Canada's Drug and
Health Technology Agency

Report of the Drug Safety and Effectiveness Data Access Sub-Working Group

January 6, 2023

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Canadian Agency for Drugs and Technologies in Health (CADTH)

Canadian Institutes of Health Research (CIHR)

Canada's Drug and Health Technology Agency

L'Agence des médicaments et des technologies de la santé au Canada

Canadian Institutes of Health Research

Instituts de recherche en santé du Canada

Representatives from the following organizations collaborated on this project:

Canadian Agency for Drugs and Technologies in Health (CADTH)

Canadian Institutes of Health Research (CIHR)

Canadian Institute for Health Information (CIHI)

Health Data Research Network Canada (HDRN Canada)

Health Canada (HC)

British Columbia Ministry of Health.

Introduction

Ensuring that the health care system is delivering good quality of care and that drugs are both safe and effective depends on having timely access to fit for purpose data. In recent years, the volume and variety of health-related data have increased exponentially, and data is being systematically collected at more time points during the patient's pathway of care.[1]

Based on one of the recommendations from the National Pharmaceutical Strategy (2006), the Drug Safety and Effectiveness Network (DSEN) was created in 2009 as a partnership between the CIHR and Health Canada, with a mandate to increase the body of evidence available to regulators, policy makers, health care providers, and patients on the safety and effectiveness of pharmaceuticals. Its secondary objective was to increase Canada's capacity to undertake high quality post-market research in the Drug Safety and Effectiveness (DSE) landscape. Four DSEN teams were funded by CIHR and included Canadian Network for Observational Drug Effect Studies (CNODES), Surveillance and Evaluation of Adverse reactions in Canadian Healthcare & the Pharmaco-genomics of Adverse Events National Team (SEARCH & PREVENT), Canadian Network for Advanced Interdisciplinary Methods for Comparative Effectiveness Research (CAN-AIM), and Methods and Applications Group for Indirect Comparisons (MAGIC). A training initiative, The Drug Safety and Effectiveness Cross-Disciplinary Training (DSECT), was also established and funded by CIHR, and aimed to provide training and development for future scientists regarding drug safety and effectiveness research.

An evaluation of DSEN in 2019 indicated that DSEN's ability to respond to the needs of decision-makers has been affected by the unavailability of data and/or delays for data access. In response to a recommendation in the evaluation of the DSEN program in 2020, the DSEN Executive Working Group formed a subgroup that focused on data availability and access, entitled the Data Access Sub-Working Group (DA-SWG). The DA-SWG met on a weekly basis from December 2020 to May 2022.

Mandate of the Data Access Sub-Working Group (DA-SWG)

The mandate of the working group was to support the implementation of the 2019 DSEN Evaluation Management Response and Action Plan by developing a better understanding the DSE data landscape and proposing an approach as well as recommendations to improve availability of, and timely access to, health system data for drug safety and effectiveness evaluations.

Objectives of the Data Access Sub-Working Group

The objectives of the DA-SWG were to:

- identify and document key data sources utilized for the evaluation of drug safety and effectiveness queries.
- identify key gaps in data required for the evaluation of drug safety and effectiveness queries.
- identify barriers to academic researchers accessing data.
- identify international best practices for achieving timely access to health data.
- identify and describe examples of initiatives to enhance the health data eco-system in Canada.
- highlight the work of a case study (e.g., COVID-19 initiatives) relating to data access.

Composition of the DA-SWG

The DA-SWG was chaired by Nicole Mittmann (CADTH) and Jennifer Campbell (CIHR). The secretariat function was held at CIHR. Working group members included representatives from the following organizations:

- CADTH
- CIHR
- CIHI
- Health Canada
- British Columbia Ministry of Health
- HDRN Canada.

Methods

Four complementary approaches were used to achieve the DA-SWG objectives.

In the first approach, CIHR invited DSEN research teams to complete a questionnaire about the data they each used to respond to DSEN queries. The survey asked about 3 main questions:

- What information and data have you accessed for DSEN-related queries?
- What data or information are not currently accessible, that, if access were improved, would facilitate research in drug safety and effectiveness?
- Considering the existing health system information for drug safety and effectiveness, what are the main gaps that exist?

In a second approach, the DA-SWG invited key Canadian data users, data holders and data access facilitators to present on data access barriers and limitations as well as successes and opportunities. The following organizations/entities participated:

- Statistics Canada
- CIHI
- HDRN Canada
- Pan Canadian Health Data Strategy
- CNODES
- CAN-AIM
- Canadian Mother-Child Cohort (CAMCCO)
- Institute of Clinical Evaluation Sciences, Ontario
- Institut National d'Excellence en Santé et Services Sociaux INESSS, Quebec (past scientific coordinator of the Cardiovascular Evaluation Unit at INESSS participated)
- Université Laval
- Canada Health Infoway; PrescribeIT
- CanREValue

A third approach included meeting with 2 patient representatives who had experience representing the patient perspective in projects that used data to evaluate drug safety and effectiveness.

The final approach was to present examples of best practices in other countries to the DA-SWG.

