Secondary Prevention of High-Risk Heart Disease in Alberta: Identification, Surveillance, and Management

Phase 1: Environmental Scan and Mapping Data Sources

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Environmental Scan

Secondary Prevention of High-Risk Heart Disease in Alberta: Identification, Surveillance, and Management

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Abbreviations

All abbreviations that have been used in this report are listed here unless the abbreviation is well known, has been used only once, or has been used only in figures or tables, in which case the abbreviation is defined in the figure legend or in the notes at the end of the table.

ACE	angiotensin-converting enzyme
APPROACH	Alberta Provincial Project for Outcome Assessment in Coronary Heart Disease
ASCVD	atherosclerotic cardiovascular disease
BMI	body mass index
CIS	clinical information system(s)
CPCSSN AB	Canadian Primary Care Sentinel Surveillance Network – Alberta
CVD	cardiovascular disease
CvHS SCN	Cardiovascular Health and Stroke Strategic Clinical Network
DAD	Discharge Abstract Database
FRS	Framingham Risk Score
LDL-C	low-density lipoprotein cholesterol
LP(a)	lipoprotein (a)
MI	myocardial infarction
NACRS	National Ambulatory Care Reporting System
siRNA	small interfering ribonucleic acid
TIA	transient ischemic attack
VRR	Vascular Risk Reduction initiative

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Introduction

Although there has been considerable improvement in atherosclerotic cardiovascular disease (ASCVD) outcomes in recent decades, ASCVD remains the leading cause of morbidity and mortality worldwide.[1] In Canada, cardiovascular disease (CVD) is the second leading cause of death (after cancer),[2] the second leading cause of disability-adjusted life years,[3] and a leading cause of hospitalization.[4] In Alberta, vascular diseases, including ischemic heart disease and stroke, are the leading cause of mortality.[2, 5] Collectively, the lives of over 300,000 people in Alberta are affected by vascular diseases, including CVD, stroke, type 2 diabetes mellitus, chronic kidney disease, or peripheral vascular disease.[6] Healthcare costs for patients with high-risk conditions for CVD in Alberta are substantial, with secondary prevention patients using more resources and incurring considerably higher costs ($36,641) than primary prevention patients ($11,299) in the first year after the index cardiovascular event.[7]

Risk Factors for ASCVD

Much of the high morbidity and mortality of ASCVD can be attributed to uncontrolled ASCVD risk factors and suboptimal implementation of prevention strategies.[1] Overall, 90% of Canadians have suboptimal cardiovascular health due to multiple vascular risk factors, high rates of diabetes and obesity, and suboptimal control of dyslipidemia, hypertension, and blood glucose.[8] Most patients who experience a myocardial infarction (MI) had at least one vascular risk factor prior to this event.[1]

In Alberta, 70% of the adult population has at least one modifiable cardiovascular risk factor.[6] Both behavioural and physiological modifiable risk factors contribute to cardiovascular risk. Behavioural risk factors include physical inactivity, unhealthy diet, alcohol consumption, and tobacco exposure.[6] Physiological risk factors include dyslipidemia, hypertension, overweight and obesity, prediabetes, and metabolic syndrome.[6] In particular, low-density lipoprotein cholesterol (LDL-C) is a major risk factor for CVD.[9] Patients with one risk factor are likely to have two or more of cardiovascular risk factors.[6, 10] Together, these risk factors contribute to the development of atherosclerosis, a condition in which plaque (composed of cholesterol, calcium, and fat) builds up in the walls of the arteries causing a narrowing of arteries and an obstruction in blood flow.[11] Atherosclerosis can lead to acute MI, stroke, and heart failure.[11, 12] Other risk factors for CVD include increasing age, male sex, family history of premature CVD, ethnicity (e.g., First Nations, individuals of South Asian descent), and high lipoprotein(a) (Lp(a)).[8, 13,14]

Patients who are at very high cardiovascular risk include those have a history of multiple major ASCVD events (MI, acute coronary syndrome, stroke, coronary or other arterial revascularization, symptomatic peripheral arterial disease) or have had one major ASCVD event and have multiple high-risk factors, such as: age ≥65 years, heterozygous familial hypercholesterolemia, hypertension, diabetes mellitus, history of prior coronary artery bypass surgery, current smoking, history of heart failure, persistent elevated LDL-C despite statin therapy, and chronic kidney disease.[15] The five-year rate of a recurrent cardiovascular event or cardiovascular death among patients with known CVD is between 20% and 30%, which is approximately four to five times higher than the rate of a cardiovascular event among moderate- to high-risk individuals without known CVD.[16]

Secondary Prevention of ASCVD

Secondary prevention of CVD is any strategy targeted at preventing or delaying a recurrent cardiovascular event in patients with known and clinically significant ASCVD, including coronary artery disease, cerebrovascular artery disease, peripheral artery disease, and atherosclerotic aortic disease.[14-16] Secondary prevention involves both lifestyle modification and use of medications for risk factor management.[16] These interventions have been shown to be highly effective in preventing and postponing recurrent vascular events, death, and disability and are highly cost-effective.[7, 16]

Purpose of Environmental Scan

Provincial strategies for the secondary prevention and management of ASCVD are needed to address the burden of disease on patient quality of life and the health care system. Real-world data, routinely collected in patient encounters with the healthcare system, have been used to identify populations affected by or at high risk of chronic diseases.[9, 17, 18] Provincial data assets can guide the implementation of prevention programs and direct public health priorities.[17]

The Institute of Health Economics conducted an environmental scan to: describe available Alberta data assets to support the identification, surveillance, and management of high-risk patients with known CVD; identify preliminary gaps in the available information; and formulate potential strategies to address the gaps identified. This environmental scan represents the first phase in exploring potential strategies for using data assets to support secondary prevention of ASCVD in Alberta and is intended to provide a common knowledge base across various health partners in preparation for a potential future policy roundtable discussion. The timing and scope of a potential policy roundtable is in development and is not within the scope of this particular project.

