

Calgary Equity Index

Methodology Documentation

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CALGARY EQUITY INDEX METHODOLOGY

1.0 Background

The Calgary Equity Index (CEI) was developed based on the World Health Organization (WHO)'s Urban Health Equity Assessment and Response Tool (HEART) framework. The Urban HEART is a place-based tool for measuring equity at the neighbourhood level. The tool was initially designed by the World Health Organization (WHO) in 2010 in response to the WHO Commission on Social Determinants of Health Report (2008) which called for the need to identify and analyze inequities in health between people living in various parts of cities or belonging to different socioeconomic groups within and across cities. The Urban HEART framework is derived from research on Social Determinants of Health. Social Determinants of Health are a range of interacting social and economic factors that influence people's health and well-being.

The Urban HEART can aid in decision making on strategies, interventions, and actions to reduce health inequities in cities. While the tool was originally envisioned to be used to assess inequity and plan collective responses for cities in low- and middle-income countries, it has been applied and adapted across cities in high income countries such as Toronto (City of Toronto, 2014) and Ottawa (Ottawa Neighbourhood Equity Index, 2019) in Canada. For instance, the Urban HEART for Toronto, is a locally based adaptation of the WHO's Urban HEART that includes five different measurable domains that specifically relate to the well-being of residents in Toronto's neighbourhoods. These domains represent different policy areas that need to be addressed together to reduce neighbourhood health inequities.

The Calgary Equity Index is a locally based adaptation of the WHO's Urban HEART modelled after Toronto's Urban HEART framework. The Community Strategies Business Unit, formerly Calgary Neighbourhoods, within the City of Calgary, led the project to develop the first iteration of the CEI in 2018. The tool was internal until 2022, when it was updated to include more indicators and made available to the public. The 2022 version of the CEI included 20 indicators across 5 domains that affect overall health and wellbeing of Calgarians at level of Community Service Area (CSA). The domains were *Economic Opportunity, Human and Social Development, Governance and Civic Engagement, Physical Environment and Infrastructure, and Population Health*.

Each domain is composed of defined measurable indicators. The indicators for the CEI domains were chosen through a comprehensive development process involving consultation with experts internally within The City and external academic experts. The



expert feedback helped refine the indicator selection by addressing gaps in components, validating and clarifying concepts and indicators, and ensuring potential for application appropriate to the geographic context.

The CEI is a spatial measure that may be useful for monitoring and identifying areas with equity concerns across Calgary. Based on the equity concerns, areas may be then targeted for program, service, or infrastructure investment to enhance overall quality of life and wellbeing.

In 2024, the CEI underwent a second update, with the index receiving a substantial overhaul. The most recent update incorporates significantly more data, involving a review of over 100 potential indicators before selecting the final 61 indicators from sources like the 2021 Federal Census, internal City administrative data, and external propriety data. The 61 indicators are grouped across the following 6 domains: *Economic Opportunity, Human and Social Wellbeing, Community Belonging and Safety, Accessibility and Amenities, Population Health, and Climate and Environment*. The 2024 CEI also offers a more detailed view of local conditions by reporting data at the census tract level instead of CSAs. Census tracts are smaller, standard geographic areas defined by Statistics Canada that typically have fewer than 7,500 residents.

In addition to the changes in the indicators and domains, the reporting of the total equity and domain scores has been inverted, with higher values now indicating more overlapping concerns of inequity and need, while lower values indicate fewer equity concerns. Previous versions of the CEI reported higher values of the total equity score as representing greater equity.



2.0 Calgary Equity Index Development Process

The Calgary Equity Index (CEI) development process involved several steps, including selecting an appropriate geographical unit of analysis; selection of indicators; developing principles for examining indicators; determining the distribution cutoffs for indicator values; weighting indicators; and calculating the total equity score.

2.1 Geographical Unit of Analysis: Census Tracts

The CEI reports data at the census tract (CT) level. Previous versions used Community Service Areas (CSAs)—a custom geography created by combining multiple CTs. The switch to CTs was made to provide a more detailed and granular measure of equity in Calgary, enabling better community engagement and more focused need identification. Another reason for switching from CSAs to CTs is that CTs are a standardized geography established by Statistics Canada, making their data widely accessible, replicable, and compatible with past and future releases. This avoids the need for complex and costly geographic transformations.

How Census Tract Boundaries are Determined

CT boundaries are created by a committee of local specialists in cooperation with Statistics Canada, following these criteria:

- Boundaries must follow permanent and easily recognizable physical features (e.g., roads, major infrastructure).
- Populations typically range from 2,500 to 7,500 people, based on the most recent federal census.
- CTs aim to be as homogeneous as possible in socioeconomic characteristics, such as economic status and living conditions.
- The shape should be as compact as possible.

CTs Included in the CEI

The Calgary Equity Index includes 288 of Calgary's 290 CTs. Two CTs are excluded:

- CT 8250076.36: which reported a population of zero in 2021.
- CT 8250066.04: which exclusively represents the University of Calgary's main campus.

CT 8250050.2 is included but has incomplete data due to its small 2021 population (63 residents), which led to data suppression for some indicators. The Tsuut'ina Nation territory, partially located within Calgary, is not included in the CEI.



Mapping CTs to Municipal Boundaries

Equity and indicator scores are reported at the CT level and have been matched to Calgary communities and quadrants. The process of matching CTs to municipal boundaries is not perfect, as boundaries do not align identically. Thus, the process used to match CTs to communities and quadrants is as follows:

- A community is assigned to a CT if more than 20% of the CT's area falls within the community.
- A quadrant is assigned to a CT if more than 50% of its area falls within that quadrant.

Data is provided at the CT level, and corresponding community and quadrant details are also provided in the app and open data.

2.2. Selection of Indicators

The indicator selection process for the first iteration of the CEI (2018 version) involved broad consultation with experts, both internal within the City of Calgary and external from academia and civil society. The consultation process involved the design and administration of 3 levels of Delphi surveys. The surveys contained open ended questions that asked experts to consider if they wanted to measure equity in Calgary, what would they measure? Based on the indicators suggested in the first survey, the experts were asked again in a second survey to rank the indicators. Based on the ranking, a third survey was implemented where the experts were asked again to review the final list of indicators and suggest any changes.

The second update of the CEI (2024 version) involved an environmental scan of the latest literature on Social Determinants of Health and existing equity or wellbeing indices. This was followed by an extensive review of available data, resulting in the development of a list of over 100 potential indicators considered for inclusion in the CEI. Variables were then chosen based on their potential to describe the social conditions of Calgarians as they relate to equity and the social determinants of health. The final set of 61 variables were then selected based on the following criteria:

- *Data availability:* The data must be available at the census tract level and present for over 90% of the census tracts, ensuring no large amounts of missing data. This criterion helps maintain the integrity and comprehensiveness of the index across all geographical areas.
- *Robustness and appropriateness:* The selected variables must serve as appropriate measures, accurately representing the domains within which each variable is

grouped. To ensure reliability and reflect reality, a significant proportion of the population must be included in each measurement. With few exceptions, the data must be recent, dating from at least 2021. In some cases, data were aggregated over multiple years to provide a sufficiently large sample size.