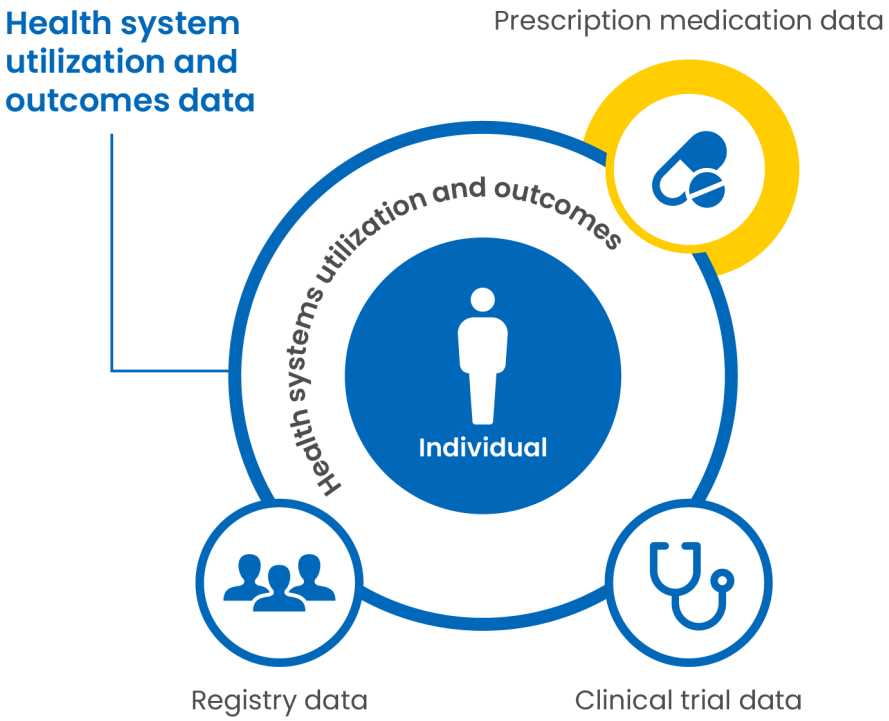
Results

Objectives 1 and 2

- Identify and document key data sources utilized for the evaluation of drug safety and effectiveness queries
- Identify key gaps in data required for the evaluation of drug safety and effectiveness queries

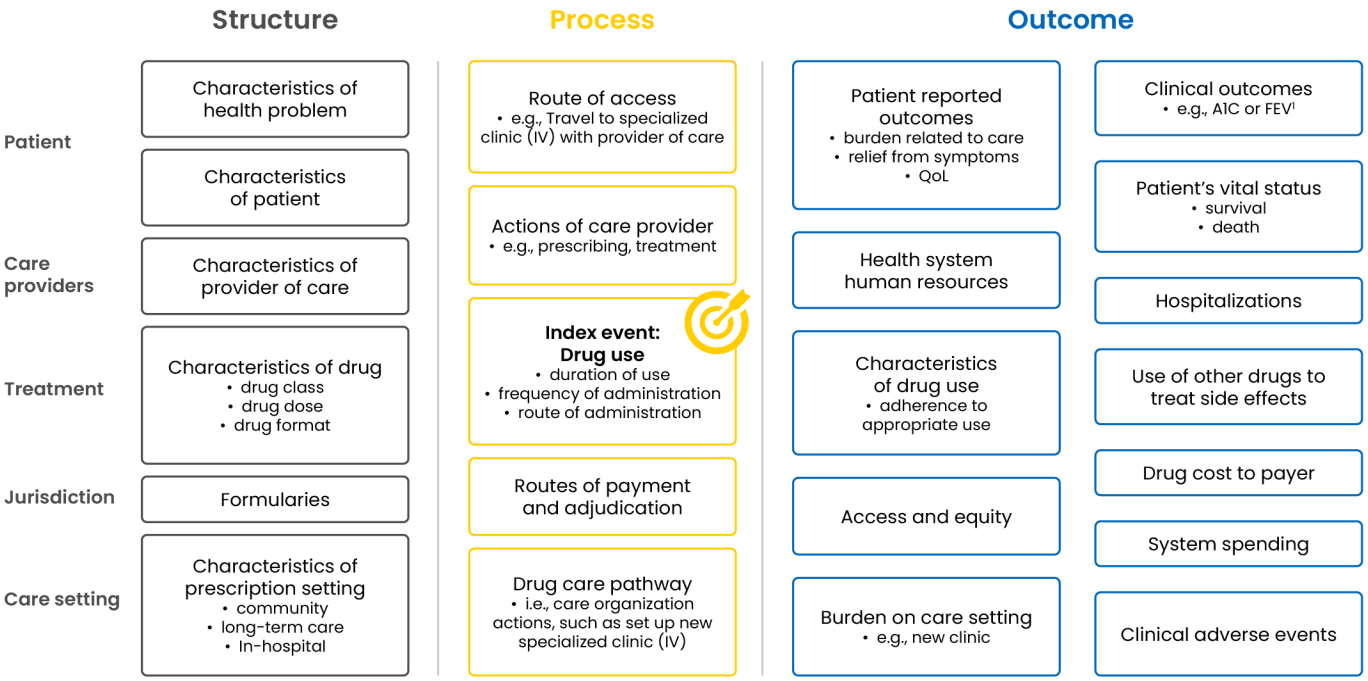
Surveys, presentations, consultations and discussions consistently highlighted that a number of data sources need to be considered in order to evaluate the safety and effectiveness of drugs in the context of the Canadian health system (Figure 1). The data sources identified spanned many types of information from industry data to clinical trials, patient registries, administrative datasets (such as prescriptions and drug claims), and patient survey data. While there is some overlap between these data sources, overall, they are complementary in facilitating the evaluation of the safety and effectiveness of drugs.

Figure 1: Drug Safety and Effectiveness Data in Context



Outcomes related to a specific drug may depend on many components of the health system, including the patient, the care provider, how the treatment was administered and in what care setting. The DA-SWG established that Canada has a rich diversity in each of these components at both the pan-Canadian and provincial/territorial level and thus has an opportunity to generate important information to support decision-making about the optimal use of drugs (Figure 2).