Methods

This environmental scan consisted two components: 1) description of the clinical treatment pathway for patients with known ASCVD in Alberta; and 2) mapping existing Alberta data sources along this pathway that would help to identify subpopulations whose cardiovascular risk is not well managed and who are a particular high risk for recurrence of cardiovascular events and mortality. We performed a targeted literature search for clinical practice guidelines outlining secondary prevention approaches for patients with known ASCVD. One researcher reviewed the literature and described the current treatment pathway. Subsequently, we conducted targeted searches of publicly available reports and websites and engaged with several key informants to determine current Alberta data assets that may be useful in identifying patients with high-risk CVD. Key informants included representatives from the Alberta Cardiovascular Health and Stroke Strategic Clinical Network (CvHS SCN) and Clinical Analytics at Alberta Health Services. Information from the literature review and key informant engagement were integrated in a narrative summary and evidence tables.

Clinical Pathway for Secondary Prevention of ASCVD

ASCVD often goes undetected until patients experience a cardiovascular event, such as an MI or stroke.[19] Patients receive acute care in hospital, including evaluation (e.g., blood tests, electrocardiogram, cardiac catheterization, computed tomography, or magnetic resonance imaging), continuous monitoring, and treatment with a variety of medications.[20, 21] If indicated, patients may undergo procedures such as angioplasty, coronary artery bypass graft surgery, or endovascular therapy.[19-21] In preparation for discharge, patients should receive long-term medications for

secondary prevention, undergo additional testing, and be enrolled in a secondary rehabilitation program (e.g., cardiac rehabilitation, stroke prevention).[20] Hospital care providers should communicate with a patient's primary care provider to insure a smooth transition of care and arrange for a follow-up appointment.[21]

Following hospital discharge, secondary prevention for ASCVD is mainly provided by primary care physicians and their teams. Primary care physicians work with patients to develop and manage a treatment plan, including behaviour modifications, medications, and routine follow-up.[10, 13] A range of additional health care providers may be involved in educating, monitoring, and supporting patients in adhering to a secondary prevention treatment plan, including nurse educators, dietitians, exercise therapist, physical therapists, psychologists, and social workers.[22] Referral to specialists, including cardiologists, cardiovascular surgeons, nephrologist, neurologists, or endocrinologist may be warranted for patients not responding to pharmacological treatment, needing specialized procedures, experiencing complications, and/or requiring treatment for comorbidities.[22] Ethnocultural considerations, such as involving family members and/or community supports, are also recommended, particularly for Indigenous and South Asian patients.[23, 24]

Clinical practice guidelines consistently assign high or very high cardiovascular risk to patients with a history of CVD (defined as previous MI, acute coronary syndromes, coronary or other arterial revascularization, stroke, transient ischemic attack, aortic aneurysm, or peripheral artery disease).[25] Because all patients with pre-existing CVD are classified as high-risk, their condition should be managed through secondary prevention measures and risk estimation (e.g., Framingham Risk Score [FRS]) is not appropriate for this population.[10] Secondary prevention relies heavily on risk factor reduction through targeted health behaviour interventions to optimize cardiovascular health and pharmaceutical interventions.[14, 21] Management of risk factors includes lifestyle intervention, vascular-protective medications such as statins, and participation in rehabilitation programs.[8, 25]

Lifestyle Intervention

Lifestyle modification is a crucial component of ASCVD risk reduction.[13, 26] Health care providers should discuss lifestyle interventions with all patients with ASCVD, including healthy eating, regular exercise, avoiding tobacco, limiting alcohol consumption, and maintaining a healthy body weight.[10, 26] A Mediterranean diet, which emphasized eating heart-healthy foods such as fruits, vegetables, fish, beans, high-fibre whole grains, and healthy fats, is recommended for patients at high cardiovascular risk.[8, 10, 13, 27] Intake of saturated and trans fats, sodium, and cholesterol should be minimized.[1, 28] It is recommended that adults should engage in at least 150 minutes of moderate to vigorous exercise weekly, in bouts of at least 10 minutes.[10, 13] Clinicians should advise smoking cessation efforts for individuals who smoke.[10, 13]

