World Health Organization’s Anatomical Therapeutic Chemical (ATC) Classification Level 5 code N05AH04.[2]

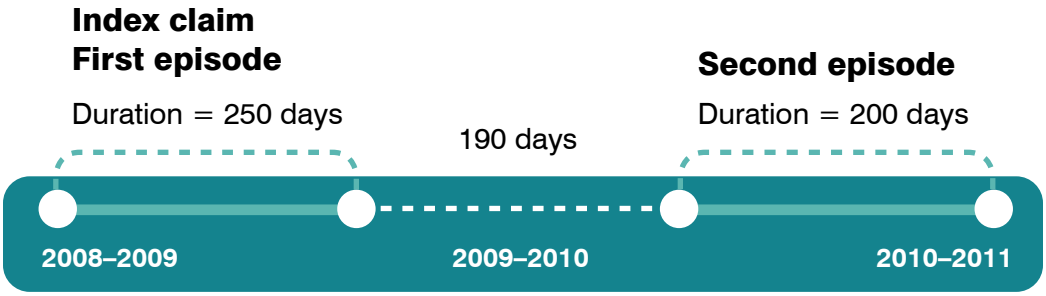
While the NPDUIS Database does not capture the reason for the prescription, we can use dose as a proxy measure when looking at quetiapine. Specifically, when quetiapine is used for insomnia, relatively low doses are prescribed (i.e., relative to doses required to treat schizophrenia and bipolar disorders). When used to treat insomnia, doses less than that recommended by the U.S. Food and Drug Administration (below 150 mg a day) are dispensed. It should be noted that quetiapine is not recommended for any use by youth in Canada.[3]

Methodology

Quetiapine use is a course of treatment, not a single event, and was characterized using the following definitions:

- Episode: Continuous use of quetiapine for more than 60 days without a gap for 180 days (6 months)
- Episode duration: The number of days between the first claim in the episode and the end date of the last claim in the episode (i.e., last claim date plus the number of days' supply in that claim)
- Low-dose quetiapine: Use of quetiapine at doses below 150 mg a day

Example of quetiapine drug use pattern



Data source

- NPDUIS Database, 2007–2008 to 2013–2014

Calculation

$$\text{Rate of quetiapine use} = \frac{\text{Patients with at least one episode of quetiapine use}}{\text{Canadian population age 5 to 24}^{v}}$$

v. Population age 5 to 24 is from Statistics Canada's population estimates.

Exclusions

- Claims associated with quetiapine in injectable form
- Episodes of 60 days or less[vi]
- Patients associated with claims with zero days' supply or other missing information required for the analysis

Limitations

The NPDUIS Database does not contain information regarding diagnoses or other indications for the drugs prescribed (i.e., other lines of therapy attempted). Low-dose quetiapine was used as a proxy for the use of quetiapine to treat insomnia.

There is no population-based data (volumes) on insomnia in youth; all youth were included in the denominator for the rate calculation. The rates presented here should be interpreted as a floor, or lower-bound estimate, for quetiapine use for insomnia in youth.

References

1. Thompson W, Quay TA, Rojas-Fernandez C, Farrell B, Bjerre LM. Atipical antipsychotics for insomnia: A systematic review. *Sleep Medicine*. June 2016.
2. World Health Organization. ATC/DDD Index 2016. Accessed September 7, 2016.
3. Health Canada. Drug Product Database online query. Accessed September 7, 2016.

vi. This exclusion prevents the inclusion of patients who are not consistently using a low dose (e.g., those on a titration plan).

Don’t use benzodiazepines and/or other sedative–hypnotics in older adults as the first choice for insomnia, agitation or delirium

Operationalizing the recommendation

The NPDUIS Database does not include diagnostic information that would indicate why drugs are prescribed. While the proportion of benzodiazepine use among seniors for primary insomnia is unknown in our sample, based on previous studies, primary insomnia is expected to account for a large proportion of overall benzodiazepine use[1].

Older adults

Older adults were defined as those age 65 and older with at least one drug claim.

Benzodiazepine and other sedative–hypnotics

Drugs were identified in the NPDUIS Database using the drug identification numbers (DIN) assigned by Health Canada and using the following World Health Organization Anatomical Therapeutic Chemical (ATC) Classification codes:

- N05BA[vii] — Benzodiazepine derivatives (under the broader class of anxiolytics)
- N05CD — Benzodiazepine derivatives (under the broader class of sedatives and hypnotics)
- N05CF — Benzodiazepine-related drugs
- N03AE — Benzodiazepine derivatives

The NPDUIS Database identifies claims that were accepted by a provincial drug plan, either toward a deductible or for reimbursement in 9 Canadian provinces. All 9 provinces were included in the analysis: Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia.

vii. Excludes code N05BA09, which is primarily used for epileptic seizures.

Methodology

Benzodiazepine and other sedative–hypnotic use is characterized using the following definitions:

- Claimant: Any individual who had at least one claim for a benzodiazepine or other related drug within the given year
- Chronic user: Any individual who had one or more claims for a benzodiazepine or other related drug in a given year, totalling at least 90 continuous supply days, without a gap in supply of at least 30 days. This definition is based on one used by the Canadian Deprescribing Network.

Data source

- NPDUIS Database, 2011–2012 to 2014–2015

Calculation

$$\text{Rate of chronic use} = \frac{\text{Chronic benzodiazepine and other sedative–hypnotic users}}{\text{Patients with at least one claim in the public drug program}}$$

Exclusions

- Patients younger than 65 at the time of the index claim
- Claims with zero days' supply

Limitations

The NPDUIS Database does not contain information regarding diagnoses or other indications for the drugs prescribed. As a result, all benzodiazepine and related drug use was included; the analysis could not be limited to use for insomnia, agitation or delirium.

Formulary coverage is largely similar across provinces, with most of the benzodiazepines being covered as full benefits; however, there is one notable exception. Zopiclone is not covered in Saskatchewan, and its coverage is restricted in Ontario and B.C. to the treatment of insomnia in patients who are not responsive to or who are intolerant to other benzodiazepines or sedative–hypnotics, or for those with insomnia and other specific concurrent diagnoses. In these provinces, zopiclone use is likely higher than what is measured using public drug program data only.