Figure 2: Examples of Measurable Components to Consider for Evaluation of Drug Safety and Effectiveness



Variables important for evaluating drug safety and effectiveness questions are already held in many existing administrative databases within Canada and center around the ability to identify drug utilization. Health Data Research Network Canada (HDRN Canada [external link]) has developed a comprehensive database inventory by dataset and region. Funded through CIHR's Strategy for Patient-Oriented Research (SPOR), HDRN Canada's Data Access Support Hub (DASH) [external link] is a one-stop portal that facilitates access to 500+ administrative databases, and other data sources, across Canada.

Table 1 provides a map of key types of data maintained by the provinces and territories, and at the pan-Canadian level by CIHI or Statistics Canada. Findings highlight that except for information about acute care hospitalizations, ambulatory or ED, births and deaths, most data for the evaluation of DSE is available only at the provincial/territorial level. Thus, collaboration across provinces and territories is necessary to create pan-Canadian insights.

Table 1: Data Available From CIHI, Statistics Canada and Other HDRN Canada Data Centres as of Spring 2022

Information source	HDRN Canada Data Centre holdings by province/territory												
	CIHI	SC	B.C.	AB	SK	MB	ON	QC	NB	NS	PEI	NL	NT
Health insurance registries	0	0	C	C	C	C	C	C	C	C	0	C	0
Hospitalization data	C	C	C	C	C	C	C	C	C	C	C	C	0
Health care clinic data	P	C	0	C	C	C	C	C	C	C	C	C	0
Emergency room data	C	C	C	C	C	C	C	P	P	C	0	C	0
Physician claims data	P	0	C	C	C	C	C	C	C	C	0	C	0
Prescription medication data	P	0	C	C	C	C	P	P	C	C	0	C	0
In-hospital drugs	0	0	0	0	0	C	0	0	0	0	0	0	0
Home care services data	P	0	C	C	C	C	C	0	plan	0	0	plan	0
Continuing or chronic care services data	P	0	C	C	C	C	C	C	C	0	0	C	0
Vital statistics data (like birth and death)	0	C	C	C	C	C	C	C	C	C	0	C	0
EMR data	P	0	plan	P	0	P	P	P	P	P	0	P	P
Laboratory test results	0	0	P	C	P	P	P	P	P	plan	0	C	0
COVID-19 Test Results data	0	0	C	C	0	C	C	0	0	0	0	C	0
COVID-19 vaccination data	0	0	0	0	0	C	C	0	0	0	0	0	0
Imaging data	0	0	P	C	0	0	0	0	plan	plan	0	0	0
Patient-reported data	P	C	P	P	0	plan	0	0	0	0	0	0	0
Data from genetic tests	0	0	0	0	0	0	0	0	0	0	0	plan	0
Health workforce	P	0	0	0	0	0	P	0	0	0	0	0	0

0 = no data; C = complete capture, data for the whole population (or close to it; > 95%); EMR = electronic medical record; P = partial capture, data for some of the population; plan = linkage and integration planned but not yet implemented.

CIHI holds comparable information across the health system, with coverage varying across provinces and territories. Appendix 1 shows the comprehensiveness of CIHI's data holdings by province and territory as of March 31, 2022.

In order to have successful drug safety and effectiveness evaluations, drug utilization information is critical. While not comprehensive, there is at least some information available in some places for in-hospital drug use; a fully pan-Canadian drug utilization database (prescription claims for dispensed medication); private-payer drug data; out-of-pocket drug utilization; and prescriptions.

- Hospital drug utilization – Some information on drug treatment administered in hospital is available through Canadian Classification of Health Interventions (CCI) coding in CIHI's Discharge Abstract Database (DAD). The drug treatment data does not have the same granularity compared to the drug claims data (e.g., drug class level instead of the specific drug product), and only specific drug-related CCI codes (including antineoplastics, immunomodulatory drugs and thrombolytics) are mandatory for submission.

- At a pan-Canadian level, the National Prescription Drug Utilization Information System (NPDUIS) is a centralized database containing significant information, but it is not yet comprehensive at the pan-Canadian level. Currently it includes:
  - linkable drug claims data from most provinces and territories (PTs) submitted by a number of public drug programs for payment or that were processed for documentation under a drug information system
  - private drug claims data from several jurisdictions as included in a drug information system
  - formulary data about which drugs are included for public reimbursement by each province and the Indigenous Services Canada federal drug program
  - drug product information which identifies drug products in a standardized format.
  - drug plan information concerning administrative policies of up to 29 public drug plans per province/territory
  - because these data are held within CIHI, these data are linkable to a wide variety of health administrative data holdings (e.g., hospital data, LTC data, primary care, health spending) per appropriate privacy protocols.
- In addition to the private drug data held in NPDUIS, private drug utilization information is also available through private companies, insurers and benefit providers (e.g., Manulife, Telus, IQIVIA). There is no one comprehensive data source for all organizations, but individual companies could be a source although would require significant funding to access.
- Out-of-pocket paid drug utilization data is not available across the country with the exception of B.C., which provides data on drugs dispensed, with private and out-of-pocket payment data available (albeit not differentiated by payer).
- Information on prescribed drugs within the community is held in EMRs as well as pharmacy management systems. Where adopted, Canada Health Infoway's PrescribeIT initiative facilitates e-transfer of prescribed drug information between prescribers and pharmacists.

Appendix 2 provides more detailed information about potential data sources in Canada for the various components of the trajectory of care identified in Figure 2.