Secondary Prevention Medications

Lowering cholesterol levels has been a primary target to reduce the risk of cardiovascular events and mortality, therefore use of lipid-lowering drugs, such as statins, are strongly recommended.[14] Statins have shown consistent effects on reducing cardiovascular morbidity and mortality.[29] Physicians should prescribe the highest approved intensity (potency and doses) of statin that patients can tolerate, because higher intensity statin therapy reduces CVD risk more than lower intensity statin therapy.[10] Statin therapy should be considered regardless of age (with a statin other than pravastatin used in patients ages 65 and older).[10] An additional factor that may support the use of high-intensity statin therapy is Asian ancestry.[15] In patients who are intolerant of one statin, another statin or lower

dose of the same statin should be used.[29] Health care providers should reinforce statin adherence, such as through phone calls, medication calendars, and/or pharmacist medication reviews.[10]

There is controversy in clinical guidelines regarding lipid targets and testing after the initiation of statin therapy. The Canadian Cardiovascular Society guidelines and the Canadian Cardiovascular Harmonized National Guidelines Endeavour (C-CHANGE) guideline recommend a "treat-to-target" approach, using lipid targets and repeat lipid testing for intensification of lipid therapy.[8, 14] The American College of Cardiology recommends against lipid targets, but advises repeat lipid testing.[26] In contrast, the US Veterans Affairs and Toward Optimized Practice recommend against both lipid targets and testing after statin initiation on the basis that there is no clinical trial data to support the use of lipid targets in risk reduction of CVD or for tracking lipid level and adjusting medications based on these levels.[10, 29, 30]

Several other vascular-protective medications are also recommended for select patients with ASCVD. Daily aspirin (or clopidogrel if intolerant to aspirin) is strongly recommended for individuals with a low risk of bleeding.[8, 10, 15, 16] Angiotensin-converting enzyme (ACE) inhibitors should be administered indefinitely for all patients with ASCVD and hypertension, diabetes, chronic kidney disease, or left ventricular ejection fraction ≤40%.[15] Angiotensin II receptor blockers (ARBs) are recommended for patients intolerant of ACE inhibitors. Beta blockers are also recommended for patients with coronary or other vascular diseases.[15, 16] Patients with transient ischemic attack (TIA) or ischemic stroke and nonvalvular atrial fibrillation should be treated with an anticoagulant.[8]

For patients in whom LDL-C remains at or above 1.8 mmol/L despite maximally tolerated statin dose, the Canadian Cardiovascular Society also recommends intensification of lipid-lowering therapy with a PCSK9 inhibitor and/or ezetimibe.[14] Toward Optimized Practice recommends considering ezetimibe as add-on therapy to high intensity statin for high-risk patients.[10]

New data showing a dose-dependent relationship between Lp(a) levels and increased risk of recurrent ASCVD support the potential role of Lp(a) as a treatment target in the future.[14] Lipid-lowering therapies such as PCSK9 inhibitors, niacin, and apheresis lead to lowering of Lp(a), but there is limited evidence of their use in patients with elevated Lp(a).[14] Newly approved therapies such as small interfering ribonucleic acids (siRNAs) and antisense oligonucleotides, are currently being assessed for CVD risk reduction in this population.[14]

Rehabilitation Programs

Rehabilitation programs, such as cardiac rehabilitation, are a cornerstone in the management of patients who have had an ASCVD event and are associated with reduction in cardiac mortality.[14, 15] In a cardiac rehabilitation program, patients receive supervised and individualized support to help them recover from a cardiovascular event and make healthy lifestyle changes.[22] Patients work with a multidisciplinary team of professions, including cardiologists, nurse specialists, pharmacists, occupational therapists, exercise therapists, physical therapists, cardiology technicians, dietitians, social workers, and psychologists.[31] Patients with coronary artery disease should be referred to a comprehensive cardiac rehabilitation program that consists of physical activity, lifestyle modification (including healthy diet, smoking cessation, and stress management), risk factor reduction, management of medication adherence, education, and psychosocial support.[15, 32] Clinical guidelines recommend that cardiac rehabilitation begin as soon as possible after a MI or other heart condition, either before or within days of hospital discharge.[15] For patients with TIA or nondisabling stroke, participation in stroke rehabilitation should be considered.[6, 32]

Data Assets for Identifying Patients with High-Risk ASCVD

Alberta has one of the most extensive, comprehensive, and detailed health system data depositories in Canada.[18] Clinical pathways for the secondary prevention of patients with ASCVD would involve specific health care encounters, evaluations, and procedures that are routinely captured in Alberta's administrative databases, clinical records, and registries. Based on targeted literature searches and discussions with key informants, we compiled information on available Alberta data sources that could support the identification, surveillance, and management of high-risk patients with known ASCVD. The data sources were categorized as follows: patient demographics, health resource utilization, clinical information systems (CIS), pharmaceuticals, and laboratory (Figure 1).