- *Alignment with established models:* Variables were selected based on their proven effectiveness in other established equity index models and representation of the factors of Social Determinants of Health. Inspiration was drawn from various reputable sources, including: the Ottawa Neighbourhood Index; the Toronto Urban HEART model; the Metro Vancouver Social Equity model; Montreal's Living Environment Equity Index; the World Health Organization's Social Determinants of Health; the OECD's Better Life Index; and the Government of Canada's Quality of Life Framework.
- *Balance across domains:* The aim was to achieve a balanced representation of variables across all six domains. While data availability sometimes constrained this goal, conscious efforts were made to avoid overrepresentation of any single domain without excluding any important data.
- *Variance in the data:* For the model to effectively represent various levels of equity or inequity, there must be sufficient variation in the data across census tracts. Variables were selected based on their ability to differentiate between areas, ensuring that not all census tracts have the same score or value. By prioritizing variables with appropriate variance, we ensure that the index can accurately reflect the diverse equity landscape across Calgary, highlighting areas of both relative advantage and disadvantage.
- *Multicollinearity and correlation:* The selection process examined relationships between variables to ensure model accuracy and meaningful interpretation. Variables needed to be correlated, indicating their relevance to equity, but not highly correlated or multicollinear. High correlation or multicollinearity suggests that variables are measuring nearly the same thing, making the inclusion of all multicollinear variables redundant. Therefore, in cases of multicollinearity or correlation greater than 80%, we retained only one of the related variables.

2.3. List of Domains and Accompanying Indicators

To make the data easier to understand and analyze, the 61 indicators are grouped into six domains and then aggregated into six domain scores. Each domain is a combination of

related indicators that, together, provides a high-level view of different aspects of equity. The domains and their corresponding indicators are listed below and in Table 2.3.



2.3.1 Economic Opportunity

For communities to thrive and for individuals to enjoy a high quality of life, residents need to be economically secure. The following indicators are in the Economic Opportunity domain.

- *Core Housing Need Rate:* A household in core housing need is one whose dwelling is considered unsuitable, inadequate, or unaffordable and whose income levels are such that they could not afford alternative suitable and adequate housing in their community. Adequate housing is reported by their residents as not requiring any major repairs. Affordable housing has shelter costs equal to less than 30% of total before-tax household income. Suitable housing has enough bedrooms for the size and composition of resident households according to the National Occupancy Standard (NOS), conceived by the Canada Mortgage and Housing Corporation and provincial and territorial representatives.
 - *Owners in core housing need:* An owner household refers to a private household where some member of the household owns the dwelling, even if it is still being paid for.
 - *Renter in core housing need:* A renter household refers to private households where no member of the household owns their dwelling. The dwelling is considered to be rented even if no cash rent is paid.
- *Economic Dependency Ratio (Single-Parent Families):* The amount of government transfer payments received by single-parent families or persons not in census families, compared to their employment income. The Economic Dependency Ratio (EDR) measures how much families or individuals rely on government benefits relative to their earnings. For example, an EDR of 4.69 means that for every \$100 earned from employment, \$4.69 is received in government transfers.
- *Gender Income Ratio (After-Tax Median Income):* The ratio of after-tax median income between Men+ and Women+. A score closer to 1 means incomes are more equal. A score less than 1 indicates that Men+ earn more than Women+, and a score higher than 1 indicates that Women+ earn more than Men+. The + indicates that gender categories include non-binary persons.

- *Income Inequality Ratio (P90/P10)*: This ratio measures income inequality by comparing the income of households at the 90th and 10th percentiles of after-tax income. The 90th percentile is the income level where 90% of households earn less, and the 10th percentile is where 10% of households earn less. A higher P90/P10 ratio means a larger gap between high and low incomes, indicating greater income inequality.
- *Low-Income Measure After-Tax Rate*: A household is considered low-income if its after-tax income is less than 50% of the national median, adjusted for household size.
- *Low-income transit pass sales (Adult)*: Age-standardized rate of persons aged 18 years and over who accessed a low-income transit pass.
- *Non-Mortgage Consumer Debt*: Average value of non-mortgage consumer debt held by any person aged 18 and over who has received a non-mortgage credit product. Non-mortgage consumer debt is the total amount of money that individuals owe on loans and credit obligations that are not secured by a mortgage on real estate. For the CEI, data is aggregated at the census tract level using values at the postal code level. Note that the indicator level data does not appear in the Geographic Information System tool due to data licensing restrictions.
- *Part-Time or Part-Year Employment*: Persons aged 15 years and over who worked mostly part time (less than 30 hours per week) or 48 weeks or less during 2020.
- *Poverty*: Persons living in poverty based on the Market Basket Measure (MBM). The MBM establishes poverty thresholds based on the cost of a basket of food, clothing, shelter, transportation, and other items for a family of four that reflect a modest, basic standard of living. The MBM is later adjusted for different family sizes. A family with a disposable income below the appropriate MBM threshold for the size of the family and the region where they live is deemed to be living in poverty. MBM thresholds are calculated for different geographic regions.
- *Renter Households*: A household is considered to rent their dwelling if no member of the household owns the dwelling.
- *Seniors in Poverty*: Persons aged 65 years and older in poverty as determined by the Market Basket Measure (MBM). *See Poverty definition above.*
- *Social Assistance Benefits*: Persons aged 15 years and over, receiving social assistance benefits. Social assistance benefits may be used to cover the cost of food, shelter, clothing and other daily necessities. Other allowances may also be granted to

persons with special needs or circumstances, such as elderly persons, persons with disabilities, single-parent families and persons with barriers to employment.

- *Unemployment Rate*: The number of unemployed persons who are 15 years or older and in the labour force who are seeking work.
- *Working Poor, Excluding Students*: Persons aged 18 to 64 in working poverty. Working poverty is defined as individuals with an after-tax income below the Low-Income Measure (LIM-AT) and earning an annual individual working income of over \$3,000.
- *Youth Not in Employment, Education, or Training*: Persons aged 15 to 24 not enrolled in employment, education, or training.



2.3.2 Human and Social Wellbeing

For communities to be vibrant, diverse, and resilient, society needs to promote inclusion and equal access to opportunities for all groups. The following indicators are in the Human and Social Wellbeing domain.

- *Activity Limitation (Relative Severity)*: The relative severity of activity limitations among people who report having a limitation. Activity limitations include challenges with vision, hearing, mobility, cognition, or mental health, and are categorized by how frequently they occur (always, often, or sometimes). The percentage reflects the severity level within the population that has an activity limitation, not the entire population of the area. A higher percentage means a greater proportion of individuals with more severe limitations.
- *Children*: Persons that are children, aged 0 to 14 years old.
- *First Generation Immigrants*: Persons who are first generation immigrants. First generation includes persons who were born outside Canada. For the most part, these are people who are now, or once were, immigrants to Canada.
- *Indigenous Identity*: Persons that identify as Indigenous. Indigenous includes persons who identify as First Nations (North American Indian), Métis and/or Inuk (Inuit) and/or those who report being Registered or Treaty Indians (that is, registered under the Indian Act of Canada), and/or those who report having membership in a First Nation or Indian band.
- *No Certificate, Degree, or Diploma*: Persons aged 25 to 64 with no educational certificate, degree, or diploma. This includes individuals who have not completed high school.

