

# SENIOR MOBILITY AND ACCESSIBILITY PROJECT

## SMAP

### Project Report

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## Contents

Executive Summary .....	4
Key Findings at a Glance.....	4
1. Problem Statement .....	5
1.1 The Core Problem .....	5
1.2 Why This Matters.....	5
1.3 The Business Case for Analysis .....	5
2. Project Scope.....	6
2.1 Geographic Framework .....	6
2.2 Core Research Questions .....	6
2.3 Products in Scope .....	6
2.4 Out of Scope .....	6
3. Methodology .....	8
3.1 The Three-Pillar Framework .....	8
3.2 Standardization Approach .....	8
3.3 Opportunity Index Construction .....	8
3.4 Pressure Metric .....	9
4. Execution and Data Pipeline .....	10
4.1 Data Gathering .....	10
4.2 Data Cleaning.....	10
4.3 Geographic Integration .....	11
4.4 Column Standardization .....	11
4.5 Integration and Index Scoring.....	11
5. Dashboard and Visualizations.....	12
5.1 Executive Overview .....	12
5.2 Demand Deep Dive (Province View).....	12
5.3 Demand Deep Dive (CMA View) .....	13
5.4 Supply Analysis .....	13
5.5 Access and Vendors.....	14
5.6 Equity and Seniors .....	15
5.7 Combined Opportunity.....	16
6. Key Findings .....	17
6.1 Demand Trends.....	17
6.2 Supply Footprint .....	17
6.3 CMA-Level Access Disparities.....	17
6.4 Equity Need.....	18

6.5 Opportunity Rankings .....	18
7. Use Cases, ROI, and Commercial Value .....	19
7.1 Healthcare Vendors and Distributors .....	19
7.2 Insurers and Payers .....	19
7.3 Government and Policymakers .....	20
7.4 Framework Transferability and Cross-Industry ROI .....	20
8. Expansion Roadmap .....	22
8.1 Phase 1 -- Ontario Completion (Current) .....	22
8.2 Phase 2 -- National Expansion .....	22
8.3 Phase 3 -- Dashboard and Product Enhancements .....	22
8.4 Phase 4 -- Commercialization .....	23
9. Risks, Limitations, and Assumptions .....	24
9.1 Statistics Canada Suppression Flags .....	24
9.2 Demand Allocated from Provincial Totals .....	24
9.3 FSA-to-CMA Mapping Imprecision .....	24
9.4 MDALL as a Proxy for Physical Supply .....	24
9.5 Temporal Misalignment .....	24
9.6 CMA Centroids as Geometric Approximations .....	25
9.7 Complete Assumptions Register .....	25
9.8 Risk Summary .....	26
10. Data Inventory and Deliverables .....	27
10.1 Curated Datasets Produced .....	27
10.2 Documentation Produced .....	27
Glossary .....	28

## Executive Summary

The Senior Mobility and Accessibility Project (SMAP) were designed to address a fundamental and growing gap in Canadian healthcare infrastructure: the misalignment between where seniors need mobility aids and where those aids are actually available. Rather than assuming the market is saturated, this project set out to prove with data that it is misallocated.

Using three independent public data sources from Health Canada, the Ontario Assistive Devices Program, and Statistics Canada, SMAP built a CMA-level Opportunity Index that scores every major city in Ontario on supply, access, and demand. The result is a quantified, geographic map of where the gaps are largest and where investment would have the greatest impact.

<b>32%</b> Growth in senior assistive tech usage (5 years)	<b>229</b> Ontario FSAs spatially mapped	<b>~400K</b> Senior users in Ottawa alone	<b>0.3</b> Devices per 10K seniors in Ottawa
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### Key Findings at a Glance

- Demand is accelerating senior assistive technology use jumped from 31.5% to 41.6% in five years, a 32% increase with no sign of slowing.
- The biggest cities are underperforming Ottawa has approximately 400,000 senior users yet ranks among the worst in the province for per-capita device access.
- Mid-size cities are leading quietly: Barrie (3.3 devices per 10K) and Kitchener-Waterloo (2.5 devices per 10K) significantly outperform larger CMAs.
- The equity gap is widest where it matters most: Windsor, Hamilton, and London carry the highest unmet need scores, with large and growing senior populations but thin supply.
- The market is not saturated. It is misallocated. This distinction changes expansion strategy, competitive positioning, and where growth actually lives.

# 1. Problem Statement

Canada's senior population is growing at an unprecedented rate. As of 2025, Ontario alone has seen its 65+ population expand by over 114,000 people across major census metropolitan areas in just four years. This demographic shift creates compounding pressure on an assistive device ecosystem that was never designed to scale at this pace.

## 1.1 The Core Problem

The fundamental issue is not a lack of supply in absolute terms. Approximately 5,806 vendors and 94,025 active devices exist across Ontario. The problem is that supply is concentrated in the wrong places, and the communities with the greatest demonstrated need are chronically underserved.

### The Gap

Ottawa, home to nearly 400,000 senior users of assistive technology, maintains one of the lowest per-capita device access ratios in the province at just 0.3 devices per 10,000 seniors. Meanwhile, Barrie, a fraction of Ottawa's size, achieves 3.3 devices per 10,000 seniors.

## 1.2 Why This Matters

Mobility aids including wheelchairs, walkers, scooters, lifts, ramps, and cushions are not discretionary products. For seniors with mobility and agility disabilities, access to these devices determines independence, quality of life, and often medical outcomes. When supply is misaligned with need, the consequences are human, not just economic.

From a healthcare industry perspective, this misalignment represents both a service failure and an unrealized commercial opportunity. Vendors, insurers, and policymakers operating without geographic intelligence are making resource allocation decisions in the dark.

## 1.3 The Business Case for Analysis

- Vendors can identify underserved CMAs for targeted expansion and recruitment.
- Insurers can anticipate claims pressure by mapping where unmet need is highest.
- Policymakers can direct program funding toward regions with the greatest equity gaps.
- Healthcare systems can use the Opportunity Index to benchmark provincial performance and model interventions.

## 2. Project Scope

SMAP was scoped to build a fully integrated, geography-aligned dataset and analytical framework for Ontario, with architecture designed from the outset to extend nationally across all Canadian provinces.