The proportion of the total senior population in each jurisdiction represented in the database (i.e., with accepted claims from public drug programs) varied from 50.7% in Newfoundland and Labrador to 91.9% in Saskatchewan. There may be differences in population characteristics (e.g., age, health status) between seniors with and without public coverage. In provinces with lower proportions of seniors who have claims accepted by the public plan (i.e., Newfoundland and Labrador, Nova Scotia, New Brunswick), drug utilization patterns among those with public coverage are less likely to reflect utilization patterns among all seniors in the province. Caution should be used when making comparisons between provinces; however, this issue will not affect trends within provinces over time.

Reference

1. Esposito E, Barbui C, Patten S. Patterns of benzodiazepine use in a Canadian population sample. *Epidemiologia e Psichiatria Sociale*. July 2009.

Don’t routinely do screening mammography for average-risk women age 40 to 49

Operationalizing the recommendation

Mammograms

Mammograms are not consistently captured in CIHI’s databases; therefore, the CCHS[1] was used for this analysis. Self-reported information on breast cancer screening was included in the 2012 CCHS PUMF,[viii] specifically answers to these questions (see Appendix E for details):

- Have you ever had a mammogram?
- Why did you have it?
- When was the last time?

Average risk

Risk status was defined based on respondents’ answers to the question “why did you have it?” Respondents could select all response options that applied. Average-risk women who had a screening mammogram were defined as those who answered that the reason for the mammogram was age and/or part of a regular check-up/routine screening only. Women were not considered average risk (and were excluded from the numerator) if they indicated any other reason for having a mammogram, such as family history or a previously detected lump. The definition of average was developed in consultation with a CWC clinical expert group.

viii. These questions are part of the Chronic Disease Screening common content module of the CCHS and were asked in all health regions in 2012.

Methodology

Average-risk women were defined as those age 40 to 49 who self-reported having a mammogram in the past 2 years. The 2-year time frame was chosen to align with the Canadian Task Force on Preventive Health Care's guidelines for the frequency of screening mammograms among the recommended age groups. Using weighted estimates from the CCHS, the total count for this group was divided by the number of female respondents who were age 40 to 49 to calculate the rate of potentially unnecessary mammograms.

An environmental scan conducted by the Canadian Partnership Against Cancer (CPAC) provided information on jurisdictional breast cancer screening guidelines, and there was further validation with members of the Canadian Breast Cancer Screening Network (Appendix F).[ix]

CCHS release guidelines

Results for selected provinces and territories were suppressed due to low sample sizes or high coefficients of variation (P.E.I., Manitoba, Saskatchewan and the territories; number of unweighted numerator less than 30 and/or coefficient of variation greater than 33.3).

Further information on the release of CCHS data from the PUMF can be found in the 2012 CCHS user guide, available on request from Statistics Canada.

Data source

- CCHS PUMF, 2012

Calculation

$$\text{Rate of mammogram use} = \frac{\text{Average-risk women (40 to 49) with a screening mammogram}}{\text{Women (40 to 49)}}$$

Exclusions

Respondents were excluded from the numerator if they indicated any of the following other reasons for a mammogram:

- Family history of breast cancer
- Previously detected lump
- Follow-up of breast cancer treatment

ix. The environmental scan is available upon request; please write to screening@partnershipagainstcancer.ca.

- On hormone replacement therapy
- Breast problem
- Other

Limitations

The CCHS is a voluntary survey of the general population, which carries the potential for self-report biases by respondents. For example, it is possible that social desirability bias will have played a role, with certain respondents answering that they'd had a screening mammogram because they felt that it was preferable to undergo screening. Cancer screening rates calculated using CCHS data (self-reported) are consistently higher than rates found using administrative data.[2]

The nature of the questionnaire also affects how "average risk" could be defined. Among respondents who answered that they had received a mammogram, average risk could be identified only by the subsequent answer for the reason for the mammogram. The risk profile for women who had not received a mammogram could not be determined and, as such, the denominator was not limited to average-risk women.

Appendix E: CCHS annual component — 2012 mammography questions[1]

Question ID	Question	Answer options
MAM_Q30	**Have you ever had a mammogram, that is, a breast X-ray?**	1. Yes 2. No
MAM_Q31	**Why did you have it? (Mark all that apply)**	1. Family history of breast cancer 2. Part of regular check-up/routine screening 3. Age 4. Previously detected lump 5. Follow-up of breast cancer treatment 6. On hormone replacement therapy 7. Breast problem 8. Other
MAM_Q32	**When was the last time?**	1. Less than 6 months ago 2. 6 months to less than 1 year ago 3. 1 year to less than 2 years ago 4. 2 years to less than 5 years ago 5. 5 or more years ago

Appendix F: 2012 jurisdictional screening mammography guidelines for average-risk women age 40 to 49

For more information on screening programs, please email CPAC or visit their website.

Jurisdiction	Eligibility for screening programs
N.L.	Not eligible
P.E.I.	Eligible for regular screening program (self-referral)
N.S.	Eligible for regular screening program (self-referral)
N.B.	Eligible only with physician (or nurse practitioner) referral
Que.	Eligible only with physician referral
Ont.*	Not eligible
Man.	Not eligible
Sask.†	Not eligible
Alta.	Eligible only with physician referral
B.C.	Eligible for regular screening program (self-referral)
Y.T.	Eligible for regular screening program (self-referral)
N.W.T.	Eligible for regular screening program (self-referral)
Nun.‡	n/a

Notes

* A high-risk screening program (annual MRI and mammogram) was available for Ontarian women age 30 to 69.

† In Saskatchewan, 49-year-old women turning 50 within the calendar year could qualify for screening at the mobile unit.

‡ There was no screening program in Nunavut.

n/a: Not applicable.

References

1. Statistics Canada. Canadian Community Health Survey — Annual Component (CCHS). Accessed August 25, 2016.
2. Lofters A, Vahabi M, Glazier R. The validity of self-reported cancer screening history and the role of social disadvantage in Ontario, Canada. *BMC Public Health*. 2015.

Specialist care

Don’t perform preoperative testing before low-risk surgeries

Operationalizing the recommendation

Rates of low-value testing had previously been released for Ontario patients undergoing low-risk surgery.[1] In order to be able to compare results, this analysis followed the methodology used by Kirkham et al.[1] CWC provided Ontario data to CIHI for inclusion in this analysis.