- *No Knowledge of Official Languages:* Persons that speak neither English or French.
- *Recently Immigrated:* Persons who immigrated to Canada between 2016 and 2021. Immigrants includes persons who are, or who have ever been, landed immigrants or permanent residents.
- *Refugees:* Persons who are refugees. Refugees includes immigrants who were granted permanent resident status on the basis of a well-founded fear of returning to their home country and those who have claimed refugee status.
- *Second Generation Immigrants:* Persons who are second generation immigrants. Second generation includes persons who were born in Canada and had at least one parent born outside Canada. For the most part, these are the children of immigrants.
- *Seniors (aged 65+):* Persons that are seniors, aged 65 years and older.
- *Seniors Living Alone:* Persons aged 65 years and older that live alone in private households.
- *Single-Parent (Woman+) Households:* One-parent family households in which the parent is a Woman+. Woman+ includes women (and/or girls), as well as some non-binary persons.



2.3.3 Community Belonging and Safety

For communities to be safe and inclusive, residents need to be engaged and connected with one another. The following indicators are in the Community Belonging and domain.

- *Mobility Status:* Persons who moved 1 year prior to 2021. This includes individuals who moved within Calgary, moved within Alberta, moved from elsewhere in Canada, or who previously lived outside of Canada.
- *Municipal Voter Turnout Rate:* Percentage of eligible voters who voted in the 2021 civic election.
- *Person Crime Rate:* The occurrence of all violent incidents such as assault, homicide, robbery, criminal negligence, domestic-related incidents, and other person related crimes, for every 100,000 persons.
- *Physical Disorder Rate:* The occurrence of physical disorders including property damage and abandoned vehicles, for every 100,000 persons.

- *Property Crime Rate*: The occurrence of all property crime including break and enter, fraud, theft, vehicle theft and other property crimes (i.e. altering/removing VIN, vehicle damage, mischief, arson), for every 100,000 persons.
- *Sense of Belonging to Local Community*: Persons who somewhat strongly or very strongly agree that they have a sense of belonging to their local community (from the Canadian Community Health Survey).
- *Social Disorder Rate*: The occurrence of all social disorders, including drunk, disturbance, indecent act, landlord/tenant dispute, mental health concerns, neighbourhood disputes, party complain, suspicious person, threats, drugs, noise complaints, and other disorderly crime, for every 100,000 persons.



2.3.4 Accessibility and Amenities

For communities to be desirable and empower residents to fully participate in community life, they need to have good accessibility and amenities. The surroundings of where we live have a strong impact on our well-being. The following indicators are in the Accessibility and Amenities domain.

- *Commute to Work by Transit*: Persons aged 15 years and over who are employed and in the labour force that use transit as their main mode of commuting to their usual place of work.
- *Commute to Work by Vehicle*: Persons aged 15 years and over who are employed and in the labour force that use a vehicle (either as the driver or passenger) as their main mode of commuting to their usual place of work.
- *Commute to Work Time*: Average commuting time (minutes) required by a person to travel to their place of work (all modes of transportation).
- *Proximity to Childcare*: Measures the closeness of a dissemination block to any dissemination block with a childcare facility within a walking distance of 1.5 km. For this tool, data is aggregated at the census tract level based on dissemination block population weights.
- *Proximity to Grocery Store*: Measures the closeness of a dissemination block to any dissemination block with a grocery store within a walking distance of 1 km. For this tool, data is aggregated at the census tract level based on dissemination block population weights.

- *Proximity to Healthcare:* Measures the closeness of a dissemination block to any dissemination block with a health care facility within a driving distance of 3 km. For this tool, data is aggregated at the census tract level based on dissemination block population weights.
- *Proximity to Library:* Measures the closeness of a dissemination block to any dissemination block with a library within a 1.5 km walking distance. For this tool, data is aggregated at the census tract level based on dissemination block population weights.
- *Proximity to Neighbourhood Parks:* Measures the closeness of a dissemination block to any dissemination block with a neighborhood park within a 1 km walking distance. For this tool, data is aggregated at the census tract level based on dissemination block population weights.
- *Proximity to Pharmacies:* Measures the closeness of a dissemination block to any dissemination block with a pharmacy or a drug store within a walking distance of 1 km. For this tool, data is aggregated at the census tract level based on dissemination block population weights.
- *Proximity to Primary Education:* Measures the closeness of a dissemination block to any dissemination block with a primary school within a walking distance of 1.5 km. For this tool, data is aggregated at the census tract level based on dissemination block population weights.
- *Proximity to Secondary Education:* Measures the closeness of a dissemination block to any dissemination block with a secondary school within a walking distance of 1.5 km. For this tool, data is aggregated at the census tract level based on dissemination block population weights.
- *Spatial Access to Primary and Secondary Education:* Measures the ease of reaching primary and secondary educational facilities via walking from an origin dissemination block. For this tool, data is aggregated at the census tract level based on dissemination block population weights.
- *Transit Score®:* The Transit Score® from WalkScore.com measures transit availability and the “usefulness” of transit routes which captures the distance to the nearest stop, transit frequency, and type of route.

- *Walk Score®*: Walk Score® is a publicly available, externally validated tool used in cities across the world. Walk Score® analyzes walking paths and routes to nearby facilities and amenities from a location, then assigns a score which illustrates the walkability of locations.



2.3.5 Population Health

For residents to actively participate in their community, local economy, and daily life, it is essential that they maintain good health and well-being. The following indicators are in the Population Health domain.

- *Chronic obstructive pulmonary disease (COPD) prevalence*: Age standardized percentage of the population aged 35 years and older with COPD.
- *Diabetes prevalence*: Age standardized percentage of the total population with diabetes (not including gestational diabetes).
- *Has a Regular Health Care Provider*: Persons with a regular healthcare provider.
- *Mental illness prevalence*: Age standardized percentage of the population with mental illness.
- *Self-perceived health*: The proportion of individuals over the age of 12 who reported perceiving their own health status as being either very good or excellent.
- *Self-perceived mental health*: The proportion of individuals over the age of 12 who reported perceiving their own mental health status as being either very good or excellent.



2.3.6 Climate and Environment

For communities to foster healthier living conditions and build resilience to climate change, it is essential to address environmental issues and promote sustainable practices. The following indicators are in the Climate and Environment domain.

- *Flood Susceptibility Score*: Flood susceptibility indicate areas that is prone to flooding based on major Canadian flood events since the 1970s. For this tool, average values of the Flood Susceptibility Index are calculated at the census tract level.
- *Land Surface Temperature*: An estimate of satellite-derived surface temperature and represents a snapshot in time and does not show the highest recorded

temperatures or average temperatures over time. For this tool, average temperature is calculated at the census tract level.

- *Noise Pollution Score:* The number of noise points such as airports, runways, helipads, railroads, fire and ambulance stations and major roads within a 1km radius of dissemination blocks. For this tool, data is aggregated at the census tract level based on dissemination block population weights.
- *Share of Park Area:* Percentage of the total area that is covered by parks including City parks, provincial parks, and most publicly accessible school sites.
- *Tree Canopy:* Percentage of tree coverage over land area.
- *Tree Density:* Number of trees on public land per square kilometer.