### 2.1 Geographic Framework

All analysis is anchored to Statistics Canada's 2021 Census Metropolitan Area (CMA) boundaries. Postal data was resolved to Forward Sortation Areas (FSAs), which were then spatially mapped to CMAs using official 2021 boundary shapefiles.

Geographic Unit	Description
<b>CMA</b>	Census Metropolitan Area: primary unit of analysis (20 Ontario CMAs)
<b>FSA</b>	Forward Sortation Area: first 3 digits of postal code, used as bridge
<b>Province</b>	Used for demand allocation and normalization baselines
<b>National</b>	MDALL supply data collected nationally; Ontario filtered for analysis

### 2.2 Core Research Questions

- Supply: Where are medical device licences and manufacturers located across Ontario?
- Access: Where are Ontario ADP mobility vendors located and how accessible are they per CMA?
- Demand: What do senior mobility needs look like across Ontario CMAs?
- Integration: How do supply, access, and demand combine into a single CMA Opportunity Index?

### 2.3 Products in Scope

- Wheelchairs (manual and powered)
- Walkers and rollators
- Mobility scooters
- Patient lifts and transfer aids
- Ramps and threshold solutions
- Pressure-relieving cushions

### 2.4 Out of Scope

- Non-mobility assistive technologies such as hearing aids, communication devices, and visual aids
- Provinces outside Ontario for access analysis (national supply data was collected but not fully integrated)
- Real-time or live data feeds: all analysis uses curated static datasets
- Individual patient-level data or clinical records

### 3. Methodology

SMAP's methodology was designed around a single principle: every step that produces a number must be documented, defensible, and reproducible. The framework integrates three independent data pillars -- Supply, Access, and Demand -- into a single Opportunity Index scored on a 0-to-100 scale for each Ontario CMA.

#### 3.1 The Three-Pillar Framework

Pillar	Source	What It Measures
Supply	MDALL (Health Canada)	Licensed device manufacturers and active device counts by CMA
Access	Ontario ADP Vendor Registry	Physical vendor locations accessible to seniors by CMA
Demand	Statistics Canada CSD and Census	Senior population size, disability prevalence, and device usage rates

#### 3.2 Standardization Approach

To enable fair comparison across CMAs of vastly different sizes, from Toronto's 1.9 million senior users to Belleville's far smaller population, all metrics were standardized using z-scores. A z-score of zero represents the provincial average; positive values indicate above-average performance; negative values indicate below-average.

Per-capita normalization (per 10,000 seniors aged 65+) was applied to supply and access metrics before z-score calculation, ensuring that smaller cities are not penalized simply for having fewer absolute devices or vendors.

#### 3.3 Opportunity Index Construction

The Opportunity Score (0-100) is the equal-weighted average of three component scores:

Component	Definition
<b>Demand Gap (0-100)</b>	The percentage of Ontario seniors NOT currently using assistive technology, scaled to 0-100. This is a province-wide anchor consistent across CMAs, reflecting the size of the unaddressed market.
<b>Access Deficit (0-100)</b>	Derived from rank-scaled vendor density and device density per 10,000 seniors. Inverted so that 100 means worst access, signaling greatest opportunity.



Equity Need (0-100)	A composite of three rank-scaled drivers: visible minority %, Indigenous identity %, and absolute senior population growth (2021-2025). Higher score means greater equity-weighted need.
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3.4 Pressure Metric

A simpler diagnostic metric called Pressure was also constructed as Demand minus Availability, expressed in standardized units. Positive pressure indicates a CMA where need outstrips availability; negative pressure indicates relatively well-served areas that can serve as benchmarks for others.

## 4. Execution and Data Pipeline

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The data pipeline was built in ten structured steps, progressing from raw source acquisition through to analysis-ready integrated outputs. Each step produced documented artifacts and was subject to quality assurance before the next step began.

### 4.1 Data Gathering

- Statistics Canada 2021 Census Profiles: CMA-level 65+ population counts for demand denominators
- MDALL (Medical Devices Active Licence Listing): national manufacturer and device licence records filtered to mobility-specific categories
- Ontario ADP Vendor Registry: registered vendor names, addresses, postal codes, and device specialties
- Geographic Framework Files: 2021 CMA boundary shapefiles and FSA boundary files from Statistics Canada

### 4.2 Data Cleaning

#### Supply (MDALL)

- Normalized postal codes to standard format
- Extracted FSA codes from postal fields
- Deduplicated licence records by original licence number and CMA code
- Standardized all dates to YYYY-MM-DD format
- Flagged records with blank, invalid, or unmatched postal codes

#### Access (ADP Vendors)

- Normalized vendor names and postal codes
- Derived FSA codes from postal addresses
- Removed duplicate vendor-postal combinations
- Produced clean vendor dataset with CMA assignment

#### Demand (Statistics Canada)

- Cleaned seven CSD demand tables covering disability, severity, device use, unmet needs, and barriers
- Filtered to provinces; coerced numeric fields
- Allocated provincial demand totals to CMAs proportionally using each CMA's share of the provincial 65+ population
- Verified mass balance: sum of CMA allocations equals provincial total

4.3 Geographic Integration

- Built a province dictionary (name-to-code mapping)
- Constructed an FSA-to-CMA fallback mapping using spatial overlay of 2021 boundary shapefiles
- Assigned CMA codes to 220 of 229 Ontario FSAs; flagged the remaining 9 as non-CMA
- Created surrogate keys (cma\_code + province\_code) for multi-province CMAs such as Ottawa-Gatineau

Technical Note	For multi-province CMAs where a single metro area spans provincial borders (e.g., Ottawa-Gatineau has Ontario and Quebec parts), separate entries were created for each provincial portion. This ensures supply, access, and demand metrics reflect provincial jurisdiction boundaries.
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4.4 Column Standardization

All datasets were normalized to a common schema using snake\_case column naming conventions. Key canonical fields enforced across all tables: province\_code, cma\_code, cma\_name, fsa, postal\_code, seniors\_65plus, device\_category.

4.5 Integration and Index Scoring

The three cleaned pillars were joined on cma\_code to produce the Opportunity Index base table. Z-scores were computed for all per-capita metrics, rank-scaled to 0-100, and combined into the final Opportunity Score. The integrated dataset was produced in both CSV and Parquet formats for downstream use.