Low-risk procedures

Low-risk procedures were identified by an expert panel (see Kirkham[1] for details) and fell into 3 general categories: endoscopy, ophthalmology and other (e.g., selected orthopedic and urological procedures; see Appendix G for a full list of CCI codes). To further ensure procedures were low risk, 2 additional criteria were applied:

- Only procedures performed on the same day as admission to acute care or performed in an ambulatory care setting were included. This excluded procedures performed as a result of or related to treatment in acute care.
- Only the principal intervention code (in the DAD) or first-listed intervention (in NACRS) was used to identify the low-risk procedure. This ensured that the low-risk procedure was the primary (or only) reason a patient was admitted for care.

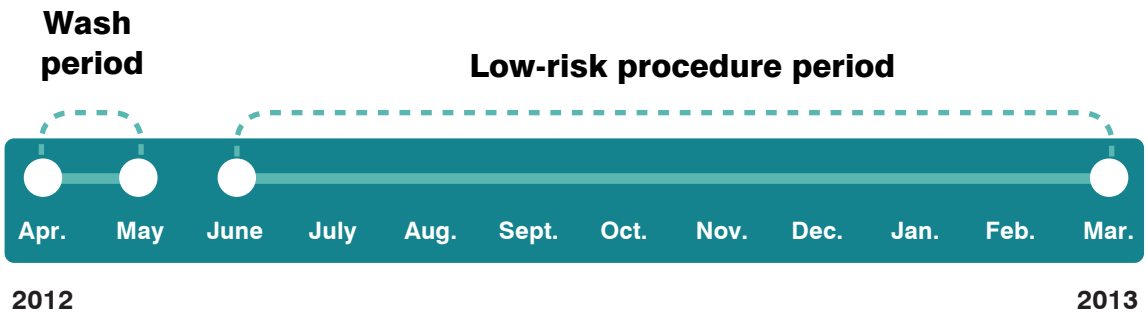
Preoperative cardiac testing

A number of specialist groups listed preoperative testing as having low value; a wide range of tests were included, from laboratory tests to X-rays. This analysis was restricted to cardiac testing. Preoperative testing was defined as having an electrocardiogram (ECG), cardiac stress test, echocardiogram or chest X-ray (see Appendix H for codes) in the 60 days prior to a low-risk procedure.

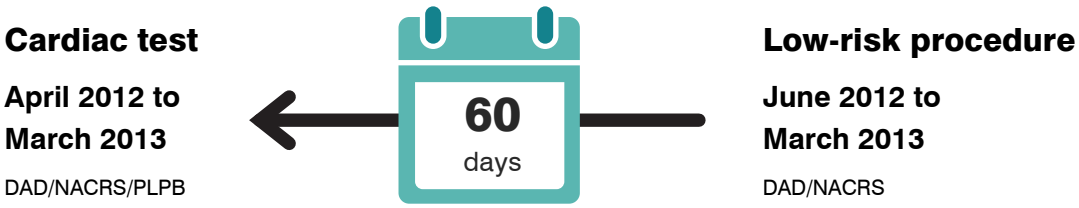
Preoperative testing can occur in a number of health care settings, each captured in a different database. For example, tests done in the community will appear in the PLPB, as they are billable services; tests done in hospital may appear in the DAD/NACRS and may or may not appear in the PLPB (depending on the funding model), resulting in duplicate reporting. If cases were reported/captured in duplicate, only one test was included. As billing data is available to CIHI from Saskatchewan and Alberta only,[x] our analysis was restricted to these provinces.

Methodology

All analysis was based on the 10-month period from June 2012 to March 2013, allowing for a 60-day preoperative testing "wash" period.



For each low-risk procedure, a retrospective search was performed to identify cardiac testing in the previous 60 days.



Data sources

- DAD, 2012–2013
- NACRS, 2012–2013
- PLPB, 2012–2013

Calculation

$$\text{Rate of preoperative testing} = \frac{\text{Procedures with at least one preoperative test}}{\text{Low-risk procedures}}$$

x. At the time of analysis, 2012–2013 was the most recent year for which PLPB data was available.

Exclusions

- Records with invalid health care numbers or gender
- Duplicate procedures based on health care number and issuing province, date and procedure type
- Patients younger than 18
- Low-risk procedures performed after the first day of admission to acute inpatient care
- Preoperative testing performed on the same day as surgery
- Procedures in facilities that performed fewer than 50 low-risk procedures

Limitations

There is no pan-Canadian standardized coding for billing; standards are set at the provincial level. Each province supplies CIHI with its data and coding manual. Codes for this analysis were selected to facilitate cross-provincial comparisons. Reasons for the test are not available in the data; therefore, the assumption was made that these were preoperative tests.

Appendix G: Low-risk procedure codes

Endoscopy

Specific procedure	CCI codes
Esophagus/stomach	2.NA.70.BA, 2.NA.71.BA, 2.NA.71.BR, 2.NF.70.BA, 2.NF.71.BA, 2.NF.71.BP, 2.NF.71.BR
Large bowel	2.NM.70.BA, 2.NM.71.BA, 2.NM.71.BR

Note

Endoscopy may also be captured in the PLPB:

- Saskatchewan: L402, L408, L360, L448, L449, L450, L492, L529
- Alberta: 1.12, 01.12A, 01.14, 01.22, 01.22A, 01.22B, 01.22C, 01.24A, 01.24B, 01.24BA, 01.24BB

Ophthalmology

Specific procedure	CCI codes
Other ophthalmology	1.CC, 1.CD, 1.CE, 1.CF, 1.CG, 1.CH, 1.CJ, 1.CL, 1.CM, 1.CN, 1.CP, 1.CQ, 1.CR, 1.CS, 1.CT, 1.CU, 1.CV, 1.CX, 1.CZ
Secondary cataract	1.CL.59
Cataract	1.CL.89