Table 2.3 CEI Indicators (2024)

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
<i>Economic Opportunity - For communities to thrive, residents need to be economically secure.</i>			
Core housing need rate <ul style="list-style-type: none"> • Owners in core housing need • Renters in core housing need 	<p>A household in core housing need is one whose dwelling is considered unsuitable, inadequate or unaffordable and whose income levels are such that they could not afford alternative suitable and adequate housing in their community.</p> <p>Owner households are those where some member of the household owns the dwelling, even if it is still being paid for.</p> <p>Renter households are those where no member of the household owns their dwelling. The dwelling is considered to be rented even if no cash rent is paid.</p>	Statistics Canada, Federal Census (2021)	<p>Core housing need, Owner</p> <ul style="list-style-type: none"> • Range across census tracts: 0 – 19.4% • Calgary average: 5.7% <p>Core housing need, Renter</p> <ul style="list-style-type: none"> • Range across census tracts: 0 – 50.0% • Calgary average: 17.0%
Economic dependency ratio (single-parent families)	The amount of government transfer payments received by single-parent families or persons not in census families, compared to their employment income. The	Statistics Canada, Taxfile T1FF (2019)	<p>Range across census tracts: \$7.10 - \$118.20</p> <p>Calgary average: \$34.40</p>

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
	Economic Dependency Ratio (EDR) measures how much families or individuals rely on government benefits relative to their earnings.		
Gender income ratio	The ratio of after-tax median income between Men+ and Women+. A score closer to 1 means incomes are more equal. A score less than 1 indicates that Men+ earn more than Women+, and a score higher than 1 indicates that Women+ earn more than Men+. <i>The + indicates that gender categories include non-binary persons.</i>	Statistics Canada, Federal Census (2021)	Range across census tracts: 0.5 - 1 Calgary average: 0.8
Income inequality ratio (P90/P10)	The P90/P10 measures income inequality by comparing the income of households at the 90th and 10th percentiles of after-tax income. The 90th percentile is the income level where 90% of households earn less, and the 10th percentile is where 10% of households earn less.	Statistics Canada, Federal Census (2021)	Range across census tracts: 2.6 - 13.7 Calgary average: 4.0

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
	A higher P90/P10 ratio means a larger gap between high and low incomes, indicating greater income inequality.		
Low-income measure after-tax rate (LIM-AT)	A household is considered low-income if its after-tax income is less than 50% of the national median, adjusted for household size.	Statistics Canada, Federal Census (2021)	Range across census tracts: 3.0 - 29.2% Calgary average: 8.9%
Low-income transit pass sales (Adult)	Age-standardized rate of persons aged 18 years and over who accessed a low-income transit pass.	City of Calgary (2022)	Range across census tracts: 0.2 - 35.3% Calgary average: 5.4%
Non-Mortgage Consumer Debt <i>Note that the indicator level data does not appear in the Geographic Information System tool due to data licensing restrictions.</i>	Average value of non-mortgage consumer debt held by any person aged 18 and over who has received a non-mortgage credit product. Non-mortgage consumer debt is the total amount of money that individuals owe on loans and credit obligations that are not secured by a mortgage on real estate. For the CEI, data is aggregated at the census tract level using values at the postal code level.	TransUnion (2019)	x

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
Part-Time or Part-Year Employment	Persons aged 15 years and over who worked mostly part time (less than 30 hours per week) or 48 weeks or less during 2020.	Statistics Canada, Federal Census (2021)	Range across census tracts: 36.5 - 60.4% Calgary average: 47.8%
Poverty	The MBM establishes poverty thresholds based on the cost of a basket of food, clothing, shelter, transportation, and other items for a family of four that reflect a modest, basic standard of living. The MBM is later adjusted for different family sizes. A family with a disposable income below the appropriate MBM threshold for the size of the family and the region where they live is deemed to be living in poverty. MBM thresholds are calculated for different geographic regions.	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 26.5% Calgary average: 8.6%
Renter Households	A household is considered to rent their dwelling if no member of the household owns the dwelling.	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 – 100% Calgary average: 27.6%
Seniors in Poverty	aged 65 years and older in poverty as determined by the Market	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 21.2%

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
	Basket Measure (MBM). <i>See Poverty definition above.</i>		Calgary average: 4.3%
Social Assistance Benefits	Persons aged 15 years and over receiving social assistance benefits. Social assistance benefits may be used to cover the cost of food, shelter, clothing and other daily necessities. Other allowances may also be granted to persons with special needs or circumstances, such as elderly persons, persons with disabilities, single-parent families and persons with barriers to employment.	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 17.2% Calgary average: 3.0%
Unemployment Rate	The number of unemployed persons who are 15 years or older and in the labour force who are seeking work.	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 27.3% Calgary average: 12.6%
Working Poor, Excluding Students	Persons aged 18 to 64 in working poverty. Working poverty is defined as individuals with an after-tax income below the Low-Income Measure (LIM-AT) and earning an annual individual working income of over \$3,000.	Statistics Canada, Taxfile T1FF (2022)	Range across census tracts: 0 - 12.8% Calgary average: 6.4%

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
Youth Not in Employment, Education, or Training	Persons aged 15 to 24 not enrolled in employment, education, or training.	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 32.1% Calgary average: 12.1%
<i>Human and Social Wellbeing - For communities to be vibrant, diverse, and resilient, society needs to promote inclusion and equal access to opportunities for all groups.</i>			
Activity Limitation (Relative Severity)	The relative severity of activity limitations among people who report having a limitation. Activity limitations include challenges with vision, hearing, mobility, cognition, or mental health, and are categorized by how frequently they occur (always, often, or sometimes). The percentage reflects the severity level within the population that has an activity limitation, not the entire population of the area. A higher percentage means a greater proportion of individuals with more severe limitations.	Statistics Canada, Federal Census (2021)	Range across census tracts: 53.2 - 100% Calgary average: 62.4%
Children	Persons that are children, aged 0 to 14 years old.	Statistics Canada, Federal Census (2021)	Range across census tracts: 4.3 - 34.5% Calgary average: 17.7%

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
First Generation Immigrants	Persons who are first generation immigrants. First generation includes persons who were born outside Canada. For the most part, these are people who are now, or once were, immigrants to Canada.	Statistics Canada, Federal Census (2021)	Range across census tracts: 12.4 - 71.3% Calgary average: 35.3%
Indigenous Identity	Persons that identify as Indigenous. Indigenous includes persons who identify as First Nations (North American Indian), Métis and/or Inuk (Inuit) and/or those who report being Registered or Treaty Indians (that is, registered under the Indian Act of Canada), and/or those who report having membership in a First Nation or Indian band.	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 12.5% Calgary average: 3.3%
No Certificate, Degree, or Diploma	Persons aged 25 to 64 with no educational certificate, degree, or diploma. This includes individuals who have not completed high school.	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 29.6% Calgary average: 7.4%
No Knowledge of Official Languages	Persons that speak neither English or French.	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 10.7% Calgary average: 2.4%

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
Recently Immigrated	Persons who immigrated to Canada between 2016 and 2021. Immigrants includes persons who are, or who have ever been, landed immigrants or permanent residents.	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 22.5% Calgary average: 5.9%
Refugees	Persons who are refugees. Refugees includes immigrants who were granted permanent resident status on the basis of a well-founded fear of returning to their home country and those who have claimed refugee status.	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 17.6% Calgary average: 4.1%
Second Generation Immigrants	Persons who are second generation immigrants. Second generation includes persons who were born in Canada and had at least one parent born outside Canada. For the most part, these are the children of immigrants.	Statistics Canada, Federal Census (2021)	Range across census tracts: 14.9 - 32.1% Calgary average: 21.7%
Seniors (aged 65+)	Persons that are seniors, aged 65 years and older.	Statistics Canada, Federal Census (2021)	Range across census tracts: 3.6 - 43.4% Calgary average: 14.2%