## 5. Dashboard and Visualizations

The analytical outputs of SMAP were made accessible through a seven-page interactive Power BI dashboard. Each page was purpose-built for a distinct audience and decision context, from executives reviewing provincial totals to analysts drilling into a single CMA's equity profile. The dashboard uses ArcGIS for Power BI for spatial visualizations and supports slicers for Year, CMA, Province, Risk Class, and Licence Type.

### 5.1 Executive Overview

The landing page surfaces four headline KPIs: total demand (143.56 million), total supply (95K active devices), total vendors (5,806), and total seniors over 65 (2 million). A bar chart shows the CMA distribution of demand, confirming Toronto's outsized footprint at 71 million while all other CMAs trail significantly. The accompanying ArcGIS map visualizes CMA-level totals as proportional bubbles, making geographic concentration immediately visible.

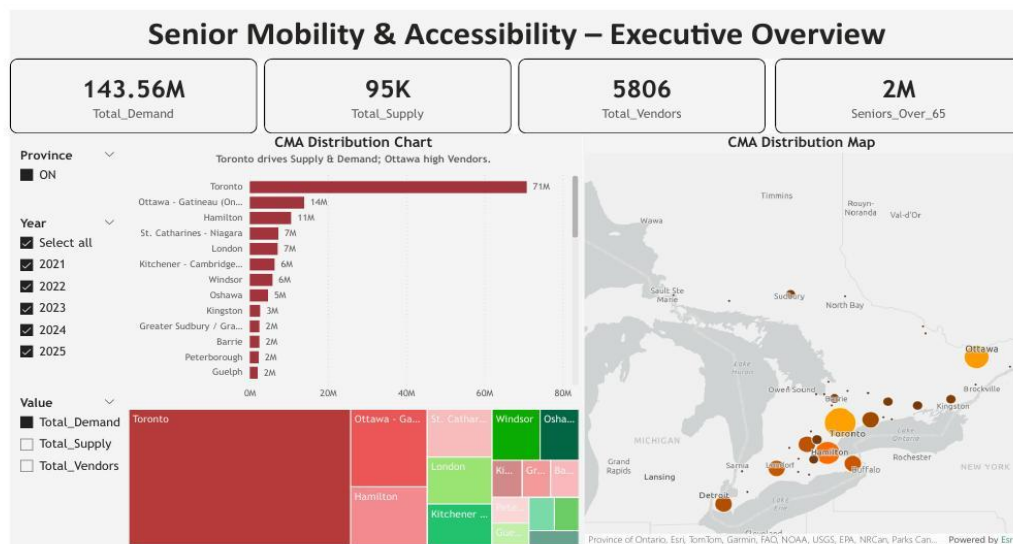


Figure 1: Executive Overview Page -- Total Demand, Supply, Vendors, and CMA Distribution

### 5.2 Demand Deep Dive (Province View)

The Province tab presents official Statistics Canada CSD data for Ontario. Three charts break down assistive technology usage: by age group (youth 15-24 lead at 44.2%, seniors 65+ at 34.0%), by gender (Men 37.1%, Women 36.2%), and by time (a continuous upward trend from 31.5% in 2017 to 41.6% in 2022). The central KPI card shows that 36.5% of Ontario seniors currently use ICT-assistive devices, with the remaining 63.5% representing the unaddressed market opportunity.

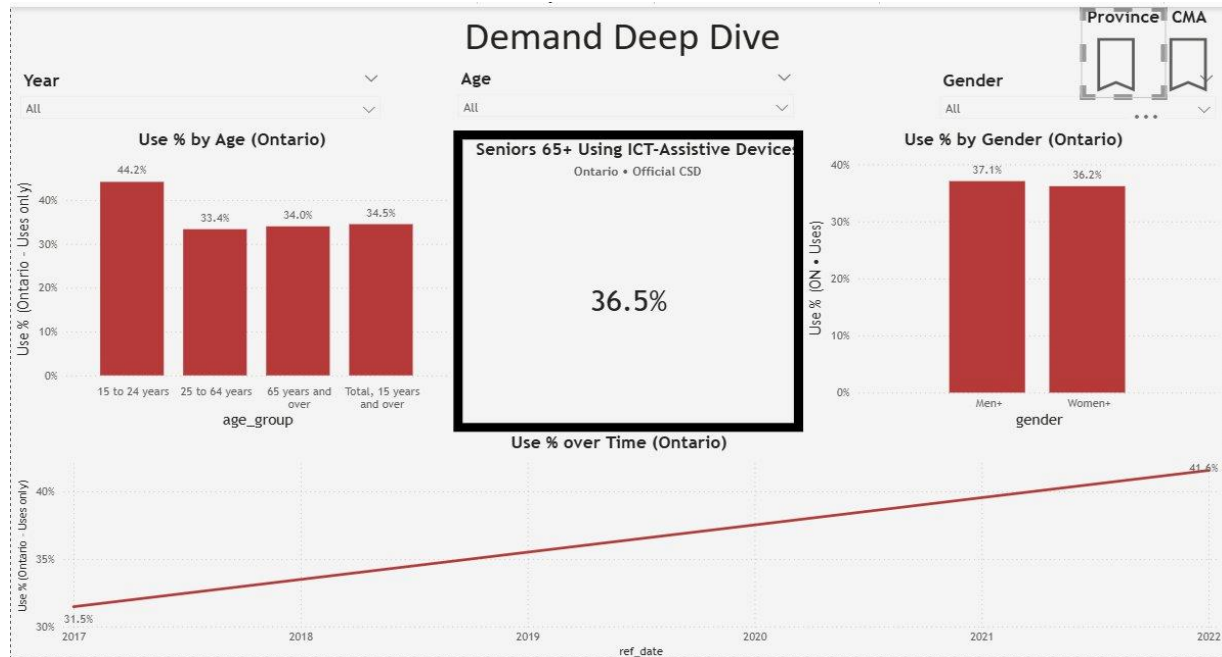


Figure 3: Demand Deep Dive -- Province View (usage by age, gender, and time trend for Ontario)

### 5.3 Demand Deep Dive (CMA View)

The CMA tab shifts from provincial percentages to raw user counts by census metropolitan area. Toronto leads with approximately 1.99 million senior users, followed by Ottawa-Gatineau Ontario part at 390,000. A trend line shows total CMA-level user counts climbing from 747,000 in 2021 to 861,000 in 2025 -- a 15.3% increase in four years. Year-over-year growth for the selected CMA and CAGR (3.6% over 2021-2025) are surfaced as KPI cards for quick executive reference.