DSEN researchers reported additional data gaps beyond those identified above, data that are challenging to access, and data that are distributed across multiple sources.

Data that are challenging to access included:

- laboratory data
- adverse drug reaction data
- data on patients with rare diseases
- data on vaccination records
- other data are available but require integration across multiple sources:
- data on pregnant women and pediatric outcomes
- administrative data for residents aged <18 years
- data on patient characteristics related to race/ethnicity, gender and psychosocial determinants of health.

Objective 3: Identify barriers to researchers accessing data

There are a number of challenges associated with accessing data in Canada. Identified challenges to accessing data in the Canadian context include:

- There is a wide range in the costs reported by DSEN researchers to obtain data from different data sources, with high costs being a barrier in some cases.
- A lack of awareness of existing data sources.
- There are varying interpretations the term "identifiable information" in laws and ethical guidelines from different jurisdictions.
- Some governance around data privacy differs across provinces, territories.
- For research purposes, accessing and linking multiple data sources requires multiple ethics approval requirements and processes, and the timeframes for ethics approvals vary widely among organizations and jurisdictions in Canada, ranging from months to years.
- Ethics approval processes operate separately from the review by data custodians for data access, thereby increasing the complexity of obtaining data access with the increasing number of data sources required.
- A lack of data standards and/or harmonization across different data holdings.
- There are additional bureaucratic and administrative hurdles to access data from different provinces, which affects the timeliness of being able to provide evidence to inform decisions.
- In many cases, researchers are required to destroy or return data that has been linked after study completion, which increases start-up costs for each new project. This is often due to legislation, which requires that linked data be used for time-limited and question-specific purposes.
- Some competing priorities for funding affect the capacity for data holders to provide researchers with requested data, even when the data are available.

A recurring theme of discussion was a lack of alignment of incentives and standards amongst the wide variety of data holders to facilitate data access across jurisdictions or provinces and territories, with many indicating a preference for centralizing health data at a pan-Canadian level. As a result, the level of interoperability between the many Canadian data sources is low and the value of existing information in assessing the safety and effectiveness of drugs being used to treat Canadians is not being fully realized. Throughout this report, examples of the multi-faceted approach to data access needed to address these challenges are described.

Objective 4: Identify international best practice for achieving timely access to health data

To identify keys to providing timely access to health data required for evaluation of drug safety and effectiveness, examples of successful initiatives related to national-level health data systems were identified and presented to the DA-SWG. Success was defined as being able to provide timely data access, to link different data from different sources, to have harmonized data definitions and to protect privacy and confidentiality.

Population Health Research Network (PHRN), Australia

The Australian Government's National Collaborative Research Infrastructure Strategy funds the collection of health data from each of the 6 Australian states and 3 territories that is shared and linked through a National Linkage Unit with remote access available.

Health and Welfare Data Centre (HWDC), Taiwan

Taiwan has a National Health Insurance and Research Database with a centralized repository of claims data that can be linked to 70 other health-related databases.

OFEK Health Information Network, Israel

The OFEK Health Information Network represents data from approximately 5 million people at 16 hospitals (8,100 beds) and 1,300 clinics with over 9,000 having access to the data.

View-only patient records are available in real-time.

The development of this information network was initiated due to lack of data interoperability between 25 different health organizations and facilities with the goal being a robust, user-friendly system providing access to a completely integrated medical record at point of care, in real-time, with strict security and privacy.

Japan Medical Data Center, Japan (JMDC)

The JMDC Claims Database contains both payer- and hospital-based inpatient, outpatient, dispensing drug data and clinical data received from multiple health insurance associations.

The database is used by major pharmaceutical and medical device manufacturers, insurance companies, governmental offices, and more than 50 universities.

More than 400 medical institutions are contracted to provide data.

Data Analysis and Real-World Interrogation Network (DARWIN), Europe

The European Medicines Agency (EMA) has established a coordination centre to provide data concerning the use, safety and effectiveness of medicines for human use, including vaccines from databases across the European Union.

DARWIN provides information about disease, populations and drugs that can be accessed by the EMA, regulatory authorities of European Union member states and European medicines regulatory networks as needed throughout the lifecycle of a medicinal product.

DARWIN is not a database, but rather a data network with the following characteristics:

- federated data access with the data housed locally
- data exchanged within the network is anonymous
- queries can be made remotely
- common data model for harmonization and accelerated analysis.

While these examples do not reflect a systematic review, they helped the DA- SWG to derive some key elements for success:

- pan-Canadian-level engagement, leadership, governance and funding
- pan-Canadian-level and modern technological and data infrastructure providing safe and secure access
- perspective of data as a requirement for regulatory and health technology assessment purposes rather than for research
- streamlined and harmonized approval process for data access
- streamlined and uniform privacy and ethics approval processes
- uniform process for centralized and remote access for approved users
- standardized terminologies, definitions, formats and operating procedures
- linkage of data from different sources at the provincial or territorial level through an individual health identifier.

These learnings led to continued discussions about what different organizations can do or are already doing to try and adopt infrastructure or processes shown to be associated with success. In the following section we provide some examples of what different Canadian organizations are already doing to address identified challenges and adopt best practices being developed around the world.

Objective 5: Identify and describe examples of initiatives to enhance the health data eco-system in Canada

Data Access in Canada is Changing: Examples of Canadian Initiatives.