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
Seniors Living Alone	Persons aged 65 years and older that live alone in private households.	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 68.2% Calgary average: 21.6%
Single-Parent (Woman+) Households	One-parent family households in which the parent is a Woman+. Woman+ includes women (and/or girls), as well as some non-binary persons.	Statistics Canada, Federal Census (2021)	Range across census tracts: 4.5 - 33.3% Calgary average: 11.5%
<i>Community Belonging and Safety - For communities to be safe and inclusive, residents need to be engaged and connected with one another.</i>			
Mobility Status	Persons who moved 1 year prior to 2021. This includes individuals who moved within Calgary, moved within Alberta, moved from elsewhere in Canada, or who previously lived outside of Canada.	Statistics Canada, Federal Census (2021)	Range across census tracts: 1.5 - 100% Calgary average: 13.7%
Municipal Voter Turnout Rate	Percentage of eligible voters who voted in the 2021 civic election.	City of Calgary (2021)	Range across census tracts: 23.4 - 61.7% Calgary average: 44.3%
Person Crime Rate	The occurrence of all violent incidents such as assault, homicide, robbery, criminal negligence, domestic-related	Calgary Police Service (2022)	Range across census tracts: 48.8 - 8,079.5 Calgary average: 787.6

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
	incidents, and other person related crimes, for every 100,000 persons.		
Physical Disorder Rate	The occurrence of physical disorders including property damage and abandoned vehicles, for every 100,000 persons.	Calgary Police Service (2022)	Range across census tracts: 0 – 10,596 Calgary average: 536.9
Property Crime Rate	The occurrence of all property crime including break and enter, fraud, theft, vehicle theft and other property crimes (i.e. altering/removing VIN, vehicle damage, mischief, arson), for every 100,000 persons.	Calgary Police Service (2022)	Range across census tracts: 370.9 - 126,622.5 Calgary average: 3,896.5
Sense of Belonging to Local Community	Persons who somewhat strongly or very strongly agree that they have a sense of belonging to their local community (from the Canadian Community Health Survey).	Statistics Canada, Canadian Community Health Survey (2015 - 2021)	Range across census tracts: 27.8 - 98.8% Calgary average: 68.8%
Social Disorder Rate	The occurrence of all social disorders, including drunk, disturbance, indecent act, landlord/tenant dispute, mental health concerns, neighbourhood disputes, party complain,	Calgary Police Service (2022)	Range across census tracts: 573.3 - 88,609.3 Calgary average: 6,385.2

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
	suspicious person, threats, drugs, noise complaints, and other disorderly crime, for every 100,000 persons.		
<i>Accessibility and Amenities - For communities to be desirable and empower residents to fully participate in community life, they need to have good accessibility and amenities.</i>			
Commute to Work by Transit	Persons aged 15 years and over who are employed and in the labour force use transit as their main mode of commuting to their usual place of work.	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 29.8% Calgary average: 8.5%
Commute to Work by Vehicle	Persons aged 15 years and over who are employed and in the labour force use a vehicle (either as the driver or passenger) as their main mode of commuting to their usual place of work.	Statistics Canada, Federal Census (2021)	Range across census tracts: 38.9 - 100% Calgary average: 83.5%
Commute to Work Time	Average commuting time (minutes) required by a person to travel to their place of work (all modes of transportation).	Statistics Canada, Federal Census (2021)	Range across census tracts: 0 - 30.6 minutes Calgary average: 25.1 minutes
Proximity to Childcare	Measures the closeness of a dissemination block to any dissemination block with a	Statistics Canada, Proximity Measures Database (2021)	Range across census tracts: 0 - 0.7 Calgary average: 0.2

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
	childcare facility within a walking distance of 1.5 km. For this tool, data is aggregated at the census tract level based on dissemination block population weights.		
Proximity to Grocery Store	Measures the closeness of a dissemination block to any dissemination block with a grocery store within a walking distance of 1 km. For this tool, data is aggregated at the census tract level based on dissemination block population weights.	Statistics Canada, Proximity Measures Database (2021)	Range across census tracts: 0 - 0.5 Calgary average: 0.1
Proximity to Healthcare	Measures the closeness of a dissemination block to any dissemination block with a health care facility within a driving distance of 3 km. For this tool, data is aggregated at the census tract level based on dissemination block population weights.	Statistics Canada, Proximity Measures Database (2021)	Range across census tracts: 0 - 0.8 Calgary average: 0.1
Proximity to Library	Measures the closeness of a dissemination block to any dissemination block with a library within a 1.5 km walking distance. For this tool, data is aggregated at	Statistics Canada, Proximity Measures Database (2021)	Range across census tracts: 0 - 0.4 Calgary average: 0.0

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
	the census tract level based on dissemination block population weights.		
Proximity to Neighbourhood Parks	Measures the closeness of a dissemination block to any dissemination block with a neighborhood park within a 1 km walking distance. For this tool, data is aggregated at the census tract level based on dissemination block population weights.	Statistics Canada, Proximity Measures Database (2021)	Range across census tracts: 0 - 0.5 Calgary average: 0.2
Proximity to Pharmacies	Measures the closeness of a dissemination block to any dissemination block with a pharmacy or a drug store within a walking distance of 1 km. For this tool, data is aggregated at the census tract level based on dissemination block population weights.	Statistics Canada, Proximity Measures Database (2021)	Range across census tracts: 0 - 0.3 Calgary average: 0.0
Proximity to Primary Education	Measures the closeness of a dissemination block to any dissemination block with a primary school within a walking distance of 1.5 km. For this tool, data is aggregated at the census tract	Statistics Canada, Proximity Measures Database (2021)	Range across census tracts: 0 - 0.3 Calgary average: 0.1

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
	level based on dissemination block population weights.		
Proximity to Secondary Education	Measures the closeness of a dissemination block to any dissemination block with a secondary school within a walking distance of 1.5 km. For this tool, data is aggregated at the census tract level based on dissemination block population weights.	Statistics Canada, Proximity Measures Database (2021)	Range across census tracts: 0 - 0.5 Calgary average: 0.1
Spatial Access to Primary and Secondary Education	Measures the ease of reaching primary and secondary educational facilities via walking from an origin dissemination block. For this tool, data is aggregated at the census tract level based on dissemination block population weights.	Spatial Access Measures, Statistics Canada	Range across census tracts: 0 - 0.8 Calgary average: 0.3
Transit Score®	The Transit Score® from WalkScore.com measures transit availability and the “usefulness” of transit routes which captures the distance to the nearest stop, transit frequency, and type of route.	Walkscore® (2023)	Range across census tracts: 3.9 - 82 Calgary average: 44.5