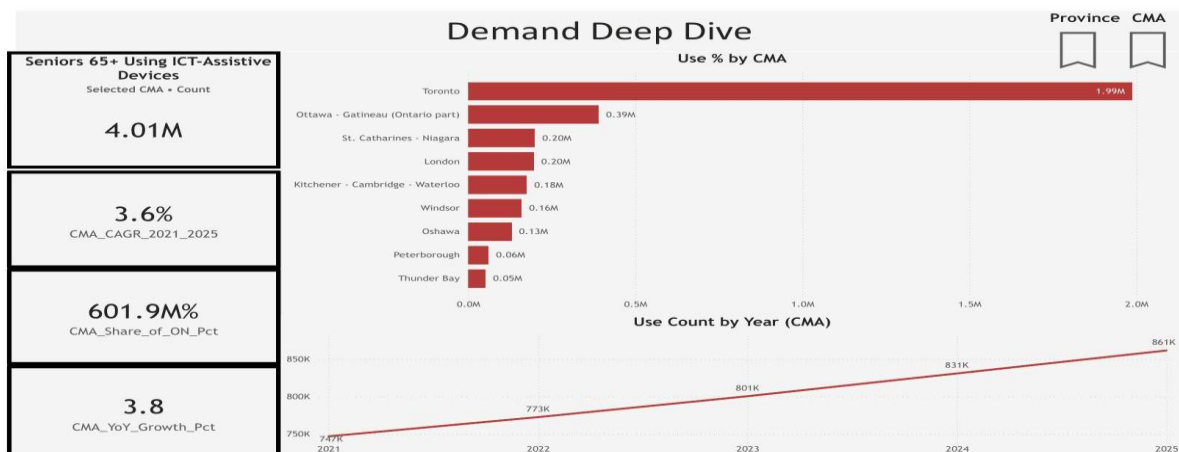


Figure 2: Demand Deep Dive -- CMA View (senior user counts by CMA and trend over time)

### 5.4 Supply Analysis

The Supply page provides an executive view of the licensed device landscape. Key metrics include 95K active devices, 34K active licences, and six distinct licence types. The Top 10 CMAs bar chart ranks cities by devices per 10,000 seniors, revealing Barrie at 3.3 and Kitchener-Cambridge-Waterloo at 2.5 as the clear per-capita leaders. Ottawa and Oshawa both sit at 0.3, the lowest in the province. A trend line tracks device growth from near zero in the late 1990s to approximately 9,000 active devices, with growth slowing to 0.8% year-over-year by 2026. The donut chart shows risk class composition: 85.8% Class II (moderate risk) versus 14.2% Class III/IV (high and highest risk).

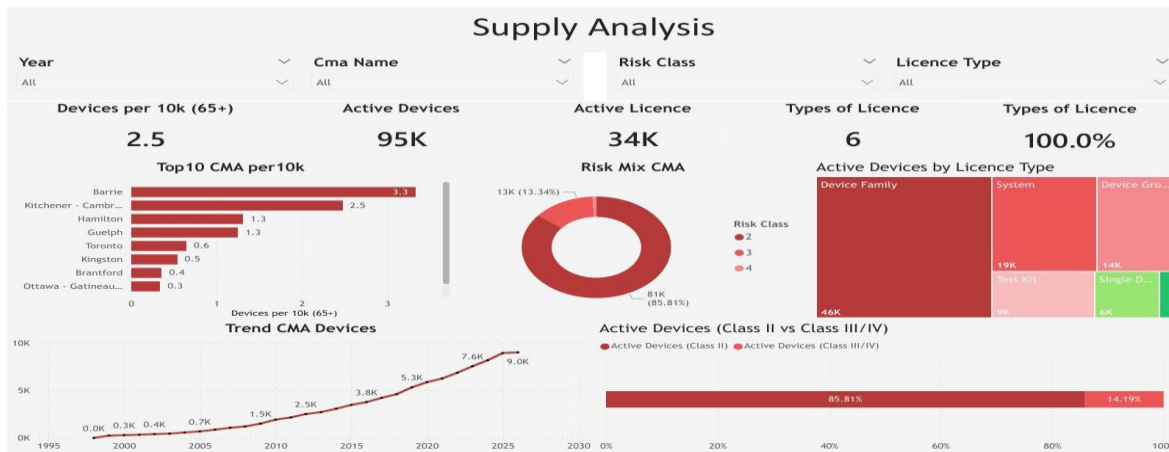


Figure 4: Supply Analysis Page -- Device density, risk class mix, licence types, and trend

## 5.5 Access and Vendors

The Access page examines the vendor landscape normalized for senior population size. With 22.7 vendors per 10,000 seniors provincially and 8.2 licences per 10,000 seniors, the top performers by vendor density are Kitchener-Cambridge-Waterloo (0.9), Guelph (0.7), and Toronto (0.4). Ottawa-Gatineau trails at 0.1 vendors per 10,000 seniors, reinforcing its position as the highest-priority expansion market. The vendor trend line shows accelerating growth in vendor registrations, with a clear upward inflection since 2015.