FIGURE 1. CATEGORIES OF ALBERTA DATA ASSETS FOR ASCVD

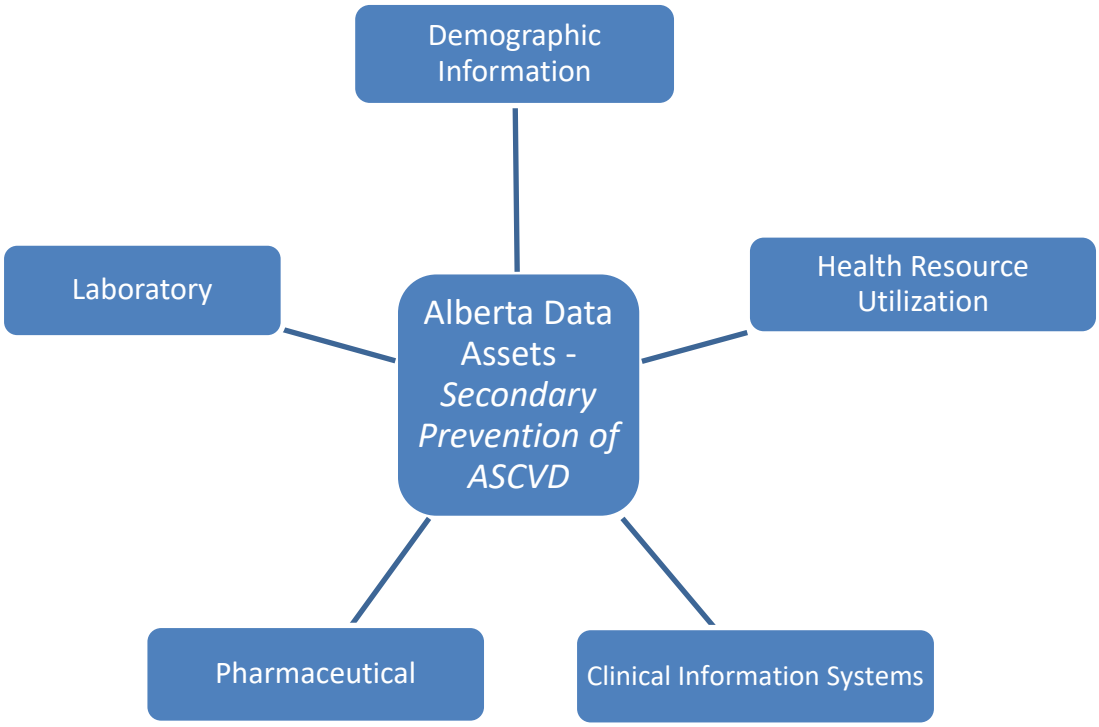

Table 1 provides an overview of the data assets identified, including a general description of the data sources, data elements captured, and other parameters. Overall, we identified 17 relevant data sources providing specific information components that, together, may be useful in identifying and tracking the management of patients with known ASCVD. About half of the data assets are composed of health resource utilization (encounter/procedure) data (n=8). Other assets are drawn from CIS (i.e., electronic medical records) (n=4) or contain patient demographic (n=2), pharmaceutical (n=2), or laboratory (n=1) data. Dates of inception ranged from 1994 to 2010 (1990 –1999: 5 sources; 2000 – 2009: 8 sources; 2010 – 2019: 1 source; variable: 3 sources). The majority of the data assets consist of data collected by Alberta Health and/or Alberta Health Services for administrative purposes (n=14). Non-administrative data sources include the Alberta Provincial Project for Outcome Assessment in Coronary Heart Disease (APPROACH) cardiac registry from

the Libin Cardiovascular Institute, the Canadian Primary Care Sentinel Surveillance Network – Alberta (CPCSSN AB) based at the University of Alberta and University of Calgary, and CIS of community primary care and specialist physicians. Some of the data assets have more limited access and documentation than others; however, they are included in this list for completeness.

Provincial data assets can be used to support secondary prevention of ASCVD through: 1) identifying patients with known and clinically significant ASCVD; and 2) identifying subgroups of these patients who have suboptimal management of their condition and/or have risk factors that place them at particularly high risk of cardiovascular event recurrence. Once identified, additional prevention interventions can be targeted and tailored to these very high-risk patient subgroups. Secondary prevention patients have previously experienced an initial cardiovascular event, resulting in an encounter with acute emergency and/or inpatient hospital care. The National Ambulatory Care Reporting System (NACRS) and Discharge Abstract Database (DAD) can be used to identify individuals who presented to the emergency department and/or were admitted to hospital due to cardiac events, such as MI, unstable angina, stroke, peripheral artery disease, and coronary or other revascularization procedures. Death registry information from Alberta Vital Statistics can be used to restrict this secondary prevention population to individuals who are still living at the time of study.

To identify subgroups of secondary prevention patients who have suboptimal control of risk factors, further stratification can be conducted examining indicators associated with high risk of event recurrence. Dyslipidemia is considered the main risk factor for CVD, and patients who optimally control dyslipidemia for secondary prevention experience lower mortality.[7,9] Therefore, tracking statin use and lipid panels are key to identifying patients at particularly high risk for CVD events.[9] The Pharmaceutical Information Network can provide information on current or history of prescription dispenses of lipid-lowering medications, such as statins, and identify patients who have never had a statin prescription filled or who have stopped filling their statin prescriptions. Patients with abnormal lipid levels can be identified through General Medical Laboratory data. Tracking lipid panels can help identify high-risk individuals who have hypercholesterolemia, including those who are not meeting target thresholds despite maximally tolerated intensity of statin therapy, recognizing that not all patients with uncontrolled hypercholesterolemia will be detected through this approach because lipid panels are not consistently tested in hospital or primary care following a cardiac event.[33] Patients with other comorbidities that are related to CVD risk, such as diabetes and chronic kidney disease, can be tagged through cardiac registries, such as APPROACH, and administrative databases (e.g., NACRS, DAD, Longitudinal Demographic Profile, and practitioner claims).