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
Walk Score®	The Walk Score® is a publicly available, externally validated tool used in cities across the world. Walk Score® analyzes walking paths and routes to nearby facilities and amenities from a location, then assigns a score which illustrates the walkability of locations.	Walkscore® (2023)	Range across census tracts: 1.1 - 98.9 Calgary average: 50.6
<i>Population Health - For residents to actively participate in their community, local economy, and daily life, it is essential that they maintain good health and well-being.</i>			
Chronic obstructive pulmonary disease (COPD) prevalence	Age standardized percentage of the population aged 35 years and older with COPD.	Alberta Health Services (2015 - 2020)	Range across census tracts: 0.2 - 4.6% Calgary average: 1.3%
Diabetes prevalence	Age standardized percentage of the total population with diabetes (not including gestational diabetes).	Alberta Health Services (2015 - 2020)	Range across census tracts: 2.3 - 11.4% Calgary average: 5.8%
Has a Regular Health Care Provider	Persons with a regular healthcare provider.	Statistics Canada, Canadian Community Health Survey (2015 - 2021)	Range across census tracts: 67.8 - 100% Calgary average: 87.5%

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
Mental illness prevalence	Age standardized percentage of the population with mental illness.	Alberta Health Services (2015 - 2020)	Range across census tracts: 2.8 - 24.1% Calgary average: 15.6%
Self-perceived health	The proportion of individuals over the age of 12 who reported perceiving their own health status as being either very good or excellent.	Statistics Canada, Canadian Community Health Survey (2015 - 2021)	Range across census tracts: 38.4 - 92.5% Calgary average: 66.9%
Self-perceived mental health	The proportion of individuals over the age of 12 who reported perceiving their own mental health status as being either very good or excellent.	Statistics Canada, Canadian Community Health Survey (2015 - 2021)	Range across census tracts: 40.9 - 87.5% Calgary average: 69.1%
<i>Climate and Environment - For communities to foster healthier living conditions and build resilience to climate change, it is essential to address environmental issues and promote sustainable practices.</i>			
Flood Susceptibility Score	Flood susceptibility indicate areas that is prone to flooding based on major Canadian flood events since the 1970s. For this tool, average values of the Flood Susceptibility Index are calculated at the census tract level.	Calculated by the City of Calgary (2023), original data from Flood Susceptibility Score (FSI), Natural Resources Canada (2022)	Range across census tracts: 4.0 - 59.8 Calgary average: 8.0

INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
Land Surface Temperature	This variable is an estimate of satellite-derived surface temperature and represents a snapshot in time and does not show the highest recorded temperatures or average temperatures over time. For this tool, average temperature is calculated at the census tract level.	City of Calgary (2022)	Range across census tracts: 14.3 - 28.6 Calgary average: 25.9
Noise Pollution Score	The number of noise points such as airports, runways, helipads, railroads, fire and ambulance stations and major roads within a 1km radius of dissemination blocks. For this tool, data is aggregated at the census tract level based on dissemination block population weights.	HealthyPlan.City (2022)	Range across census tracts: 1.9 - 36.3 Calgary average: 7.2
Share of Park Area	Percentage of the total area that is covered by parks including City parks, provincial parks, and most publicly accessible school sites.	City of Calgary (2023)	Range across census tracts: 0 - 86.5% Calgary average: 15.6%
Tree Canopy	Percentage of tree coverage over land area.	City of Calgary (2022)	Range across census tracts: 0.4 - 37.6% Calgary average: 10.9%



INDICATOR	DESCRIPTION	SOURCE	SUMMARY STATISTICS
Tree Density	Number of trees on public land per square kilometer.	City of Calgary (2022)	Range across census tracts: 15.4 - 3,694.7 Calgary average: 1,100.9

2.4. Overlay Data

To provide additional context, the CEI application includes overlay data that are not part of the index calculations. The overlay data can be mapped alongside CEI scores and includes sociodemographic characteristics from the 2021 Federal Census, results from the latest Fall Survey of Calgarians (2023), and other administrative sources.

2.4.1 Sociodemographic Data

The CEI app presents the following sociodemographic data at the census tract level:

- *Population (2016)*: Total population in 2016.
- *Population (2021)*: Total population in 2021.
- *Population Change (2016 to 2021)*: Population percentage change from 2016 to 2021. Note that some census tracts had very little to no population in 2016 and thus have exhibited a large percentage change in population growth for 2021.
- *Population Density*: The number of persons (total population) per square kilometre.
- *Average Age of Population*: The average age of the population based on the age of persons as of their last birthday.
- *Children and Youth in Poverty*: Persons aged 0 to 17 years living in poverty based on the Market Basket Measure (MBM). The MBM establishes poverty thresholds based on the cost of a basket of food, clothing, shelter, transportation, and other items for a family of four that reflect a modest, basic standard of living. The MBM is later adjusted for different family sizes. A family with a disposable income below the appropriate MBM threshold for the size of the family and the region where they live is deemed to be living in poverty. MBM thresholds are calculated for different geographic regions.
- *First Nations Identity*: Persons who identify as First Nations (North American Indian) and/or those who have membership in a First Nation or Indian band.
- *Metis Identity*: Persons who identify as Métis.
- *Visible Minority*: Persons, other than Indigenous peoples, who are non-Caucasian in race or non-white in colour. The visible minority population consists mainly of the following groups: South Asian, Chinese, Black, Filipino, Arab, Latin American, Southeast Asian, West Asian, Korean and Japanese.
- *Bachelor's Degree or Higher*: Persons aged 25 to 64 who have obtained a bachelor's degree, or a certificate, diploma or degree that typically has a bachelor's degree as a prerequisite, from a degree-granting institution or higher. This includes persons who obtained a bachelor's degree; a degree in medicine, dentistry, veterinary

medicine or optometry; a master's degree; or an earned doctorate. It also includes persons who have obtained a university certificate or diploma above the bachelor level.

- *Youth Low-Income Transit Pass Sales Rate*: Age-standardized rate of persons under the age of 18 years who accessed a low-income transit pass.
- *Private Dwellings (2021)*: Total number of private dwellings. Private dwelling refers to a separate set of living quarters with a private entrance either from outside the building or from a common hall, lobby, vestibule or stairway inside the building. The entrance to the dwelling must be one that can be used without passing through the living quarters of some other person or group of persons. A private dwelling is one in which a person or a group of persons is permanently residing (usual residents).
- *Average Household Size*: The average number of persons living in a private household.
- *Owner Households*: A private household where some member of the household owns the dwelling, even if it is still being paid for.
- *Median After-Tax Household Income*: Median income level from all household members, after income taxes and deductions. After-tax income is the total income less income taxes for the 2020 calendar year. Median income is the amount that divides the after-tax household income distribution of a population group in two halves; the median is the middle amount. A household refers to a person or group of persons who occupy the same dwelling and do not have a usual place of residence elsewhere in Canada or abroad. The household may consist of a family group such as a census family, of two or more families sharing a dwelling, of a group of unrelated persons or of a person living alone.
- *Households Spending 50% or More of Income on Shelter*: Households who spend 50% or more of their average monthly total income on average monthly shelter costs. Shelter costs for owner households include, where applicable, mortgage payments, property taxes and condominium fees, along with the costs of electricity, heat, water and other municipal services. For renter households, shelter costs include, where applicable, the rent and the costs of electricity, heat, water and other municipal services. For households living in a dwelling provided by the local government, First Nation or Indian band, shelter costs include, where applicable, the monthly use or occupancy payment and the costs of electricity, heat, water and other municipal services.
- *Households in Energy Poverty*: Estimate of the number of households in energy poverty in Calgary using a dual criteria metric that classifies households in energy poverty based on their estimated energy expenditure to income ratio and their ability to afford the Market Basket Measure (MBM) threshold for Calgary in 2023. The MBM is based on the cost of a specific basket of goods and services

representing a modest, basic standard of living for a reference family. This is a pilot measurement calculated by The City's Climate and Environment Business Unit.