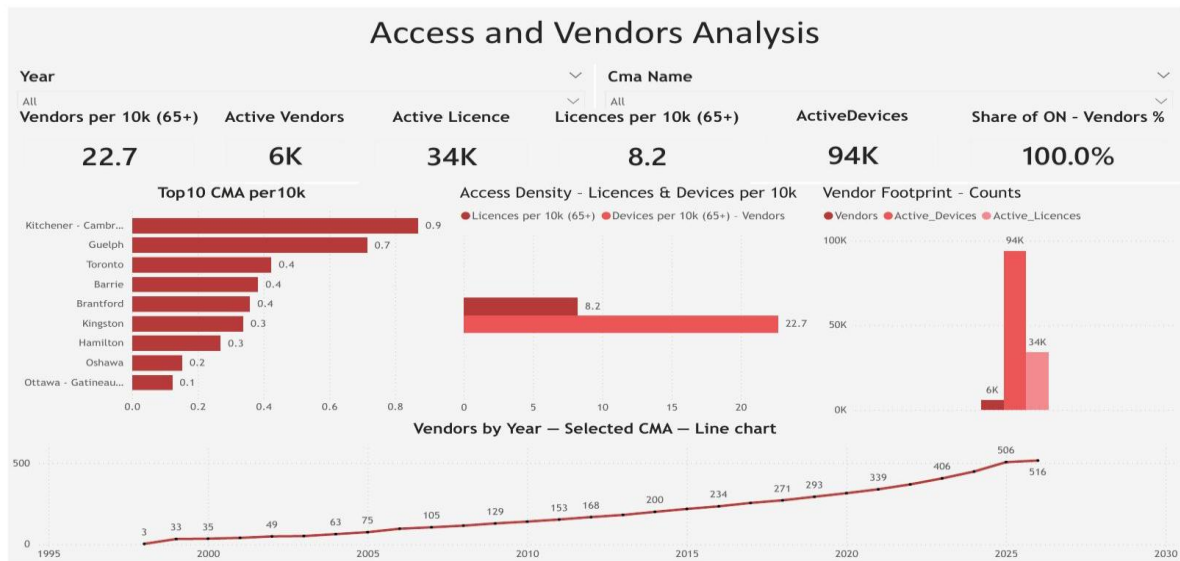


Figure 5: Access and Vendors Page -- Vendor density, licence footprint, and per-capita access

## 5.6 Equity and Seniors

The Equity page introduces a social vulnerability lens. The Seniors Equity Need Index (0-100) ranks CMAs by combining visible minority share, Indigenous identity share, and absolute senior population growth. Ottawa scores highest at 78, followed by Toronto at 69, Windsor at 64, and Hamilton, London, and St. Catharines-Niagara all at 62. The Drivers by CMA chart shows the contribution of each factor, making it possible to understand why a CMA scores high and which intervention would be most targeted. The Seniors Growth plot confirms Toronto and Ottawa are adding seniors at the greatest absolute volume, reinforcing the urgency of addressing their access deficits.

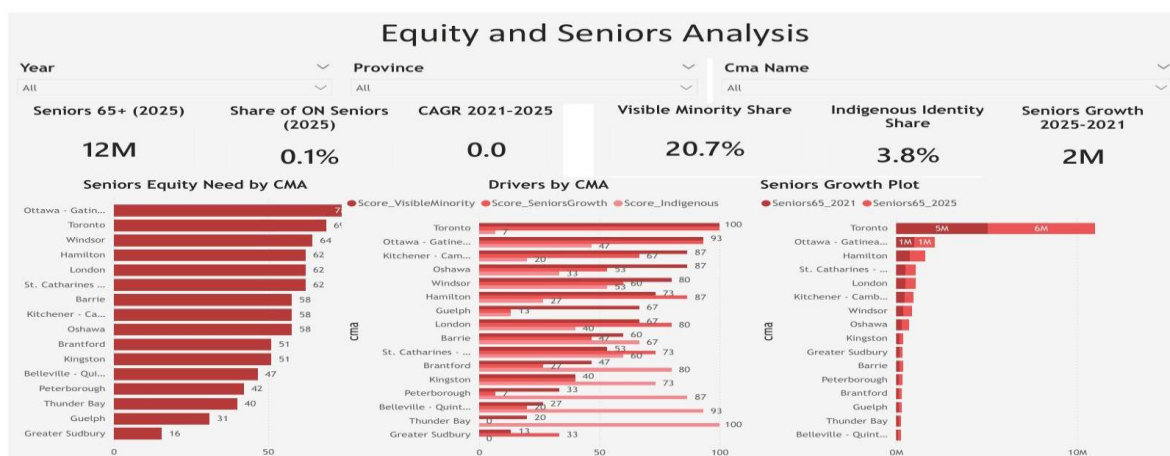


Figure 6: Equity and Seniors Page -- Equity Need Index, demographic drivers, seniors growth

## 5.7 Combined Opportunity

The final and most strategically important page synthesizes all three pillars into a single Opportunity Score for each CMA. Belleville-Quinte West leads the ranking alongside Thunder Bay, Guelph, Brantford, Peterborough, Greater Sudbury, Barrie, Kingston, and Oshawa, all scoring 55 out of 100. Windsor and Kitchener-Cambridge-Waterloo follow at 52. The component breakdown chart for any selected CMA reveals whether its score is driven primarily by access deficit, equity need, or demand gap, enabling stakeholders to prioritize interventions by root cause. Toronto scores -5, which reflects the current scoring inputs rather than absence of need and should be interpreted in the context of its scale.

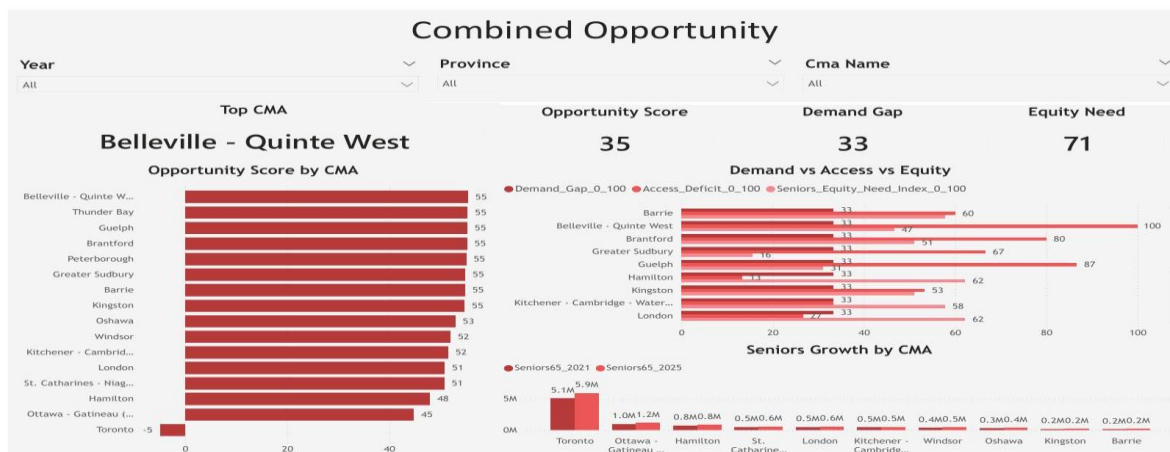


Figure 7: Combined Opportunity Page -- Opportunity Score rankings and component breakdown



## 6. Key Findings

The following findings emerged from the integrated analysis of supply, access, demand, and equity data across Ontario's Census Metropolitan Areas. All statistics are derived from curated, QA-validated datasets.