Other

Specific procedure	CCI codes
Orthopedic: **Shoulder (endoscopic drainage/extraction/procurement/release)**	1.TA.52.DA, 1.TA.58.DA, 1.TA.72.DA, 1.TA.80.DA^ ^, 1.TA.80.GZ
Orthopedic: **Clavicle (endoscopic drainage/distal resection)**	1.TB.52.GB, 1.TB.52.GD, 1.TB.87.DA
Orthopedic: **Rotator cuff (endoscopic extraction/release/repair)**	1.TC.57.DA, 1.TC.59.DA, 1.TC.72.DA, 1.TC.80.DA^ ^, 1.TC.80.GC^ ^
Orthopedic: **Arm/forearm (nerve decompression/repair/excision)**	1.BM.72, 1.BM.80, 1.BM.87, 1.BN.72
Orthopedic: **Wrist/hand**	1.UB.52, 1.UB.53, 1.UB.55, 1.UB.57, 1.UB.58, 1.UB.72, 1.UB.73, 1.UB.74, 1.UB.75, 1.UB.80, 1.UB.87, 1.UC.53, 1.UC.55, 1.UC.57, 1.UC.72, 1.UC.73, 1.UC.74, 1.UC.75, 1.UC.79, 1.UC.80, 1.UC.82, 1.UC.87, 1.UC.89, 1.UF.55, 1.UF.73, 1.UF.74, 1.UF.80, 1.UF.87, 1.UG.52, 1.UG.53, 1.UG.55, 1.UG.57, 1.UG.72, 1.UG.73, 1.UG.74, 1.UG.75, 1.UG.80, 1.UG.87, 1.UJ.71, 1.UJ.73, 1.UJ.74, 1.UJ.75, 1.UJ.82, 1.UJ.87, 1.UJ.93, 1.UK.53, 1.UK.55, 1.UK.72, 1.UK.73, 1.UK.74, 1.UK.75, 1.UK.80, 1.UK.87, 1.UK.93, 1.US.58, 1.US.72, 1.US.80, 1.UT.53, 1.UT.55, 1.UT.72, 1.UT.80, 1.UT.84, 1.UU.53, 1.UU.55, 1.UU.72, 1.UU.80, 1.UU.84, 1.UV.72, 1.UV.80, 1.UY.52, 1.UY.55, 1.UY.56, 1.UY.57, 1.UY.59, 1.UY.72, 1.UY.80, 1.UY.87
Orthopedic: **Nerve**	1.BP.72, 1.BP.80, 1.BP.87, 1.BQ.72, 1.BQ.80, 1.BQ.87
Orthopedic: **Hip arthroscopy (extraction/ procurement/release/partial excision)**	1.VA.58.DA, 1.VA.72.DA, 1.VA.87.DA, 1.VA.87.GB
Orthopedic: **Knee arthroscopy (drainage/ extraction/procurement/release/ partial excision)**	1.VG.52.DA, 1.VG.58.DA, 1.VG.72.DA, 1.VG.87.DA, 1.VG.87.GB
Orthopedic: **Knee meniscus (endoscopic repair/partial or total excision)**	1.VK.80.DA^ ^, 1.VK.87.DA, 1.VK.89.DA
Orthopedic: **Knee ligament (ACL) (endoscopic repair/partial excision)**	1.VL.80.DA, 1.VL.80.FY, 1.VL.87.DA, 1.VL.87.GB
Orthopedic: **Knee ankle/foot arthroscopy (extraction/procurement/release)**	1.WA.58.DA, 1.WA.72.DA
Orthopedic: **Excision partial, intervertebral disc**	1.SE.87
Urologic: **Bladder neck suspension**	1.PL.74
Urologic: **Transurethral partial excision**	1.PL.87
Urologic: **Bladder drainage**	1.PM.52, 1.PM.54
Urologic: **Destruction, bladder**	1.PM.59
Urologic: **Prostate resection (TURP)**	1.QT.87

Specific procedure	CCI codes
Urologic: **Urethra**	1.PQ.26, 1.PQ.35, 1.PQ.50, 1.PQ.52, 1.PQ.53, 1.PQ.54, 1.PQ.55, 1.PQ.57, 1.PQ.58, 1.PQ.59, 1.PQ.72, 1.PQ.77, 1.PQ.78, 1.PQ.80
Gynecologic: **Hysteroscopy (endometrial ablation)**	1.RM.59.BA
Gynecologic: **Laparoscopy (oophorectomy, cystectomy)**	1.RB.52.BA, 1.RB.52.DA, 1.RB.56.DA, 1.RB.74.DA, 1.RB.87.DA, 1.RB.89.DA, 1.RD.52.BA, 1.RD.89.DA
Hernia repair (repair muscles of chest and abdomen)	1.SY.80
Inguinal lymph nodes	1.MJ.52, 1.MJ.87, 1.MJ.89
Peripheral lymph nodes	1.MK.52, 1.MK.87, 1.MK.89
Breast (removal of device/fixation/size reduction/size increase/repair/partial or total excision)	1.YM.55, 1.YM.74, 1.YM.78, 1.YM.79, 1.YM.80, 1.YM.87, 1.YM.89
Laparoscopic cholecystectomy	1.OD.57

Notes
ACL: Anterior cruciate ligament.
TURP: Transurethral resection of the prostate.

Appendix H: CCI and billing codes identifying cardiac testing

Source	ECG	Echocardiogram	Stress test	Chest X-ray
DAD/NACRS (CCI)	2.HZ.24^ ^	3.IP.30^ ^	2.HZ.08^ ^	3.IK.10^ ^, 3.IM.10^ ^, 3.IN.10^ ^, 3.IP.10^ ^, 3.IS.10^ ^
PLPB — Sask.	D030, D031, D032	A320, A321, A322, A323, A324, A520, A521, A522, A523, A530, A531, A532, A533, A534, A556, A557, W020	D62, D63, D64, D65, D66, D67	X150, X158, X159
PLPB — Alta.	03.52A, 03.52B	X306, X307	X170, X171, X172, X173, 03.41A, 03.41B, 03.41C, 03.41D, 03.44A	X 20, X 20A, X 20B, X 21*

Note
* Spaces in these codes are intentional.

Reference

1. Kirkham KR, Wijeysundera DN, Pendrith C, Ng R, Tu JV, Laupacis A, et al. Preoperative testing before low-risk surgical procedures. *Canadian Medical Association Journal*. 2015.

Don’t do imaging for minor head trauma unless red flags are present

Operationalizing the recommendation

There are 2 CWC recommendations on the use of diagnostic imaging for minor head trauma:

- Don’t do imaging for minor head trauma unless red flags are present (radiology).
- Don’t order CT head scans in adults and children who have suffered minor head injuries unless positive for a validated head injury clinical decision rule (emergency medicine).