- *Multigenerational Households*: Households with three or more generations. These households contain at least one person who is both the grandparent of a person in the household and the parent of another person in the same household.
- *Detached Private Dwellings*: A single dwelling not attached to any other dwelling or structure (except its own garage or shed). A single-detached house has open space on all sides and has no dwellings either above it or below it. A mobile home fixed permanently to a foundation is also classified as a single-detached house.
- *Semi-Detached or Row Houses*: Semi-Detached dwellings are one of two dwellings attached side by side (or back-to-back) to each other, but not attached to any other dwelling or structure (except its own garage or shed). A semi-detached dwelling has no dwellings either above it or below it, and the two units together have open space on all sides. Row houses are one of three or more dwellings joined side by side (or occasionally side to back), such as a townhouse or garden home, but not having any other dwellings either above or below. Townhouses attached to a high-rise building are also classified as row houses.
- *Apartments*: One of two dwellings, located one above the other, may or may not be attached to other dwellings or buildings.
- *Bike Score®*: Bike Score® is a publicly available, externally validated tool used in cities across the world. It measures whether a location is good for biking based on four equally weighted components (bike lanes, hills, destinations and destinations and road connectivity).

2.4.2 Survey of Calgarians

The following data from the Fall 2023 Survey of Calgarians are presented at the ward level:

- *I am proud to live in my neighbourhood*: Percentage of respondents from the Fall 2023 Survey of Calgarians who agreed they were proud to live in their neighborhood (top 4 ratings on a scale of 1 to 10).
- *I feel or would feel safe walking alone in my neighbourhood after dark*: Percentage of respondents from the Fall 2023 Survey of Calgarians who indicated they feel or would feel very or reasonably safe walking alone in their neighbourhood after dark.
- *I am regularly involved in neighbourhood and local community events*: Percentage of respondents from the Fall 2023 Survey of Calgarians who agreed they are regularly involved in neighbourhood and local community events (top 4 ratings on a scale of 1 to 10).
- *Calgary is safe for all residents and visitors, regardless of ethnicity, race, religion, income, or sexual identity*: Percentage of respondents from the Fall 2023 Survey of Calgarians

who agreed that Calgary is safe for all residents and visitors, regardless of things like ethnicity, race, religion, income, or sexual identity (top 4 ratings on a scale of 1 to 10).

- *The City allows Calgarians to have meaningful input into decision making:* Percentage of respondents from the Fall 2023 Survey of Calgarians who strongly or somewhat agree that The City allows citizens to have meaningful input into decision-making.
- *I think we need to act now to address climate change:* Percentage of respondents from the Fall 2023 Survey of Calgarians who agreed that we need to act now to address climate change (top 4 ratings on a scale of 1 to 10).
- *My overall quality of life in Calgary is good:* Percentage of respondents from the Fall 2023 Survey of Calgarians who agreed that their overall quality of life in Calgary is good (top 4 ratings on a scale of 1 to 10).

2.5 Weight Indicators to Create a Total Equity Score

After selecting the final list of indicators, the next step in calculating the total equity score is to assign a weight to each indicator. Weights are based on each indicator's relationship with and impact on social conditions and equity. There are two steps involved:

a) Standardize indicator values

- The indicator values are standardized to fall between 0 and 1 so that they can be summed and averaged to create an overall composite score as well as a score for each of the domains (where a score of 1 is assigned to the census tract with the most inequitable outcome). The score-range transformation locates each value in relation to the overall range of the variable. If the variables were selected because they indicate greater need (a high rate indicates greater need) the variables are then transformed using $(v - \text{min}) / (\text{max} - \text{min})$, where 'v' is each of the area's values and 'min' and 'max' are the overall minimum and maximum values.
- Variables with an opposite relationship such as post-secondary education or access to green spaces, are included in the model by using the opposite formula $(\text{max} - v) / (\text{max} - \text{min})$. The standardization makes it possible to include variables that act in different directions, have narrow or large differences, assign weights for each variable, and sum their scores to produce a single index by dividing the total by the number of indicators included.
- The disadvantage of this method is that it treats the differences in the actual rates as relevant, which may be of concern if the quality of the data is questionable.

b) Determine indicator weighting – Each indicator is weighted proportional to its contribution in describing the variance in total equity.

- The weight for each standardized indicator is calculated using principal components analysis (PCA) with varimax rotation.
- Using factor results, weights for each of the indicators are derived using the factor loadings for each indicator and the variance explained by each of the retained factors.
- Factors explaining the most variance are weighted more heavily. This can be observed quantitatively from the eigenvalues of the retained factors.
- Within each factor, the factor loading describes which indicators are more strongly related to each factor, and thus, the factor loadings are used to determine how strongly each indicator is weighted within each factor.
- Each indicator is weighted according to its respective factor loading in each factor. Lower factor loadings correspond to lower weighting, correcting for weak relationships in the underlying data.
- The composite weight for each indicator was derived using the following formula:

Indicator Weight

$$= (Factor\ Score_1 \times Eigenvalue_1) + (Factor\ Score_2 \times Eigenvalue_2) + (Factor\ Score_3 \times Eigenvalue_3)$$

- Once each indicator weight is calculated, they are further standardized so the sum of all indicator weightings is equal to 1:

$$Standardized\ Indicator\ Weight = \frac{Indicator\ Weight}{Sum\ of\ all\ indicator\ weights}$$

After each indicator receives a standardized indicator weight, we arranged them in ascending order to determine which contributes the most to the explained variation we see amongst the data.

- The indicators used in the CEI explain 79 per cent of the variation in differences in equity across census tracts. Social and Economic indicators contributed the most to the explained variance in scores.
- The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and strength of the partial correlations amongst variables was conducted and passed with a value of 0.896. KMO values closer to 1 are ideal – indicating strong partial correlation, while anything below 0.5 is unacceptable.
- The Bartlett's test of sphericity was used to measure the correlation of individual indicators and test if the correlation matrix was an identity matrix. The test passed with an approximate chi-squared value of 20335.8 and 1830 degrees of freedom, rejecting the null hypothesis.

- The top five weighted indicators in the model were lack of education (no certificate, diploma, or degree, including high school); prevalence of diabetes; economic dependency on social assistance supports; presence of single parent women headed households; and adult low-income transit pass sales. Weighting in PCA and factor analysis corrects for overlapping information between two or more correlated indicators and is not necessarily a measure of theoretical importance of the indicators.

2.6 Calculate the Total Equity Score

The following steps were taken to calculate the total equity score:

- Weighted scores are calculated by first multiplying the standardized indicator values for each census tract by their respective indicator weights and then summing the products. The resulting score ranges from 0 to 1, with 1 indicating maximum inequity:

$$\text{Weighted Score} = \sum_i (\text{Indicator Value}_i \times \text{Indicator Weight}_i)$$

Where i is one of the indicators

- To aid in the presentation and interpretation of the data, each weighted score is then multiplied by 100 so that the total equity scores range from 0 to 100. A census tract with a theoretical score of 0 would have the best outcomes, representing the lowest need and lowest inequity. A theoretical score of 100 describes a census tract with the worst outcomes, representing the highest need and highest inequity.
- The final Equity Score is calculated as follows:

To aid with interpretation, each census tract is sorted by its total equity score and assigned a rank based on relative need. A rank of 1 represents the census tract with the highest total equity score (highest need and inequity) and a rank of 288 represents the census tract with the lowest total equity score (lowest need and inequity).