Demographic data, available from the Provincial Registry and some health utilization databases, can be linked with other databases through an individual's Unique Lifetime Identified and provide information on age, gender, Aboriginal status, socioeconomic status, and geographic region (e.g., remote, rural). Surveillance for high-risk patients that takes these demographic variables into account can reveal cardiovascular health and risk disparities within the province and be a step towards addressing equity considerations in cardiac prevention and treatment. For instance, early research using the APPROACH database revealed that elderly Albertans and women with heart conditions were less likely to be offered some heart procedures, and women were not as likely to be referred to or participate in cardiac rehabilitation programs.[34] Awareness of treatment discrepancies by identifying barriers to treatment can increase longevity and improve quality of life.[34]

Although secondary prevention for ASCVD is predominantly provided in primary care settings, community physicians' CIS do not share data with Alberta Netcare and are therefore not currently

available for research purposes. Data on some patient risk factors, such as smoking status and body mass index (BMI), is only recorded in physicians' CIS. The CPCSSN is a national repository of de-identified primary care data, derived from the CIS of participating primary care physicians, which is available for approved research and surveillance purposes.[35] Data from CPCSSN have been used in the surveillance of dyslipidemia[9] and hypertension[35] and have been successfully linked with identifiable administrative databases in Alberta.[35] Although CPCSSN AB data are available for only a small subset of the provincial population, they include important and high-quality data for some CVD risk factors (e.g., BMI, blood pressure, lipid profile, details of prescribed medications).[36] Merging CPSSN AB data with administrative data for secondary prevention ASCVD patients could provide another avenue for identifying patient subpopulations at high risk of recurrent events based on their risk factor profiles.

TABLE 1. DATA ASSETS FOR THE IDENTIFICATION, SURVEILLANCE, AND MANAGEMENT OF ASCVD

Data Source	Overview	Relevant Data Elements	Availability dates, data refresh, custodian, other details
Demographic Information			
Provincial Registry* [18, 37]	Also called Population Demographics. Data is extracted from AHCIP Registry. Provides basic demographic and geographic information on Albertans with AHCIP coverage†	Personal Health Number, date of birth, age, sex, postal code, migration indicator, Aboriginal status, SES proxy	Apr 1994 – present Annually AHS
Vital Statistics – Deaths* [18, 37]	Registry of all deaths occurring in Alberta.	Demographic information; date, place, and cause of death; autopsy	Jan 1999 – present Annually Service Alberta / AH
Health Resource Utilization: Encounters and Procedures			
Alberta Provincial Project for Outcome Assessment in Coronary Heart Disease (APPROACH) database [34]	Cardiac registry of >200,000 patients who have undergone >500,000 procedures in Alberta.	Demographic information, diagnoses, medical history, risk factors, hospital admission, procedures, medications, laboratory tests, vital statistics, quality of life information	1995 – present Daily AHS
Admission, Discharge, Transfer (ADT)* [18]	Admission, discharge, and transfer information for services that are attached to an acute facility (i.e., inpatient, ambulatory, seniors).	Admitting diagnosis, ICD-10 listing, event identified, episode identifier, level of care, payer information, (language, age, gender, city), discharge destination, triage score, ED information, provider specialty	Apr 2007 – present Daily AHS
Discharge Abstract Database (DAD)* [18, 35, 37]	Inpatient morbidity from all acute care institutions in Alberta.	Demographic information (gender, age, geography code), admission / discharge / transfer, coded diagnoses (primary and secondary), interventions, main patient service, special care unit information (ICU, step-down), morbidity level, CMG derived data, readmission, disposition, alternate level of care, payment	From Apr 2002 – present Monthly AH / AHS Reported to CIHI and AH via MACAR Coded in ICD-10-CA/CCI

Data Source	Overview	Relevant Data Elements	Availability dates, data refresh, custodian, other details
Health Resource Utilization: Encounters and Procedures (continued)			
Longitudinal Demographic Profile (LDP)* [37]	Enables observation of trends in health care utilization, health care burden, and costs by individual for Albertans registered with AHCIP.	Demographic information (from Population Registry) Health service utilization: annual visits to GP and specialist, inpatient and outpatient visits, LTC days Chronic diseases / CRGs: diagnosis with hypertension, diabetes, asthma, COPD, IHD, CHF, and dementia Health care costs	Apr 2000 – present NR AH
National Ambulatory Care Reporting System (NACRS)* [35, 37]	Outpatient medical and surgical care provided in emergency departments (ED), clinics, and day surgery settings.	Demographic information, ambulatory care information (surgery, day procedures, emergency department visits, community rehabilitation), triage, coded diagnoses (primary and secondary), service, intervention, admission / discharge / transfer	Apr 2010 – present Monthly AHS Reported to CIHI and AH via MACAR Coded in ICD-10-CA
National Rehabilitation System (NRS)* [38,39]	Data set of clients' rehabilitation in inpatient rehabilitation facilities/ programs and care outcomes.	Demographic information, health characteristics (e.g., most responsible health condition, comorbidities), activities and participation, service interruption, interventions	2000 – present Quarterly AHS Coded in ICD-10-CA
Practitioner Claims* [18, 35, 37]	Billing claims from fee-for-service physicians and allied health practitioners and shadow-billed claims for Albertans who receive Alberta Health Care Insurance Plan benefits.	Demographics, provider, and service information (e.g., health service code, up to 3 diagnostic codes, medical service category, referral information, date of service, amount paid).	Apr 1994 – present Weekly AH Coded in ICD-9-CM/Schedule of Medical Benefits
Interactive Health Data Application (IHDA) Data [40]	Provides information on the health status and determinants of health of Albertans. IHDA contains statistics on various health-related topics, including chronic diseases, drawn from administrative databases (e.g., Population Registry, Vital Statistics, DAD).	Incidence, prevalence, and subpopulation data on chronic disease data sets, including acute MI, atrial fibrillation, diabetes, heart failure, hypertension, ischemic heart disease, and renal disease, stroke.	2000 – 2018 NR AH