### 6.1 Demand Trends

- Senior assistive technology use rose from 31.5% to 41.6% between 2017 and 2022, a 10.1 percentage point increase representing approximately 32% growth.
- The total CMA-level senior user count across Ontario grew from approximately 747,178 to 861,420 between 2021 and 2025, an increase of over 114,000 people.
- Usage is broad-based: seniors 65+ account for approximately 34.0% usage, comparable to the 25-64 age group at 33.4%, with youth (15-24) leading at 44.2%.
- No significant gender gap was identified: male usage at 37.1% versus female usage at 36.2%.

### 6.2 Supply Footprint

- Ontario currently has approximately 5,806 active vendors, 94,025 licensed devices, and 34,095 active licences.
- Supply growth has slowed considerably: while active devices grew at approximately 10% annually during 2019-2024, year-over-year growth slowed to 0.8% in 2026.
- Risk class composition: approximately 85.8% of devices are Moderate-risk (Class II), with 14.2% classified as High or Highest-risk (Class III/IV).

### 6.3 CMA-Level Access Disparities

The most striking finding of the project is the inverse relationship between city size and per-capita access:

CMA	Senior Users (approx.)	Devices per 10K Seniors
Barrie	Moderate	3.3 -- Province Leader
Kitchener-Cambridge-Waterloo	Large	2.5 -- Strong Access
Hamilton	Large	1.3 -- Average
Guelph	Moderate	1.3 -- Average
Ottawa-Gatineau (ON part)	390,000	0.3 -- Province Laggard
Oshawa	130,000	0.3 -- Province Laggard
Brantford	Moderate	0.4 -- Below Average

## 6.4 Equity Need

Cities with the highest Equity Need Index scores are disproportionately the same cities with weak access. Ottawa (78), Toronto (69), Windsor (64), Hamilton (62), London (62), and St. Catharines-Niagara (62) sit at the top. This overlap between equity need and access deficit defines the highest-priority intervention zones.

## 6.5 Opportunity Rankings

- Belleville-Quinte West, Thunder Bay, Guelph, Brantford, Peterborough, Greater Sudbury, Barrie, and Kingston all score 55 or higher on the 0-100 Opportunity Index.
- The correlation between Access Deficit and Opportunity Score is approximately  $r = 0.57$ , confirming that access, not demand, is the primary driver of opportunity across Ontario CMAs.
- Toronto scores -5 on the current index, reflecting scoring inputs. Given Toronto's population scale it remains strategically in scope for any national expansion plan.

## 7. Use Cases, ROI, and Commercial Value

SMAP is not an academic exercise. It is a decision-support tool with direct and measurable commercial value for every stakeholder in the senior mobility ecosystem. The following section maps the framework to concrete use cases and quantifies the return on investment that each stakeholder class can expect from acting on its outputs.

### 7.1 Healthcare Vendors and Distributors

For companies that manufacture, distribute, or retail mobility aids, SMAP answers the most expensive question in market development: where should we expand next?

- **Market entry targeting:** The Opportunity Score identifies CMAs where the combination of high demand, low access, and growing senior populations creates the most favorable conditions for new vendor entry. Cities scoring 55+ represent markets where a new entrant faces limited competition relative to demand size.
- **Vendor recruitment:** The per-capita access maps identify specific CMAs where vendor density is critically low. A distributor recruiting retail partners can use these rankings to prioritize outreach geographically rather than relying on ad hoc relationships.
- **Stock and inventory planning:** The senior population growth plots show where demand is rising fastest on a four-year trajectory. Allocating inventory to high-growth CMAs one to two years ahead of the curve reduces stockouts and improves fill rates.
- **Replication of high-performing models:** Barrie and Kitchener-Cambridge-Waterloo consistently outperform on per-capita access. Understanding the structural factors behind their performance (vendor mix, licence type distribution, proximity to manufacturing) creates a replicable playbook for lifting lagging markets.

#### ROI Estimate

A vendor using SMAP to prioritize one additional CMA expansion per year, capturing even 5% of the unaddressed senior user base in a high-pressure city like Ottawa, represents tens of thousands of incremental device placements annually. At average device revenue of \$1,500 to \$5,000 per unit, the commercial upside of a single well-targeted expansion decision significantly exceeds the cost of building and maintaining the index.

### 7.2 Insurers and Payers

For insurers covering assistive device benefits, the Opportunity Index functions as a forward-looking risk and claims management tool.

- **Claims pressure anticipation:** CMAs with high equity need and rapidly growing senior populations will generate increasing claims volume regardless of current supply. Insurers can use the growth plots to anticipate benefit utilization 3-5 years ahead and adjust reserves accordingly.

- **Network adequacy assessment:** The vendor density maps allow insurers to assess whether their preferred provider networks are adequately distributed relative to where their members are located. CMAs with 0.1-0.3 vendors per 10,000 seniors signal network gaps that will drive member dissatisfaction and out-of-network costs.
- **Unmet need as deferred cost:** The 63.5% of Ontario seniors not currently using assistive technology represents a population whose needs are unmet today but will likely manifest as more expensive interventions tomorrow. Insurers who can identify and serve this population proactively reduce downstream hospitalization and long-term care costs.

### 7.3 Government and Policymakers

For provincial ministries, health authorities, and program administrators, SMAP provides an evidence base for funding allocation that is geographically precise and equity-aware.