Although the 2 recommendations were put forth by different disciplines (radiology and emergency medicine), they are similar to each other. The report addresses the first recommendation and focuses on an adult population. Assessing and treating children with head trauma is different[1, 2] from adult assessment and treatment.

Minor head trauma

Existing literature uses different terminologies, often interchangeably, when talking about head trauma.[3, 4] As well, studies use different ICD codes to identify head trauma. The codes used for head trauma in this analysis were adopted from a study by the Toronto Rehabilitation Institute[4] (see Appendix I), which is based on 15 studies from the World Health Organization, the United States, Canada, Australia, New Zealand and several European countries.

A head scan for head trauma is necessary in some cases; these should be removed from the analysis of potentially unnecessary scans (see Appendix J). In addition, as there is no clear definition of *minor* head trauma using administrative data, 3 further types of screens were put in place:

1. Exclude patients with a major trauma or with a comorbidity that would indicate a head scan:
   - Had a triage score indicating they were resuscitated (Canadian Triage and Acuity Scale Level 1)
   - Had a Glasgow Coma Scale (GCS) score less than 13, indicating moderate to severe brain injury
   - Were admitted to inpatient care or transferred to another facility
2. Exclude cases with signs of severe trauma during any emergency department visit or hospital admission in the 12 months before the index visit. Previous emergency department visits/hospital admissions should have a diagnosis of injury due to external causes (S00–T98) or external causes of injury (V01–Y98). In addition, the visit should meet at least one of the criteria in screen 1.
3. To aid in interpretation, the sample was restricted to concussive head injury by excluding patients with non-concussive head injuries and injuries due to penetrative forces. Note that this exclusion was not used when a fall was involved. This list is based on previous work associated with the World Health Organization's Collaborating Centre for Neurotrauma Task Force on Mild Traumatic Brain Injury.[5] The ICD-10-CA codes (see Appendix K) were compiled by CIHI's classification experts.

Head scans

Brain and cranial X-rays, CT scans and MRI scans administered in the emergency department were included (see Appendix L for CCI codes).

Methodology

Analysis was restricted to adults (age 18 to 64) who had an unplanned visit to the emergency department for a minor head injury between April 1, 2015, and March 31, 2016, in Ontario and Alberta. Only scans in the same admission were included.

Modelling

To help predict drivers of CT scans for minor head trauma, odds ratios were calculated for the following variables:

- Age (18–24; 25–34; 35–44; 45–54; 55–64)
- Sex
- Neighbourhood income quintile derived from patient postal code per the Postal Code Conversion File developed by Statistics Canada
- Urban and rural status as assigned by the Postal Code Conversion File developed by Statistics Canada
- Trauma volume at emergency department (quintile of trauma discharges from the emergency department for patients age 18 to 64)

Data sources

- DAD, 2014–2015 to 2015–2016
- NACRS, 2014–2015 to 2015–2016

Calculation

$$\text{Rate of head scans for minor trauma} = \frac{\text{Head scans for minor head injury}}{\text{Admissions in emergency department with minor head injury}}$$

Exclusions

- Patients younger than age 18 and patients age 65 and older

Limitations

There is no consensus on how to clearly distinguish minor from major head trauma in administrative databases, which will limit comparability with other studies. Several clinical guidelines use the GCS[xi] as one of the indications to distinguish minor from major head trauma.[1, 2] GCS score is mandatory in the DAD only when a patient suffers from intracranial injury (approximately 45% of reported minor head trauma cases); however, a GCS score is not always provided.

xi. The Glasgow Coma Scale is a validated tool to assess the level of consciousness in a person and an important element for evaluating the severity of head trauma.

Administrative data also does not capture the clinician's decision process and may not capture a patient's full clinical history. While efforts were made to identify and exclude patients with any indication for receiving a head scan, it is possible that some patients required a scan from a clinical perspective and that this was not reflected in the data.

Appendix I: ICD-10-CA codes to identify head injury

Definition	ICD-10-CA codes
Postconcussional syndrome	F07.2
Fracture of vault of skull	S02.0
Fracture of base of skull	S02.1
Fracture of orbital floor	S02.3
Multiple fractures involving skull and facial bone	S02.7
Fractures of other skull and facial bones	S02.8
Fracture of skull and facial bones, part unspecified	S02.9
Intracranial injury	S06
Crushing injury of skull	S07.1
Unspecified injury of head	S09.9
Sequelae of fracture of skull and facial bones	T90.2
Sequelae of intracranial injury	T90.5

Appendix J: Red flags for CT scans

Red flag category	ICD-10-CA/CCI codes
Obvious open skull fracture; suspected open or depressed skull fracture; any sign of basilar skull fracture (e.g., hemotympanum, raccoon eyes, Battle sign, cerebrospinal fluid otorhinorrhea)	G96.0–, S02.0–, S02.1–, S02.7–, S02.901, S06.86
Indicators of severe head trauma	F04, F05, F06.–, F07.–, F09.–, G40.–, G41.–, G45.–, G46.–, I60.–, R11.–, R25.–, R26.–, R27.–, R29.–, R40.–, R41.–, R42.–, R44.–, R55.–, R56.–, S02.3–, S02.8–, S02.9–, S04.0–, S04.1–, S04.2–, S04.4–, S04.6–, S04.7–, S06.1, S06.2–, S06.4, S06.5, S06.6, S07.8, S07.9, S08.–, T02.0–, T04.0, T06.0, T90.2, T90.3, T90.5
Retrograde amnesia to the event lasting 30 minutes or longer after the event	R41.2
Dangerous mechanism (e.g., pedestrian struck by motor vehicle, occupant ejected from motor vehicle, fall from higher than 3 feet or down more than 5 stairs)	V02.–, V03.–, V04.–, V05.–, V09.–, V12.–, V13.–, V14.–, V15.–, V23.–, V24.–, V25.–, W13.–
Bleeding disorders	D65.– to D69.–
Coumadin use	Z92.1
Other diagnostic CT scan indications, such as encephalitis, neoplasms	A81.1, A83.–, A84.–, A85.–, A86, A87.–, C41.0.–, C41.1, C47.0, C49.0, C71.–, C77.–, C78.–, C79.–, D89.1, E22.–, E23.–, E24.–, F44.5, F81.–, F89, G04.–, G05.–, G11.–, G43.–, G44.3, G50.–, G51.–, G52.–, G53.–, G91.–, G93.–, H11.4, H34.0, H34.1, H46, H47.0, H49.0, H49.1, H49.2, H53.2, H81.–, H93.3, I25.0, I25.1.–, I60.– to I69.–, I71.–, I72.–, I77.6, I79.0, R62.9, R28.–, R90.0, Q04.0, Q04.3, Q04.6, Q04.8, Q07.8, Q28.–, Z85.80, Z86.7, Z87.8
Severe interventions such as drainage of meninges and dura mater of brain, management of external appliances related to the respiratory system	1.AA.52.^ ^, 1.EA.74.^ ^, 1.EA.80.^ ^, 1.GZ.30.^ ^, 1.GZ.31.^ ^, 1.GZ.38.^ ^

Note

CT scan indication codes are based on the Canadian CT Head Rule for patients with minor head injury[1] as well as consultation with CWC clinical advisors.