The census tracts have also been colour coded by quintiles (20th percentiles). This colour coding applies to total equity scores, domain scores, and individual indicator values. For the total equity and domain level scores, the colours highlight areas with higher or lower inequity. For indicator values, the colours show the relative distribution or magnitude of each measure.

- **The lightest colour** (beige) represents the bottom 20% (lowest quintile) of equity scores or indicator values. For equity scores, lighter colours reflect

lower inequity and less overall need. For indicators, lighter colours reflect the lowest distribution or concentration of raw values for each measure.

- **The darkest colour** (maroon) represents the top 20% (highest quintile) of equity scores or indicator values. For equity scores, darker colours reflect higher inequity and greater overall need. For indicators, darker colours reflect the highest distribution or concentration of raw values for each measure.



Verifying index accurately reflects key patterns of inequity

To ensure that the CEI accurately reflects key patterns of inequity, the index is verified by cross-referencing Calgary Equity Scores with data from other relevant social indicators:

- I. **Population groups:** Does the index sufficiently capture areas of the city with significant concentrations of equity-seeking groups?
 - This includes children (0-14), youth (15-25), seniors (65+), newcomers and visible minorities.
- II. **Other Social Indicators:** Is the index related to a range of important social indicators not included in the index?
 - Calculate Pearson correlation coefficient scores between the Calgary Equity Index and a range of other social indicators (e.g. housing suitability, median property value, social housing waiting list, early childhood development, homicides, housing affordability, major crime rate)
- III. **Validate patterns of equity and inequity with previous version of the CEI:** Does the 2024 CEI illustrate a similar pattern of equity as the previous CEI?
 - The nature of the model and the selection of indicators make it more likely that equity levels are influenced by large economic factors or municipal changes rather than by interventions from individual programs. As a result, significant variation in communities' relative positions within the CEI is less likely. For example, changes in factors such as unemployment rates or income inequality are expected to affect multiple communities on a similar scale.

- Overall patterns of equity and inequity across the city are expected to remain relatively stable, with only smaller-scale changes happening at the domain or indicator level. Large shifts or swings in equity levels from year to year may indicate potential issues with data quality. At a macro level, the CEI is anticipated to show consistency in patterns of total equity and inequity when compared to the previous version, with changes happening over longer periods of time.

2.7 Calculate Domain Scores

Besides the total equity score, composite scores are also developed by domain. The method to calculate domain scores is adopted from the Ottawa Neighbourhood Index. All indicators (a total of 61) within respective domains are used to calculate their scores. The domain scores are based on the average of the standardized indicator values where indicators are equally weighted. To align with the total equity score, each domain score is then multiplied by 100 so that they range from 0 to 100. A score of 0 would have the best outcomes (lowest need) and a score of 100 describes a census tract with the worst outcomes (highest need) for a specific domain.

Domain scores do not add up to the total equity score because of the methodological differences in deriving the two measures. Weighting of the indicators (based on PCA factor analysis) is only applied to calculate the total equity scores, while for domain scores, indicators are equally weighted.

3.0 Notes on Exploring the Calgary Equity Index

This section provides essential guidance for interpreting and using the CEI. It explains the intended applications, limitations, and considerations when exploring the geographic data and insights presented in the CEI.

3.1 CEI Terms of Use and Interpretation

1. *The CEI provides information about the [Social Determinants of Health](#) and health equity, as an estimate or proxy of need.*
2. *The CEI provides an initial programming screen:* The CEI indicates geographic areas experiencing need and can be used as a first screen about where programming may be located. However, additional information sources would be needed to make any decisions about programming.
3. *The CEI is not intended to be used alone:* The CEI is intended to be an objective initial screen of geographic need. The CEI is not intended to be used alone, and users should supplement the CEI with additional data and information that is relevant to any decisions being made.
4. *Not intended to measure outcomes:* Any changes in the indicators that make up the total equity score and domain scores, and the rankings of census tracts, are more likely affected by large economic factors or community changes than interventions from any one program. Therefore, the CEI should not be used as a benchmark to measure progress or performance of a program or intervention.
5. *Relative and Arbitrary Quintile Assignments:* The CEI uses quintiles to categorize the equity scores and indicator values for each census tract and then assigns a colour to each by quintile. This assignment is arbitrary and relative. For example, a census tract in the top quintile (20th percentile), shown by the darkest colour, may have similar characteristics to a census tract in the 22nd percentile (dark colour). While both may indicate high need, the difference between the two areas might be small, and they will be represented by different colours. We encourage users to explore domain scores and specific indicators to gain a deeper understanding of the factors influencing equity scores.
6. *Total equity score:* The total equity and domain score is highest in the census tracts where there is highest need (lower socio-economic and health equity) and lowest in areas with the lowest need (higher socio-economic and health equity).

3.2 Limitations

- *Not directly comparable with previous CEI versions:* Due to changes in the level of geography (moving from CSAs to CTs), additional indicator data (expanding the

index from 20 to 61 indicators), and updates to how the total equity scores are reported (inverted), results from the 2024 CEI are not directly comparable to the results from the previous CEI. The updated CEI includes data that captures a broader range of equity dimensions, altering the way the total equity scores are calculated and interpreted. As a result, a score from the earlier CEI may not reflect the same underlying factors of equity as a score in 2024.

- *The CEI is a simplification of realities:* The Calgary Equity Index is a result of the averaging and aggregating of data from several sources to arrive at a single score to understand overall wellbeing, including access to services, in Calgary. This necessitates the simplification of complex realities experienced by different groups. Thus, the potential to obscure differences within communities or CTs that will not be captured at the Index level is very high. For instance, at the level of the total equity score, CTs might be assigned the lightest colour and have a low score, representing high equity and low need, which gives the impression that all other indicators in the CTs reflect positively desired outcomes, or that no resident experiences inequities. However, this is misleading since not all indicators within the CT may be positive. Also, although a CT has a low total equity score and thus, be assigned the lightest colour, might suggest that the majority of residents in the CT are doing well, the experiences of a minority of residents is hidden in the averaging and aggregating process of the CEI.
- *The CEI is not exhaustive of factors impacting equity:* The index is not comprehensive in its external validation and currently does not represent all the concepts that should be reflected to show socioeconomic and health equity in Calgary, for example, early childhood education indicators are missing. Although the selection of indicators, domains, statistical thresholds, weighting and aggregation is done in a thorough, standard statistical approach, and in consultation with subject matter experts, the final selection may not necessarily reflect the perspective of a majority of people. Thus, not all equity related interests may have been captured and represented.

Some important equity indicators are not included in the CEI due to the limited availability of data, such as child and youth education outcomes (Early Development Instrument, Early Years Assessment, or high school graduation rates) or vacancy rates to measure the demand of housing. These exclusions limit the ability to capture all relevant dimensions of equity.

- *Point-in-time data:* The CEI relies heavily on federal census and other historical data, which may not reflect current conditions, especially in fast growing communities. This can make it difficult to capture emerging equity concerns in real-time.

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