CNODES Common Data Model

In response to the challenges experienced in relation to working with multiple research sites across Canada that use different database structures to answer queries from decision-makers, CNODES leveraged the tools and experience of the FDA Sentinel Initiative to create and test a common data model. This standardized data structure allows data centres to execute distributed computer programs against their local data to generate common output tables, which can then be pooled to give aggregate, multi-centre results. The common data model can provide rapid analyses of prescription medication use, patient characteristics, apparent indications for drug therapy, clinical outcomes and health service use following drug treatment.[2,3]

DSEN Transition to Health Technology Assessment (HTA) Host

In response to the evaluation of the DSEN program, Health Canada and CIHR have transitioned DSEN from CIHR to CADTH [external link] to leverage CADTH's established role in the management of pharmaceuticals throughout the drug lifecycle, its ongoing work with federal/provincial/territorial decision-makers and its ability to support the evaluation of drug safety and effectiveness analytics through contracts as well as grants. However, it is important to note that capacity building for drug safety and effectiveness was not included in this transition; the responsibility still rests with CIHR.

Making Results of Health Research More Findable and Accessible to Health System Stakeholders

Part of CIHR's Strategic Plan 2021-31 [external link] focuses on making the results of Canadian health research more findable and accessible. CIHR is committed to ensuring that health research and health-related data in Canada are effectively accessed, analyzed, linked, integrated, used, reused, stored and preserved to advance knowledge, expand research opportunities, and improve health services, products and outcomes. CIHR is actively involved in integrating data-related considerations into initiatives, strategies, policies, funding opportunities and other activities (refer to Health Research Data [external link]).

Research data collected through the use of public funds should be responsibly and securely managed and be, where ethical, legal and commercial obligations allow, available for reuse by others. Launched in 2021, the Tri-Agency Research Data Management (RDM) Policy [external link] supports Canadian research excellence by promoting sound RDM and data stewardship practices. For primary data collection, the policy encourages grant holders to provide appropriate access to data where allowed by ethical, cultural, legal and commercial requirements, and in accordance with the FAIR principles (Findable, Accessible, Interoperable, and Reusable) and the standards of the grantee's discipline.

In line with the concept of Indigenous self-determination and in an effort to support Indigenous communities to conduct research and partner with the broader research community, CIHR recognizes that data related to research by and with the First Nations, Métis, or Inuit whose traditional and ancestral territories are in Canada must be managed in accordance with data management principles developed and approved by these communities, and on the basis of free, prior and informed consent. recognize that a distinctions-based approach is needed to ensure that the unique rights, interests and circumstances of the First Nations, Métis and Inuit are acknowledged, affirmed, and implemented.

Through Canada's SPOR, CIHR funded HDRN Canada's development of a SPOR Canadian Data Platform to connect provincial and territorial SPOR SUPPORT Unit data platforms and provincial and national data centres, which act as stewards of the data held within their jurisdiction. Together, this network facilitates multi-region research.

Complementary Roles in Health Data Standards

CIHI, Statistics Canada, and Canada Health Infoway have complementary roles with respect to data standards. Statistics Canada focuses on standards for population health, sociodemographic information and for population-based surveys, including a recent survey on access to pharmaceuticals during the pandemic.[4] CIHI sets data content standards for health system use, including for collection of public and private drug claims dispensed from community pharmacies in NPDUIS.[5] Canada Health Infoway has a primary role around data exchange standards for clinical and patient access, including their PrescribeIT initiative.[6]

Supporting improvements to Data Access and Its Use

HDRN Canada was established as a not-for-profit Corporation in 2020 and includes provincial, territorial and pan-Canadian organizations that hold and manage data. Its focus is on multi-regional data use, recognizing that Canada's status as a federation, existing legislation, evolving relationships with Indigenous Peoples, communities and nations, and

long-standing practices all contribute to challenges with data sharing. These challenges are also opportunities for shared learning and the development of new approaches to supporting the use of data that may not all reside in a single location. HDRN Canada supports research and analyses using pooled data where possible (such as that held by CIHI or Statistics Canada) or using federated, distributed models where legislative or policy barriers do not permit data to be pooled across regions.

A legislative analysis[7] by HDRN Canada reviewed the various legal frameworks concerning data sharing across Canada with a view to ascertaining and distinguishing legislative requirements, and regulatory requirements and policy requirements.

Guidelines for the wording of informed consent were developed to enable the ability for clinical trial, cohort, registry or other researcher-collected data to be linked with administrative data. The guidelines are reported here.[8]

HDRN Canada has established a partnership with the Canadian Critical Care Trials Group [external link] and the CIHR Network of Clinical Trial Networks for COVID-19 to develop a data strategy for real-time data collection from case report forms for linkage and analysis.

Case study: COVID-19 Network of Clinical Trial Networks

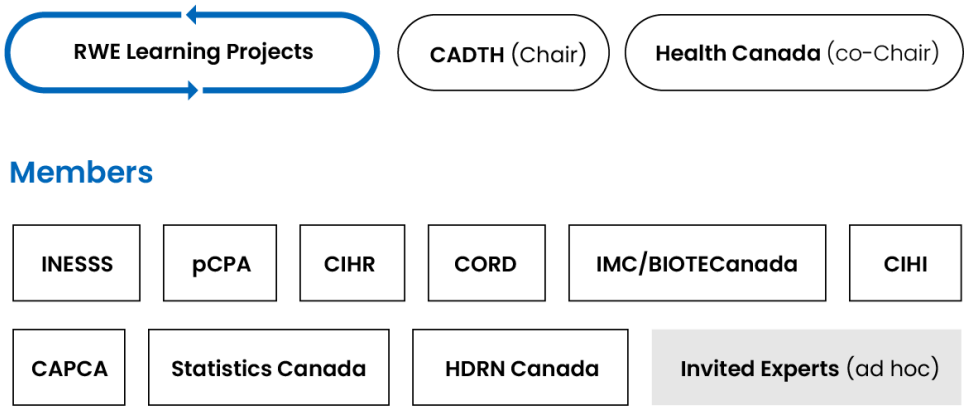
A multi-centre COVID-19 randomized control trial is seeking to link and pool fact of death (one binary variable) in each province to study outcomes of in-hospital therapeutics, which is not currently possible under existing policy frameworks.