- **ADP program targeting:** The Ontario Assistive Devices Program can use the Opportunity Index to direct vendor onboarding incentives, subsidy enhancements, and outreach campaigns to the highest-pressure CMAs rather than allocating resources uniformly.
- **Equity-based prioritization:** The Equity Need Index surfaces cities where the gap between need and access falls disproportionately on visible minority and Indigenous populations, enabling program officers to apply an equity lens to budget decisions with data to support the rationale.
- **Policy evaluation:** As the index is refreshed in future years, changes in CMA scores will reflect whether interventions are working. A CMA that improves its access deficit over two cycles provides evidence of program effectiveness.

### 7.4 Framework Transferability and Cross-Industry ROI

The analytical framework underlying SMAP is not specific to healthcare. The three-pillar approach of integrating supply, access, and demand into a geographic opportunity index is directly transferable to any industry where physical service delivery must be matched to population-level need.

Industry	Supply Equivalent	Demand Equivalent
Financial Services	Bank branches and ATM density	Underbanked population concentration
Retail	Store locations by category	Purchasing power and product demand by geography
Real Estate	Available units by type	Household formation and demographic growth
Logistics	Warehouse and distribution nodes	Order density and last-mile delivery demand
Telecommunications	Network infrastructure coverage	Connectivity need and digital exclusion rates

In each case, the methodology remains identical: collect supply-side data, map access points, layer in demand signals, and score geographies by the gap between what exists and what is needed. The data sources change; the logic does not.

## 8. Expansion Roadmap

SMAP's Ontario build is the first module of a national framework. The architecture, data pipeline, and scoring methodology were designed from the outset to scale. The following roadmap defines the path from Ontario pilot to national Opportunity Index.

### 8.1 Phase 1 -- Ontario Completion (Current)

Several steps remain to fully complete the Ontario module:

- Schema finalization: normalize remaining data types and produce analysis-ready Parquet versions of all integrated tables.
- Demand harmonization: unify age and sex labels across all CSD tables and complete CMA-level demand metric alignment.
- CHSS PUMF integration: apply survey weights to the microdata, filter to 65+, and generate CMA-level summaries for mobility indicators, chronic conditions, and care needs.
- Sensitivity analysis: test the Opportunity Score under alternative weighting schemes and document how CMA rankings shift.

### 8.2 Phase 2 -- National Expansion

Expanding to all Canadian provinces is the highest-value next step. The national index would allow vendors, insurers, and policymakers to prioritize at a federal level rather than being constrained by provincial boundaries.

- Re-run FSA-to-CMA spatial overlay for each province using the same 2021 boundary methodology.
- Determine whether z-score standardization should be conducted within each province separately or across all CMAs nationally. Both should be reported for transparency.
- Integrate Quebec's RAMQ vendor registry and other provincial equivalents of the Ontario ADP to build a comparable access layer in each province.
- Extend MDALL supply analysis to all provinces, removing the Ontario filter currently applied at the analysis stage.

#### Priority Markets

Based on senior population size and publicly available data on access constraints, British Columbia (Greater Vancouver, Victoria) and Quebec (Montreal, Quebec City) represent the highest-value expansion markets after Ontario. Both provinces have large, rapidly aging urban populations with fragmented vendor ecosystems.

### 8.3 Phase 3 -- Dashboard and Product Enhancements

- Dynamic weighting: add a What-If parameter to the Power BI dashboard allowing users to adjust Opportunity Score weights in real time (e.g., 25% Demand, 45% Access, 30% Equity).
- Threshold filtering: add a minimum senior population filter (e.g., 20,000+ seniors in 2025) to focus the ranking on CMAs with statistically stable estimates.
- Explainability tooltips: surface raw per-capita values and equity drivers on hover for ranking visuals, making the index interpretable for non-technical stakeholders.
- Row-Level Security: implement province-specific access controls for distributing the dashboard to regional stakeholders.
- Annual refresh cadence: establish a data refresh process tied to Statistics Canada's annual population estimates and MDALL quarterly updates.

## 8.4 Phase 4 -- Commercialization

The Opportunity Index has a natural commercial path as a licensed data product or consulting deliverable for healthcare vendors, insurers, and government clients.

- SaaS licensing: the Power BI dashboard, updated annually, can be licensed to healthcare vendors and insurers as a market intelligence subscription.
- Custom analysis: the pipeline can be adapted to answer client-specific questions such as territory design, competitive benchmarking, or M&A target identification.
- Government contracts: the methodology aligns directly with provincial and federal requirements for evidence-based program design, creating a path to consulting and research contracts.

## 9. Risks, Limitations, and Assumptions

Every data project built on public administrative data carries inherent constraints. SMAP is no exception. The following section documents every risk, limitation, and assumption made during the build. Transparency here is not a weakness; it is what makes the outputs trustworthy.

### 9.1 Statistics Canada Suppression Flags

Statistics Canada suppresses cell values when counts fall below a confidentiality threshold. This policy is correct and necessary, but it creates gaps precisely in the places most likely to be underserved: smaller CMAs with fewer respondents.

Impact	Suppressed values were encountered across multiple demand tables, particularly in CMAs with smaller senior populations. Each suppressed cell forced a decision: estimate proportionally from provincial totals, flag as unreliable, or exclude from scoring. Every decision was documented in the assumptions log.
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### 9.2 Demand Allocated from Provincial Totals

Statistics Canada's CSD provides demand statistics at the provincial level, not the CMA level. To derive CMA-level demand estimates, SMAP allocated provincial totals proportionally using each CMA's share of the provincial 65+ population. This ensures mass balance across CMAs but introduces estimation uncertainty for any individual CMA whose true need diverges from its population share.

### 9.3 FSA-to-CMA Mapping Imprecision

Forward Sortation Areas do not align perfectly with CMA boundaries. Of Ontario's 229 FSAs, 220 were assigned to CMAs through spatial overlay; the remaining 9 fell outside any CMA boundary and were designated as non-CMA rather than being force-assigned. For FSAs spanning multiple CMA boundaries, a majority-area rule was applied.

### 9.4 MDALL as a Proxy for Physical Supply

Health Canada's MDALL registry records device licences, not physical device locations. A licence holder may have a registered address in one CMA but distribute devices across a much wider geography. Supply metrics therefore represent the regulatory footprint of the market, not the true physical distribution of devices.