Data Source	Overview	Relevant Data Elements	Availability dates, data refresh, custodian, other details
Clinical Information Systems (CIS)			
Canadian Primary Care Sentinel Surveillance Network – Alberta (CPCSSN AB)[18, 35]	Population health surveillance system of chronic disease information from the CIS (EMRs) of participating primary care physicians. Information on five chronic and mental health conditions is collected, including hypertension and diabetes. De-identified data is derived from two primary care research networks, consisting of about 300 family physicians and 300,000 patients.	Patient information from EMR database, including demographics, diagnoses, physical measurements (e.g., height, weight, blood pressure), behavioural risk factors, prescribed medications, laboratory results, medical procedures, and referrals.	From 2008 – present Bi-annually (June and December) University of Alberta, University of Calgary EMR data extracted twice annually.
Community Physician CIS (EMR)[18]	Community-based primary care and specialist physicians record patient clinical information in one of several different CIS/EMR. The adoption rate is 80-85%.	Demographic and clinical information, including health history, diagnoses, medications, tests, risk factors, allergies, immunizations, treatment plans.	Start date varies – present Daily Physicians CIS do not share data with Alberta Netcare, therefore are not currently available for research purposes. In future, it is anticipated that data elements from CIS will be systematically uploaded to Connect Care.
Alberta Netcare / Alberta Electronic Health Record [41, 42]	Integrated provincial electronic health information network that provides authorized health care professionals shared access to key patient health information. Individual health care sites submit select information to Alberta Netcare.	Demographic information, clinical information including medications, laboratory tests, diagnostic images and reports, hospital visits, surgeries, allergies, and immunizations.	Mar 2006 – present Daily AH / AHS Accessible to authorized users. Data sets can be analyzed and integrated to support clinical program improvement, monitoring of health, and related health research.
Connect Care (EPIC) and Other Hospital CIS [18,43]	A number of different CIS are currently used in AHS facilities, but these are being consolidated into one central, shared CIS, Connect Care. Implementation is occurring in multiple waves and is currently in progress.	Demographic information and record of care from all AHS facilities and the facilities of AHS partners (e.g., hospitals, clinics, continuing care, cancer centres, AHS-operated community health sites, DynaLIFE).	Start date varies – present Daily AHS Available by request to AHS Analytics

Data Source	Overview	Relevant Data Elements	Availability dates, data refresh, custodian, other details
Laboratory			
General Medical Laboratory [18]	All AHS general laboratory tests	Laboratory tests include clinical chemistry, toxicology, hematology, serology, urinalysis, and immunology.	Start date varies Daily (8-day latency) AHS
Pharmaceutical			
Alberta Blue Cross (ABC) Pharmacy Claims* [18,37]	Covers seniors, their dependents, and persons on assistance. For claims that are covered under supplemental health benefit and are paid by ABC on behalf of AH.	Prescription drug dispensing: includes DIN, quantity, date of service, prescriber	Apr 1994 – present Monthly and annually. Claims may be submitted up to 365 after service. AH
Pharmaceutical Information Network (PIN)* [18, 35, 37]	Record of prescription medications dispensed from Alberta community pharmacists. Information is on drugs dispensed, not prescribed. Does not include in-hospital and ED dispenses or reason for prescription.	Drug dispense event (e.g., patient, prescriber, dispenser, facility information), drug information details (e.g., drug name, DIN, ATC code, dose, compound components, quantity dispensed, supply amount),	Apr 2008 – present Weekly AH / AHS

ABC: Alberta Blue Cross; ADT: Admission, Discharge, Transfer; AH: Alberta Health; AHCIP: Alberta Health Care Insurance Plan; CIHI: Canadian Institute for Health Information; CIS: clinical information systems; CHF: congestive heart failure; CMG: Case Mix Groups; CRG: Clinical Risk Groupers; COPD: chronic obstructive pulmonary disease; DAD: Discharge Abstract Database; DIN: drug information number; ED: emergency department; EMR: electronic medical records; GP: general practitioner; IHD: ischemic heart disease; LTC: long-term care; MACAR: Morbidity and Ambulatory Care Abstract Reporting System; MI: myocardial infarction; NACRS: National Ambulatory Care Reporting System; SES: socioeconomic status

* Alberta administrative databases are collected for administrative purposes and available for research, planning, policy development, and quality improvement. All datasets can be linked through an individual's Unique Lifetime Identified (ULI).