The COVID-19 Network of Clinical Trial Networks [external link] has permitted HDRN Canada to follow the progress of these requests to allow for identification of the issues at the root of the ongoing barriers to administrative data sharing across borders.

Establishing a Real-World Evidence (RWE) Steering Committee

CADTH has collaborated with Health Canada to establish a Real World Evidence Steering Committee that will meet 4 times per year to foster interorganizational collaborations and partnerships. In addition to core member pan-Canadian health organizations, the RWE Steering Committee is establishing time-limited working groups that will be responsible for conducting specific initiatives or learning projects (Figure 3). Learning projects concerning the collection or generation of data about drugs with a Health Canada Notice of Compliance with conditions will be a major focus.

Figure 3: Real-World Evidence Steering Committee



CAPCA = Canadian Association of Provincial Cancer Agencies; CIHI = Canadian Institute for Health Information; CIHR = Canadian Institutes of Health Research; CORD = Canadian Organization for Rare Disorders; IMC = Innovative Medicines Canada; HDRN = Health Data Research Network; INESSS = Institut national d'excellence en santé et en services sociaux; pCPA = Pan-Canadian Pharmaceutical Alliance; RWE = real-world evidence.

Pan-Canadian Health Data Strategy

In 2020, the Public Health Agency of Canada launched the development of the pan-Canadian Health Data Strategy (pCHDS) to support creation, sharing, and use of health data for the benefit of the health of Canadians and public health systems. The pCHDS's Expert Advisory Group has published 3 reports to date. The first focused on barriers to data access, sharing and use, and outlined the following principles to deliver a learning health system [Expert Advisory Group Report 1: Charting a Path toward Ambition - Canada.ca][9]:

- Empowerment of Canadians
- Indigenous Data Sovereignty
- Equity
- Stewardship
- Privacy and Security
- Trust and Trustworthiness
- Collaboration
- Innovation

In the second, the need for coordinated investments in Canada's data infrastructure to support the full continuum of care was described [Building Canada's health data foundation: Pan-Canadian Health Data Strategy Expert Advisory Group - Canada.ca].[10] The pCHDS proposes that federal/provincial/territorial would commit to:

- drive action toward a learning health system – a system that continually improves health outcomes, system effectiveness, and overall public health by using data
- harmonize data sharing and access policies to ensure public good can be derived from health data while protecting privacy
- develop and implement interoperability standards within and across jurisdictions
- build capacity and public trust, collaborating for the benefit of Canadians and using health data for public good
- establish accountability and shared governance for health data across Canada.

The third and final report presented advice about the actions needed to enable a world-class, person-centred health data system [Expert Advisory Group Report 3: Toward a world-class health data system - Canada.ca].[11] Consistent with the findings of the DA-SWG, the report notes the importance of increasing the interoperability and linkability of data, and of a governance model that allows for the potential of Canada's existing data assets and investments to be harnessed. It proposes that that implementation of the pCHDS by jurisdictions would be advised by a Health Information Stewardship Council and facilitated by one or more representative Learning Health System Table(s). Only through collaboration and aligned incentives can the vision of a learning health system be achieved.

Objective 6: Highlight the work of a case study (e.g., COVID-19 initiatives) relating to data access

The COVID-19 pandemic created a scenario where there was a powerful incentive to urgently collect, analyze and interpret data about the safety and effectiveness of preventive and therapeutic treatments that was shared across all stakeholders in the health system. This section provides some important examples of the successes and challenges experienced during this unprecedented situation and important learning about how to move forward.

Case study: Canadian COVID-19 Emergency Department Rapid Response Network (CCEDRRN)

In 2020, CIHR funded the establishment (1 year funding) of a multi-centric, population-based registry to harmonize data collection on COVID-19 patients in 50 EDs across Canada.[12] This pan-Canadian registry (CCEDRRN) has captured data about emergency department visits and in-hospital stays on COVID-19 tested patients and included information about in-hospital drugs for over 193,000 patients. The registry captured important clinical data on the type and duration of patient symptoms, risk factors for infection, oxygen demand and airway management, drugs used in EDs and in hospital, and vulnerability (e.g., homelessness, substance use) that are not captured in administrative data. Phone follow-up data in participating provinces captured race, ethnicity, gender, education, occupation, socioeconomic and immigration status, household size, and ascertained post-COVID-19 condition. Substantial delays occurred by needing to get provincial research ethics board (REB) and institutional privacy approvals to cover all participating sites. As a result, scientific outputs were delayed, which would have provided

Canadian emergency and critical care physicians with highly accurate validated clinical decision instruments to predict patient outcomes at a time in the pandemic when critical care resources were restricted. Despite this challenge, the CCEDRRN registry became the third largest of 177 COVID-19 registries listed with the Of the 177 observational COVID-19 registries listed with the World Health Organization (WHO).