Appendix K: Non-concussive mild and penetrating head injury

Description	ICD-10-CA codes
Sharp objects and penetrating injuries	
Effects of foreign body entering through natural orifice	T15–T19
Contact with sharp glass	W25
Contact with other sharp object(s)	W26.–
Handgun discharge	W32
Rifle, shotgun and larger firearm discharge	W33
Discharge from other and unspecified firearms	W34.–
Exposure to noise	W42
Foreign body entering into or through eye or natural orifice	W44
Foreign body or object entering through skin	W45
Contact with hypodermic needle	W46
Bitten by rat	W53
Bitten or struck by dog	W54
Bitten or struck by other mammals	W55
Contact with marine animal	W56
Bitten or stung by nonvenomous insect and other nonvenomous arthropods	W57
Bitten or struck by crocodile or alligator	W58
Bitten or crushed by other reptiles	W59
Contact with plant thorns and spines and sharp leaves	W60
Intentional self-harm by handgun discharge	X72
Intentional self-harm by rifle, shotgun and larger firearm discharge	X73
Intentional self-harm by other and unspecified firearm discharge	X74
Intentional self-harm by explosive material	X75
Intentional self-harm by sharp object	X78
Assault by handgun discharge	X93
Assault by rifle, shotgun and larger firearm discharge	X94
Assault by other and unspecified firearm discharge	X95
Assault by sharp object	X99
Handgun discharge, undetermined intent	Y22
Rifle, shotgun and larger firearm discharge, undetermined intent	Y23
Other and unspecified firearm discharge, undetermined intent	Y24
Contact with sharp object, undetermined intent	Y28
Legal intervention involving firearm discharge	Y35.0
Legal intervention involving sharp objects	Y35.4
War operations involving firearm discharge and other forms of conventional warfare	Y36.4

Description	ICD-10-CA codes
Extreme temperatures or sunlight	
Burns and corrosions of external body surface, specified by site	T20–T25
Burns and corrosions confined to eye and internal organs	T26–T28
Burns and corrosions of multiple and unspecified body regions	T29–T32
Frostbite	T33–T35
Exposure to electric current, radiation and extreme ambient air temperature and pressure	W85–W99
Exposure to excessive natural heat	X30
Exposure to excessive natural cold	X31
Exposure to sunlight	X32
Intentional self-harm by steam, hot vapours and hot objects	X77
Assault by steam, hot vapours and hot objects	X98
Contact with steam, hot vapours and hot objects, undetermined intent	Y27
War operations involving other explosions and fragments	Y36.2
War operations involving fires, conflagrations and hot substances	Y36.3
War operations involving nuclear weapons (blast effects, exposure to ionizing radiation from nuclear weapon, fireball effects, heat, other direct and secondary effects of nuclear weapons)	Y36.5
Substance toxicity	
Poisoning by drugs, medicaments and biological substances	T36–T50
Toxic effects of substances chiefly nonmedicinal as to source	T51–T65
Other and unspecified effects of external causes	T66–T78
Sequelae of injuries, of poisoning and of other consequences of external causes	T90–T98
Exposure to smoke, fire and flames	X00–X09
Contact with heat and hot substances	X10–X19
Contact with venomous animals and plants	X20–X29
Accidental poisoning by and exposure to noxious substances	X40–X49
Intentional self-poisoning by and exposure to nonopioid analgesics, antipyretics and antirheumatics	X60
Intentional self-poisoning by and exposure to antiepileptic, sedative–hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified	X61
Intentional self-poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified	X62
Intentional self-poisoning by and exposure to other drugs acting on the autonomic nervous system	X63
Intentional self-poisoning by and exposure to other and unspecified drugs, medicaments and biological substances	X64
Intentional self-poisoning by and exposure to alcohol	X65

Description	ICD-10-CA codes
Intentional self-poisoning by and exposure to organic solvents and halogenated hydrocarbons and their vapours	X66
Intentional self-poisoning by and exposure to other gases and vapours	X67
Intentional self-poisoning by and exposure to pesticides	X68
Intentional self-poisoning by and exposure to other and unspecified chemicals and noxious substances	X69
Intentional self-harm by smoke, fire and flames	X76
Assault by drugs, medicaments and biological substances	X85
Assault by corrosive substance	X86
Assault by pesticides	X87
Assault by gases and vapours	X88
Assault by other specified chemicals and noxious substances	X89
Assault by unspecified chemical or noxious substance	X90
Assault by smoke, fire and flames	X97
Neglect and abandonment	Y06
Other maltreatment	Y07
Poisoning by and exposure to drugs of undetermined intent	Y10–Y19
Exposure to smoke, fire and flames, undetermined intent	Y26
Legal intervention involving gas	Y35.2
War operations involving biological weapons	Y36.6
War operations involving chemical weapons and other forms of unconventional warfare (gases, fumes and chemicals, lasers)	Y36.7
Accidental drowning and submersion	W65–W74
Other accidental threats to breathing	W75–W84
Overexertion, travel and privation	X50–X57
Intentional self-harm by hanging, strangulation and suffocation	X70
Intentional self-harm by drowning and submersion	X71
Assault by drowning and submersion	X92
Assault by hanging, strangulation and suffocation	X91
Hanging, strangulation and suffocation, undetermined intent	Y20
Drowning and submersion, undetermined intent	Y21
Due to medical treatment	
Complications of medical and surgical care	Y40–Y84

Appendix L: CCI codes to identify brain and cranial scan

Type of diagnostic imaging scans	CCI codes
X-ray	3.AN.10, 3.AN.12, 3.EA.10, 3.EA.12
CT	3.AN.20, 3.AN.70, 3.EA.18, 3.EA.20, 3.ER.20
MRI	3.AN.40, 3.ER.40

Note
Scans were identified from NACRS within the index visit.