† Includes nearly all Alberta residents except members of the Canadian Armed Forced and inmates of federal penitentiaries.

Discussion

This environmental scan describes key Alberta data assets along the clinical pathway for ASCVD that are available to support the identification, surveillance, and management of secondary prevention patients with ASCVD. The data assets vary in their purpose, scope, data elements, and degree of accessibility for research. Data sources include administrative databases, a cardiac registry, and CIS databases. The information in these data assets is drawn from health resource utilization (encounter/procedure) (n=8), CIS (n=4), patient demographic (n=2), pharmaceutical (n=2), and laboratory (n=1) sources.

Information Gaps in Data Assets

The various data sources identified are characterized by specific strengths and limitations. Administrative data are collected for non-research purposes (typically for billing) and provide data for a large population, yet lack important clinical information.[35] Data from registries and CIS are extracted for a smaller subset of the population and may be more difficult to analyze.[35] In addition, researchers have no access to data in community physician CIS, which is often the only record of important clinical information, such as patient height, weight, blood pressure, medical history, and tobacco and alcohol use (personal communication). De-identified clinical information derived from primary care CIS is available for a subset of the Alberta population through the CPCSSN AB.[35] Linking administrative databases with the CPCSSN AB has potential to alleviate the respective limitations of these data sources and enhance surveillance.[35]

Other common short-comings in data sources include incomplete data and lack of standardized data entry. Demographic information on patient ethnicity and socioeconomic status is often missing or inconsistently reported (personal communication). Laboratory data often require considerable cleaning to be usable since there is no standardization across Alberta laboratory systems in recording results (personal communication). In addition, some values such as cholesterol are particularly difficult to extract due to the different kinds and combinations of cholesterol reported (personal communication). Information on medical encounters is only accessible if it is recorded and there is a mechanism for extraction (personal communication). Ongoing efforts to create a centralized access point and standardized data collection and entry through Connect Care aim to bridge information gaps in the future.[43] In order for data from Connect Care to be accessible, there is a need for clear expectations of what information will get extracted and a need for algorithms that impose data extraction to be built into Connect Care (personal communication).

Provincial Priorities and Strategies for CVD Prevention

Leveraging provincial data assets to strengthen secondary prevention of ASCVD aligns well with priorities identified by cardiology experts across the province. The CvHS SCN has defined three strategic pillars in its transformational roadmap: enhancing prevention and integration of health promotion and wellness; reducing inequities in care and outcomes; and improving the patient journey, health system quality, and care.[44] Using data routinely collected by the health care system to improve surveillance and monitoring of CVD risk factors, build data links to clinical pathways, and identify and reduce inequalities in preventive care are key priorities in mitigating the risk of adverse cardiovascular outcomes and supporting the health of Albertans.[44] Recently, the University Hospital Foundation engaged with experts in the sphere of the cardiovascular healthcare system to explore pathways to more effectively address secondary prevention for high-risk CVD in Alberta.[45] One key

recommendation that was put forward during the deliberation was the need to review data sets and digital systems to examine what information exists, or could exist, to support the proactive identifications of high-risk CVD patients.[45]

Over the past decade, a number of provincial strategies have focused on the prevention of CVD in Alberta. In 2012, the CvHS SCN launched the *Vascular Risk Reduction Initiative* (VRR 1.0), which consisted of six pilot projects designed to address the interrelated causes of vascular disease and high prevalence of vascular risk in Alberta.[6] Table 2 provides an overview of the characteristics of these projects. The first four projects focused on primary prevention, including vascular risk factor screening, case finding, and early management. A fifth project targeted integration of vascular secondary prevention services, including consolidating services, improving access, and providing more integrated care.[6] This project identified several implementation challenges, including difficulties recruiting and retaining patients and limited data collection due to resource and process constraints. The final project focused on knowledge translation to promote common, consistent, and evidence-based messaging about vascular risk reduction.[6] Although there was limited formal evaluation of the impact of these initiatives, the pilot projects generally resulted in increased levels of screening, increased identification of high-risk patients, and improved care integration across healthcare providers and settings.[6] The CvHS SCN continues to prioritize the use of integrated approaches to the prevention and management of vascular risk and is in the process of developing future projects within VRR 2.0.

The CvHS SCN is also currently implementing the spread and scale of enhanced lipid reporting to primary care across the province, based on the findings of a VRR 1.0 pilot project (personal communication).[6] This initiative uses the FRS, recently included in the new provincial general laboratory requisition, to assess patients' 10-year CVD risk for primary prevention purposes. Physicians ordering a lipid profile complete the additional patient risk factor information needed to calculate the FRS on the laboratory requisition. Front-line laboratory staff input this information into the laboratory information system when patients present for lipid testing. A risk engine then automatically calculates the FRS when results of lipid profile tests become available. A lipid report is sent to the primary care physician. In addition, an algorithm for the FRS is being built into Connect Care, enabling access to this data for research purposes (personal communication). Although risk score calculation is not appropriate for secondary prevention patients, using similar approaches to linking information on patients' modifiable (e.g., BMI, smoking status, alcohol use) and non-modifiable risk factors (e.g., family history, ethnicity) with lipid values so that this information becomes available through Connect Care may provide an effective strategy to identify and monitor secondary prevention patients.