In 2021, CITF/PHAC funded CCEDRRN (1 year funding) to assist with vaccine effectiveness evaluations in special populations (e.g., immune compromised). CCEDRRN applied for linkage to vaccine registry data in all participating provinces and added vaccination status questionnaires to phone follow-up data collection. Yet, more than 15 months after repeatedly requesting linkage of CCEDRRN data with provincial vaccination registry data, none of the provinces have provided the data, one province (B.C.) has approved the request, 2 provinces (AB, NS) are evaluating the request and other provinces (ON, QC, SK, MB, NB) have declined to provide any data. While provinces have enabled researchers to access provincial vaccine registry data in provincial hubs (e.g., ICES), they have not enabled the creation of a pan-Canadian dataset or linkage with pan-Canadian datasets which would be critical to study vaccine effectiveness in vulnerable populations at greatest risk for poor COVID-19 outcomes (e.g., Indigenous, homeless, transplant recipients).

In 2022, CCEDRRN was unable to secure ongoing funding to continue to operate and had to successively close sites, despite multiple governmental agencies, including PHAC, CITF and CADTH, expressing interest in utilizing and leveraging CCEDRRN's unique data holdings and widespread recognition that CCEDRRN is ideally poised to support Canada's pandemic and emergency preparedness by being able to be re-activated rapidly for pan-Canadian data collection on rapidly emerging Public Health Crises.

Health Canada

During the COVID-19 pandemic, the International Coalition of Medicines Regulatory Authorities (ICMRA) acted as a forum to support strategic coordination and international cooperation among global medicine regulatory authorities to expedite and streamline the development, authorization and availability of COVID-19 treatments and vaccines worldwide.

In response to the COVID-19 pandemic, Health Canada put the DSEN into action to collect data at a pan-Canadian and international level to inform decision-making. Examples of 2 queries submitted to DSEN researchers about drugs safety and effectiveness are listed below:

- Rapid review of the effectiveness and safety of treatments for COVID-19 and other coronaviruses that cause serious respiratory tract infections
- Allogeneic mesenchymal stem cell therapy for COVID-19 and other viral and bacterial-induced acute respiratory distress syndrome: a clinical systematic review of donor, recipient, and therapeutic characteristics and efficacy and safety (ongoing)

For a complete list of queries, see DSEN Research: Query List - CIHR (cihr-irsc.gc.ca)

In collaboration with the International Coalition of Medicines Regulatory Authorities, and by using DSEN, Health Canada also contributed to the following projects about COVID-19 drug safety and effectiveness or COVID-19 as a disease. For the complete updated list of projects, please refer to the COVID-19 | International Coalition of Medicines Regulatory Authorities (ICMRA):[13]

- Active Surveillance for Safety and Effectiveness of Health Products for COVID-19
- Patterns of Steroid Utilization in COVID-19 Patients
- COVID-19 infection and medicines in pregnancy
- Natural history of coagulopathy and characteristics of its treatment in COVID-19 patients
- Reliability of COVID-19 case definitions in administrative and clinical databases.

These examples serve to illustrate the strengths and weaknesses of Canada's ability to generate, share and link data for the purpose of assessing the safety and effectiveness of drugs and optimize outcomes for patients and the health system.

Recommendations and Next Steps

Based on these learnings, the Data Access Sub-Working Group (DA-SWG) has recognized the importance of collaboration between a wide variety of stakeholders to improve Canada's capacity to improve the availability of data and/or limit delays for data access and to generate evidence to enhance decision-making about drug safety and effectiveness. To this end, DA-SWG recommends to:

- ensure drug effectiveness and safety data work is aligned to related pan-Canadian initiatives
- expand pan-Canadian data holdings to include data on coverage of public and private drug claims across Canada, drugs for rare disease and fill pharmaceutical data gaps
- accelerate advancements in legislation and governance to improve quality, timeliness, costs, and data access and data sharing
- develop continuum of types of data and evidence needed for specific decisions to enable a lifecycle across different data platforms
- promote infrastructure and processes that increase and enhance capacity to link individual-level data across different data sources through individual identifiers.

Finally, to support continued efforts of this interorganizational collaborative working group towards implementation of these recommendations it is proposed that the group transitions to a working group that reports to the RWE Steering Committee co-chaired by CADTH and Health Canada.

Appendix 1 describes CIHI's data holdings by province and territory. While coverage varies, there is almost pan-Canadian coverage of several data holdings relevant in the evaluation of drug safety and effectiveness. These include public drug claims, inpatient hospital stays, health expenditures, and the supply of health workforce (physicians, nurses, OT, PT, pharmacists). Other data holding's pan-Canadian coverage are not as complete.

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Appendix 1: Comprehensiveness of CIHI's Data Holdings as of March 31, 2022

Table 2: CIHI's Data Holdings by Province and Territory

Category	Data on	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nun.
Clinical	Acute hospital stays (inpatient and day surgery)	C	C	C	C	C	C	C	C	C	C	C	C	P
	Emergency care	I	P	P	I	C	C	P	P	C	P	C	N	N
	Ambulatory clinics	N	P	P[a]	N	N	P	N	P	P	N	N	N	N
	Inpatient mental health and addictions[b]	C	C	C	C	C	C	C	C	C	C	C	C	C
	Inpatient rehabilitation	C	C	P	P	N	C	P	C	P	P	N/A	N/A	N/A
	Continuing and residential care	C	N	P	C	N	C	P	C	C	C	C	I	N
	Home care[c]	C	I	I	N	N	C	I	P	P	P	C	I	N
	Organ replacement (dialysis and transplant)[d]	C	C[e]	C	C	P	C	C	C	C	C	N/A	C[e]	N/A
	Joint replacement prosthesis information	C	N	P	P	P	P	C	P	P	C	N	C	N/A
	Trauma[f]	N/A	N/A	N/A	N/A	N/A	C	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Patient-reported measures	Experiences in acute care hospitals	N	N	P	C	N	P	C	N	C	C[g]	N	N	N
	Patient-reported outcome measures (hip and knee)	N	N	I	N	N	P	P	N	P	I	N	N	N/A
Patient safety	Medication and radiation incidents	P	N	P	P	P	P	P	P	P	C	N	N	C
Prescription drugs	Public drug plans	C	C	C	C	C	C	C	C	C	C	C	I	I
Health spending	Health expenditures	C	C	C	C	C	C	C	C	C	C	C	C	C
	MIS financial/statistical reporting	C	C	C	C	C	C	C	C	C	C	C	C	N
	Physician payments and service utilization	C	C	C	C	C	C	C	C	C	C	C	P	N
	Patient costs	N	N	P	N	N	P	N	N	P	P	N	N	N