References

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Don’t routinely obtain head CT scans in hospitalized patients with delirium in the absence of risk factors

Operationalizing the recommendation

While head CT scans may be necessary in some patients with delirium, such as those with recent head trauma or new findings of focal neurological deficit, these tests can be of low diagnostic value and are regarded as avoidable in many cases, especially in those caused by extracranial factors. Patients with red flags as defined below were excluded from the analysis. As well, since reporting of CT scans is mandatory only for Ontario inpatients, all analysis was restricted to Ontario.

Inpatients with delirium

Inpatients with delirium were defined as Ontario acute care inpatients (age 18 and older) with delirium as identified using ICD-10-CA codes (see Appendix M for the full list of codes).

CT scans

Head CT scans were identified using CCI codes (see Appendix N for the full list of codes) and included CT scans of the pituitary region, brain, cranium and head (not specified).

Red flags

Indicators of appropriate head CT scans (i.e., red flags or risk factors) were identified by a CWC expert panel and through literature review (see Appendix O) and excluded from further consideration. Patients with a head surgery were also excluded (see Appendix P).

Methodology

Inpatients with delirium were identified in the DAD between 2010–2011 and 2014–2015. Only scans occurring while the patient was in hospital were included; that is, the scan occurred in the same hospital visit where the delirium was documented.

Data source

- DAD, 2010–2011 to 2014–2015

Calculation

$$\text{Rate of head CT scans for delirium} = \frac{\text{Head CT scans among delirium patients}}{\text{Delirium patients in acute care}}$$

Exclusions

- Facilities reporting no CT scans

Limitations

Administrative data does not provide the reason a scan was performed, so it was assumed that head CT scans were done for delirium. Steps were taken to reduce the risk of misclassifying scans as unnecessary by excluding cases where there may have been potential reasons for head CT scans (i.e., where there were red flags).

Administrative data also does not capture the clinician's decision process and may not capture a patient's full clinical history. While efforts were made to identify and exclude patients with any indication for receiving a head CT scan, it is possible that some patients required a scan from a clinical perspective and that this was not reflected in the data.

Appendix M: ICD-10-CA codes used to identify delirium

Description	ICD-10-CA codes
Delirium not superimposed on dementia, so described	F05.0
Delirium superimposed on dementia	F05.1
Other delirium	F05.8
Delirium, unspecified	F05.9
Disorientation, unspecified	R41.0
Alcohol or drug induced delirium	F1–.4

Appendix N: CCI codes used to identify head CT scans

Description	CCI codes
Computerized tomography [CT], pituitary region	3.AF.20. ^ ^
Computerized tomography [CT], brain	3.AN.20. ^ ^
Computerized tomography [CT], cranium	3.EA.20. ^ ^
Computerized tomography [CT], head NEC	3.ER.20. ^ ^

Appendix O: ICD-10-CA codes used to identify red flags or risk factors for head CT scans

Description	ICD-10-CA codes
Malignant neoplasm of brain	C71.–
Mental status change[†]	R41.–, R40.–
Vertigo	H81.–, R42
Intracranial space-occupying lesion	R90.0
Diplopia	H53.2
Disorders of acoustic nerve	H93.3
Optic neuritis	H46
Disorders of optic nerve, not elsewhere classified	H47.0
Third [oculomotor] nerve palsy	H49.0
Fourth [trochlear] nerve palsy	H49.1
Sixth [abducent] nerve palsy	H49.2
Cranial nerve disorders	G50–G53
Symptoms and signs involving the nervous and musculoskeletal system	R25–R29
Hereditary ataxia	G11.–

Description	ICD-10-CA codes
Lack of expected normal physiological development, unspecified	R62.9
Unspecified disorder of psychological development	F89
Specific developmental disorders of scholastic skills	F81.–
Hyperfunction of pituitary gland	E22.–
Hypofunction and other disorders of pituitary gland	E23.–
Cushing's syndrome	E24.–
Subacute sclerosing panencephalitis	A81.1
Mosquito-borne viral encephalitis	A83.–
Tick-borne viral encephalitis	A84.–
Other viral encephalitis, not elsewhere classified	A85.–
Unspecified viral encephalitis	A86
Viral meningitis	A87.–
Encephalitis, myelitis and encephalomyelitis	G04.–
Encephalitis, myelitis and encephalomyelitis in diseases classified elsewhere	G05.–*
Atherosclerotic cardiovascular disease, so described	I25.0
Atherosclerotic heart disease	I25.1–
Cryoglobulinemia (includes vasculitis type)	D89.1
Arteritis, unspecified (Vasculitis, NOS)	I77.6
Other conjunctival vascular disorders and cysts (includes aneurysm)	H11.4
Aortic aneurysm and dissection	I71.–
Other aneurysm and dissection	I72.–
Aneurysm of aorta in diseases classified elsewhere	I79.0*
Other congenital malformations of circulatory system (includes congenital aneurysms)	Q28.–
Congenital malformations of corpus callosum	Q04.0
Other reduction deformities of brain	Q04.3
Congenital cerebral cysts	Q04.6
Other specified congenital malformations of brain	Q04.8
Other specified congenital malformations of nervous system	Q07.8
Personal history of other diseases and conditions	Z87.8
Personal history of diseases of the circulatory system	Z86.7
Sequelae of injuries of head	T90.–, T91.–
Head Injuries, head trauma	S00–S09
History of brain cancer	Z85.80
Stroke/TIA	G45 (except G45.4), H34.0, H34.1, I60–I69
Seizures	G40.–, G41.–, R56.–, F44.5

Description	ICD-10-CA codes
Other cancer (metastasis)	C77.–, C78.–, C79.–
Malignant neoplasm bones of skull and face	C41.0
Malignant neoplasm of mandible	C41.1
Malignant neoplasm of peripheral nerves of head, face and neck	C47.0
Malignant neoplasm of connective and soft tissue of head, face and neck	C49.0
Migraine, headache	G43.–, G44.3
Hydrocephalus	G91.–
Other disorders of brain	G93.–

Notes

† In the absence of other indications, we assume a head CT scan is indicated for patients with mental status change when

- R41 is accompanied by R40 or by R40 and one of the following delirium codes: F05.9, F05.8, F05.1 or F05.0; and/or
- R40 is accompanied by one of the following delirium codes: F05.9, F05.8, F05.1 or F05.0.