TABLE 2. CHARACTERISTICS OF ALBERTA'S SIX VRR 1.0 PROJECTS

Project type Project name	Objective	Start and end dates	Study design	Setting	Type of prevention Target population
Primary care Alberta Screening and Prevention (ASaP)	To implement a primary care-based case finding and preventive care program for patients presenting to primary care clinics	Jul 2013 to Dec 2014 Maintenance phase ongoing	Before-after Multicentre	Primary care	Primary prevention Adults
Community pharmacy Alberta Vascular Risk Reduction Community Pharmacy Project (RxEACH)	To implement a community pharmacy-based case finding and management program to engage with patients who would not otherwise present for screening and preventive care at primary care clinics	Jan 2014 to Sep 2015	RCT Multicentre	Community pharmacies	Mostly primary prevention Adults at high risk for CVD
Worksite	To implement a worksite-based screening and case management program to engage with patients who would not otherwise present for screening and preventive care at primary care clinics	Nov 2015 to Jun 2016	Before-after Single site	Worksite (newsprint company)	Primary prevention Adult employees
Enhanced lipid reporting	To implement a laboratory-based cardiovascular risk assessment program using Framingham Risk Scores and provide clinical treatment recommendations for patients undergoing lipid testing as recommended by primary care physicians.	Oct 2014 to Nov 2015	Before-after Multicentre	Primary care and laboratory services	Primary prevention in patients undergoing routine lipid testing Adults at high risk for CVD
Integrated approaches	To integrate vascular secondary prevention services in order to consolidate services, improve access, and provide more integrated care	Dec 2013 to Oct 2015	Before-after Multicentre	Secondary care	Mostly secondary prevention Primarily adults at high risk for vascular disease with a history of previous vascular events
Knowledge translation	To widely disseminate and provide common, consistent, evidence-based messaging regarding vascular risk reduction	Aug 2013 to Jul 2015	NA	NA	Primary prevention Educational materials for healthcare providers, patients, and the public

CVD: cardiovascular disease; NA: not applicable; RCT: randomized controlled trial; VRR: vascular risk reduction

Adapted from: Institute of Health Economics. *Optimizing vascular risk reduction initiatives in Alberta: A clinical review and economic analysis.* Edmonton (AB): Institute of Health Economics; 2020.

Using Provincial Data Assets to Inform Treatment Strategies

Although numerous lipid-lowering drugs are available to treat hypercholesterolemia, there is considerable variability across patients in their response and tolerance to therapy.[45] Less than 50% of patients with pre-existing CVD achieve their lipid targets with statin therapy, demonstrating an unmet need for effective lipid-lowering drugs for high-risk ASCVD.[45] Adherence also remains a barrier to effective management, as approximately half of patients discontinue statin treatment within the first year, and adherence decreases over time.[46]

Newer investigational drugs, such as inclisiran, an siRNA therapy, have been developed to reduce LDL-C levels in patients with hypercholesterolemia. Due to the cost of this drug, it is anticipated that inclisiran will most likely be targeted to patients who are intolerant to statin therapy, not adherent to their statin therapy, or are unable to reach their LDL-C targets despite maximum tolerated statin therapy.[45] Inclisiran is administered as a 6-month maintenance dose, which may provide an advantage for patients who are not adherent to statins.[47]

Data assets may be leveraged to select treatment candidates for newer agents and monitor their outcomes, with the aim of reducing risk of secondary cardiovascular events and mortality and providing potential cost savings to the healthcare system. The NHS has recently entered into an agreement with Novartis to use a population health management approach to identify and provide access to inclisiran treatment to high-risk patients for the secondary prevention of ASCVD in primary care settings.[48] It is expected that approximately 300,000 patients at high risk of a second cardiovascular event will be treated with inclisiran over the next three years.[48] Patients who have a history of specific cardiovascular events (acute coronary syndrome, coronary or other arterial revascularization procedures, coronary heart disease, ischaemic stroke, or peripheral artery disease) and have persistently elevated LDL-C levels (2.5 mmol/l) despite maximum tolerated statin therapy will be eligible for inclisiran therapy.[48] Novartis, the NHS Accelerated Access Collaborative, and the Academic Health Science Network (supported by NHS Digital) will work in collaboration to proactively identify, treat, and monitor these eligible individuals who are at highest risk of recurrent cardiac events.[48]

There are opportunities for Alberta to leverage its extensive health system data repositories to address the burden of CVD in secondary prevention patients building on successful examples of government-industry collaborations, such as in the United Kingdom. For such initiatives, where value or appropriateness are being evaluated, it is important to have third party involvement to ensure independence and objectivity of analyses from both the payor and the innovative company.

Next Steps

For data sources to be effective in identifying individual high-risk patients and tracking their outcomes, it is critical to address current information gaps in provincial data assets. Potential strategies for addressing the current information gaps in data assets will be explored in future roundtable deliberation with relevant stakeholders during the next phase of this project.

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