Category	Data on	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nun.
Workforce supply and educationion[h]	Physicians	C	C	C	C	C	C	C	C	C	C	C	C	C
	Registered nurses[i]	C	C	C	C	C	C	C	C	C	C	C	C	C
	Licensed practical nurses	C	C	C	C	C	C	C	C	C	C	P	C	P
	Registered psychiatric nurses[j]	N/A	N/A	N/A	N/A	N/A	N/A	C	C	C	C	C	N/A	N/A
	Occupational therapists	C	C	C	C	C	C	C	C	C	C	C	C	C
	Pharmacists	C	C	C	C	C	C	C	C	C	C	P	C	P
	Physiotherapists	C	C	C	C	C	C	C	C	C	C	P	N	N
International comparisons	The Commonwealth Fund Survey (Canada)[k]	C	C	C	C	C	C	C	C	C	C	C	C	C

C = complete data collection (95% or greater coverage); I = in discussion or implementation; MIS = management information system; N = not implemented; N/A = not applicable; P = partial data collection.

[a] Day procedures using MIS functional centre accounts that are currently grouped to clinics.

[b] The Hospital Mental Health Database (HMHDB) contains data on hospitalizations for mental illness or addiction from all provinces and territories. Additional administrative and clinical information on individuals receiving services in designated adult inpatient mental health beds in Ontario, Manitoba (partial) and Newfoundland and Labrador is available through the Ontario Mental Health Reporting System (OMHRS).

[c] Includes both short- and long-term home care clients. Newfoundland and Labrador and Yukon have full coverage of long-term clients.

[d] Applies to new patient registrations only.

[e] Renal dialysis — fully implemented; organ replacement — not applicable.

[f] 2012–2013 was the last year for the specialized National Trauma Registry (NTR) data collection. The Ontario Trauma Registry (OTR) continues to collect specialized data and report on injuries in Ontario. Trauma information is also available through the Discharge Abstract Database/Hospital Morbidity Database (DAD/HMDB) and the National Ambulatory Care Reporting System (NACRS).

[g] Discussions are underway about the level of participation.

[h] In addition to record-level data for 7 health professionals, aggregate-level supply and demographic data is collected for 23 health professionals in Canada

[i] Registered nurses include nurse practitioners.

[j] Registered psychiatric nurses (RPNs) are currently regulated in Manitoba, Saskatchewan, Alberta, British Columbia and Yukon.

[k] The Commonwealth Fund International Health Policy Survey provides comparable information on patient and provider experience in Canada. The survey targets different populations throughout a given survey cycle: the general population (age 18 and older), older adults and primary care physicians.

Source: Canadian Institute for Health Information. Comprehensiveness of CIHI's Data Holdings as of March 31, 2022. 2022: https://www.cihi.ca/sites/default/files/document/comprehensiveness-data-holdings-2020-2021-data-table-en.xlsx. Accessed 2022 Aug 22.

Appendix 2: Potential Data Sources in Canada for the Various Components of the Trajectory of Care

As identified in Figure 2.

Appendix 2 provides examples of potential patient characteristics of interest to measure and potential data sources where the information might be found. Similarly, potential examples and potential data sources are provided for drugs, care providers, drug utilization and the care pathway.

Table 3: Examples of Potential Patient Characteristics of Interest

Characteristic	Medical administrative data sources
Examples of potential characteristics of patients and data sources	
Geographic location (postal code)	Provincial health insurance registries
Demographics	Provincial health insurance registries
Previous drug use	Dispensed prescriptions/drug claims data
Previous primary care visits	Primary care EMR records
Previous lab test results	Laboratory data
Previous Imaging data	Medical imaging data
Dx of previous ED visits	Emergency department visits
Dx and procedures during previous hospitalizations	Acute care hospitalizations
Examples of potential characteristics of the index drug and practitioner	
Practitioner location: Office; long-term care; hospital	Practitioner databases
Practitioner medical specialty	Prescription claims; Practitioner databases
Drug class and format	Prescription claims; Drug product information
Prescribed dose and frequency	Prescription claims
Examples of potential characteristics of drug use and care pathway	
Duration of use	Prescription claims
Adherence: Prescriptions filled over time	Prescription claims
Examples of potential post-drug treatment outcomes and data sources	
Patient-reported measures	Patient-reported outcome measures (PROMs) and Patient-reported experience measures (PREMs) via surveys; registries
Adverse clinical events	Emergency department visits, acute care hospitalizations
Use of other prescribed medications	Prescription claims
Consultations with care providers	Physician claims
Visits to ER	Emergency department visits
Hospital stays	Acute care hospitalizations
Patient's vital status	Vital Statistics; Provincial health insurance registries; Emergency department visits, acute care hospitalizations
Drug costs to payer	Prescription claims
Hospital system resources	National Health Expenditure Database; Management Information System database