Please see the *Canadian Coding Standards for ICD-10-CA and CCI* for information on the dagger/asterisk convention used in some ICD-10-CA codes.

Appendix P: CCI codes used to identify head surgery/intervention exclusions

Description	CCI codes
Therapeutic Interventions on Brain and Spinal Cord	1.A^.^^.^^ (except 1.AW.^^.^^ and 1.AX.^^.^^)
Therapeutic Interventions on Nerves	1.B^.^^.^^
Therapeutic Interventions on the Eye and Ocular Adnexa	1.C^.^^.^^
Therapeutic Interventions on the Ear and Mastoid (Process)	1.D^.^^.^^
Therapeutic Interventions on Musculoskeletal Tissue of Head, Nasal Cavity and Sinuses	1.E^.^^.^^
Therapeutic Interventions on the Oral Cavity and Pharynx	1.F^.^^.^^
Therapeutic Interventions on the Carotid Artery	1.JE.^^.^^
Therapeutic Interventions on the Intracranial Vessels	1.JW.^^.^^

Don’t transfuse red blood cells for arbitrary hemoglobin or hematocrit thresholds in the absence of symptoms

Operationalizing the recommendation

The unnecessary use of red blood cell transfusions (RBCTs) appears on 2 CWC lists (the Canadian Society of Internal Medicine and the Canadian Society of Palliative Care Physicians). There is no single laboratory measurement or physiologic parameter that can predict the need for transfusion; it depends on clinical assessment and the etiology of the condition. To provide useful information on RBCTs in the context of this uncertainty, a subgroup of patients with a homogeneous clinical pathway — elective hip and knee replacement surgery patients — was selected. This group was identified through consultations with CWC.

Blood transfusions

RBCTs were identified in acute in-hospital patients across Canada using either CCI codes (in Quebec) or a blood transfusion indicator (in all other provinces) (see Appendix Q). Note that this analysis includes only non-autologous transfusions (i.e., from a donor). Autologous (own blood) transfusions are almost risk-free, while receiving donor blood has the potential for adverse reactions.

Elective hip and knee replacement surgery patients

Hip and knee replacement surgeries were identified using the CCI codes 1.VG.53.^^ (total knee replacement) and 1.VA.53.^^ (total hip replacement). Only elective admissions (i.e., admitted for a scheduled treatment) were included.

Methodology

Adult patients (age 18 and older) in acute care facilities in Canada with an elective hip or knee replacement surgery were selected for inclusion. Only RBCTs performed in the same hospitalization were included in the rate calculation.

Risk adjustments

As the administrative data has limited contextual information from patients' charts, we could not confidently define indications that would indicate a potentially unnecessary RBCT in this population. Instead, an extra step was taken to adjust for factors that may put patients at different risk for blood transfusion during their hip or knee replacement. Rates were risk adjusted for the following variables:

- Age (18–59; 60–74; 75+)
- Sex
- Severity index (see Appendix R)
- Total length of stay (less than 72 hours; 72–119 hours; 120+ hours)
- Anesthetic technique (spinal; all other techniques)
- Fixation type (CCI codes: cement = "^.^^.^^.LA-SL-N"; all other types)
- Bilateral or unilateral procedure
- Primary procedure or revision

Data sources

- DAD, 2006–2007 to 2013–2014
- HMDB, 2006–2007 to 2013–2014

Calculation

Rates were risk adjusted for all patients with an RBCT and an elective hip or knee replacement.

$$\text{Risk-adjusted rate of RBCT} = \left(\frac{\text{Number of observed patients}}{\text{Number of expected patients}} \right) \times \text{Overall rate}$$

Observed patients = the number of observed events (or numerator cases, patients with an RBCT and an elective hip or knee replacement).

Expected patients = the number of expected events, adjusted for the distribution of risk factors in the provinces. Coefficients derived from regression models used data from each fiscal year to obtain the expected number of cases.

Overall average rate (crude rate) = total number of numerator cases divided by total number of denominator cases.

Exclusions

- Patients younger than 18
- Autologous blood transfusions (CCI code 1.LZ.19.HH-U1-A or 1.LZ.19.HH-U9-A)
- Facilities in British Columbia (where blood transfusion is not mandatory to report)
- Replacements related to post-admit hip and knee fractures identified using ICD-10-CA codes (hip: S72.0, S72.1, S72.2; knee: S82.0, S82.1, S82.2) and CIHI diagnosis type (2) (indicating the event occurred post-admission).

Limitations

Administrative data does not capture the clinician's decision process and may not capture a patient's full clinical history. While efforts were made to identify and exclude patients with any indication for receiving an RBCT, it is possible that some patients required a transfusion from a clinical perspective and that this was not reflected in the data.

Blood test data on hematocrit and hemoglobin levels or red blood cell counts for patients was not available for this study. Data for other factors that could be relevant to the use of RBCT, such as a patient's height and weight, was also not available for the study.

Appendix Q: Identification of RBCTs

Criteria	Definition
Blood transfusion indicator	In DAD: Indicates whether the patient received a blood transfusion using blood products or components distributed by the reporting facility's blood bank during the episode of care
CCI code present*	1.LZ.19.HH-U1-A, 1.LZ.19.HH-U1-J, 1.LZ.19.HM-U1, 1.LZ.19.HH-U9-A, 1.LZ.19.HH-U9-J, 1.LZ.19.HM-U9

Note

* CCI codes were used to capture transfusions in Quebec only, as this province does not submit a blood transfusion indicator. Transfusions are mandatory to code for Quebec inpatients.

Appendix R: Severity index for indication

Condition	Weighting
Anemia	3
Hemorrhage	2
Heart failure and pulmonary edema	1
Ischemic heart diseases	1
Cerebrovascular diseases	1
Renal failure	1
Cancer	1
Trauma	1

The total value of the severity index equals a sum of the weights on each abstract.

Values of the severity index are broken down into 3 groups:

- 0: Non-severe
- 1 and 2: Moderately severe
- 3+: Very severe

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