### 9.5 Temporal Misalignment

The three data pillars were collected across different time periods. MDALL supply data is current to the point of extraction. ADP vendor data reflects a point-in-time registry. Statistics Canada



demand data is drawn from the 2021 Census and 2022 CSD cycle. All data is treated as contemporaneous for the purpose of index construction, which introduces a modest lag risk for rapidly changing markets.

## 9.6 CMA Centroids as Geometric Approximations

The map visualizations in Power BI use CMA centroid coordinates computed from official 2021 Statistics Canada boundary shapefiles rather than the official GeoSuite Representative Point coordinates. The geometric centroid approach is accurate to within a few kilometers for most CMAs but may place the map bubble slightly outside the intended population center for irregularly shaped or multi-part CMAs.

## 9.7 Complete Assumptions Register

Assumption	Impact	Mitigation
Demand allocated by 65+ population share	Medium: individual CMA demand estimates are modeled, not observed	Mass-balance QA; flag as proxy in all outputs
FSA majority-area rule for boundary overlap	Low: affects a minority of FSAs with split boundaries	Document affected FSAs; provide non-CMA flag
MDALL address = device distribution location	Medium: actual device footprint may differ from licence address	Combine with ADP vendor data as cross-check
All data treated as contemporaneous	Low-Medium: 2021-2022 demand data used with 2025 supply data	Flag in documentation; refresh when new CSD data is published
Equal weighting of Demand, Access, Equity in Opportunity Score	Medium: different stakeholders may prefer different weights	Sensitivity analysis planned; What-If parameter in Phase 3
StatCan suppressed cells estimated from provincial proportions	Medium: suppressed CMAs may have genuinely different profiles	Flag suppressed cells in outputs; do not rank them alongside unsuppressed CMAs
Geometric centroids used for map visualization	Low: minor positional inaccuracy for some CMAs	Swap with official GeoSuite RP coordinates when available
CHSS PUMF microdata analyzed at province level only	Medium: individual-level mobility indicators not yet mapped to CMAs	PUMF CMA-level integration planned in Phase 1 completion
Ottawa-Gatineau split by province (ON vs QC parts)	Low: correct by design; reflects ADP program jurisdiction	Surrogate key (cma_code + pruid) enforces separation

Non-CMA FSAs assigned to code 000 and excluded from scoring	Low: rural areas outside CMAs are out of scope by design	Flag in data dictionary; include in national expansion if rural scope is added
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## 9.8 Risk Summary

Risk	Severity	Mitigation
StatCan suppression flags	High	Document, flag, and estimate where possible
Province-level demand allocation	Medium	Proportional allocation with mass-balance QA
FSA boundary misalignment	Low-Medium	Majority-area rule; 9 non-CMA FSAs excluded
MDALL as proxy for physical supply	Medium	Noted in all outputs; cross-checked with ADP vendor data
Temporal misalignment across sources	Low	Treated as contemporaneous; flagged in documentation
Small CMA instability in per-capita rates	Medium	Z-score outlier flags applied
Geometric centroids in map layer	Low	Swap with official GeoSuite RP when available
Equal-weight Opportunity Score	Medium	Sensitivity analysis and dynamic weighting planned

## 10. Data Inventory and Deliverables

### 10.1 Curated Datasets Produced

Dataset	Format	Description
mdall_active_licences_curated	CSV + Parquet	Cleaned, deduplicated MDALL supply records
mdall_mobility_licences_curated	CSV	Mobility-specific licence subset
adp_mobility_vendors_with_cma	CSV	ADP vendors with FSA and CMA assignment
demand_by_cma	CSV	CMA-level demand metrics allocated from provincial totals
fsa_to_cma_filled	CSV	Complete FSA-to-CMA mapping for Ontario (229 FSAs)
opportunity_index_base_by_cma	CSV + Parquet	Integrated supply-access-demand base table
opportunity_index_by_cma_wide	CSV	Wide-format index with all component scores
cma_centroids	CSV	Latitude/longitude coordinates for Power BI mapping
smap_data_dictionary	CSV	Field definitions and metadata for all tables

### 10.2 Documentation Produced

- Master Project Briefing: Full context document for continuity across sessions and team members
- Data Gathering and Cleaning Report: Step-by-step process documentation with issue log and resolutions
- EDA Report (Ontario CMAs): Plain-language exploratory analysis with pressure rankings and recommendations
- Supply Page Build Guide: Power BI DAX measures, visual configurations, and QA checklist
- Demand Deep Dive Build Guide: Ontario and CMA panel configurations with bookmark interactions
- Dashboard Design and Handover Report: Full semantic model, relationships, and continuation plan
- Engagement Closeout Report: CMA centroid mapping methodology and Power BI integration decisions
- Data Readiness Summary: One-page confirmation of data pillar completeness

## Glossary

Term	Definition
<b>ADP</b>	Assistive Devices Program: Ontario Ministry of Health program funding assistive devices for eligible residents
<b>CMA</b>	Census Metropolitan Area: a large urban area and surrounding communities as defined by Statistics Canada
<b>CSD</b>	Canadian Survey on Disability: Statistics Canada survey measuring disability prevalence and assistive device use
<b>CHSS PUMF</b>	Canadian Health Survey on Seniors Public Use Microfile: individual-level senior health data with survey weights
<b>FSA</b>	Forward Sortation Area: the first three characters of a Canadian postal code, used as a geographic bridge
<b>MDALL</b>	Medical Devices Active Licence Listing: Health Canada registry of licensed medical device manufacturers
<b>Opportunity Index</b>	A 0-100 composite score reflecting the relative opportunity to expand mobility aid access in a given CMA
<b>Pressure</b>	Demand minus Availability in standardized units; positive values indicate underserved CMAs
<b>Z-score</b>	A standardized value indicating how far a CMA's metric is from the provincial average, in standard deviation units
<b>Access Deficit</b>	Inverted access score (0-100); higher scores indicate weaker vendor/device access per 10,000 seniors
<b>Equity Need Index</b>	A composite score reflecting social vulnerability based on visible minority %, Indigenous identity %, and senior population growth