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The Methodology for Preparing Annual Population Estimates for Subprovincial Areas in Canada

Conference of the Canadian Rural Revitalization Foundation

T11. Panel - Accessing Rural Data Part I

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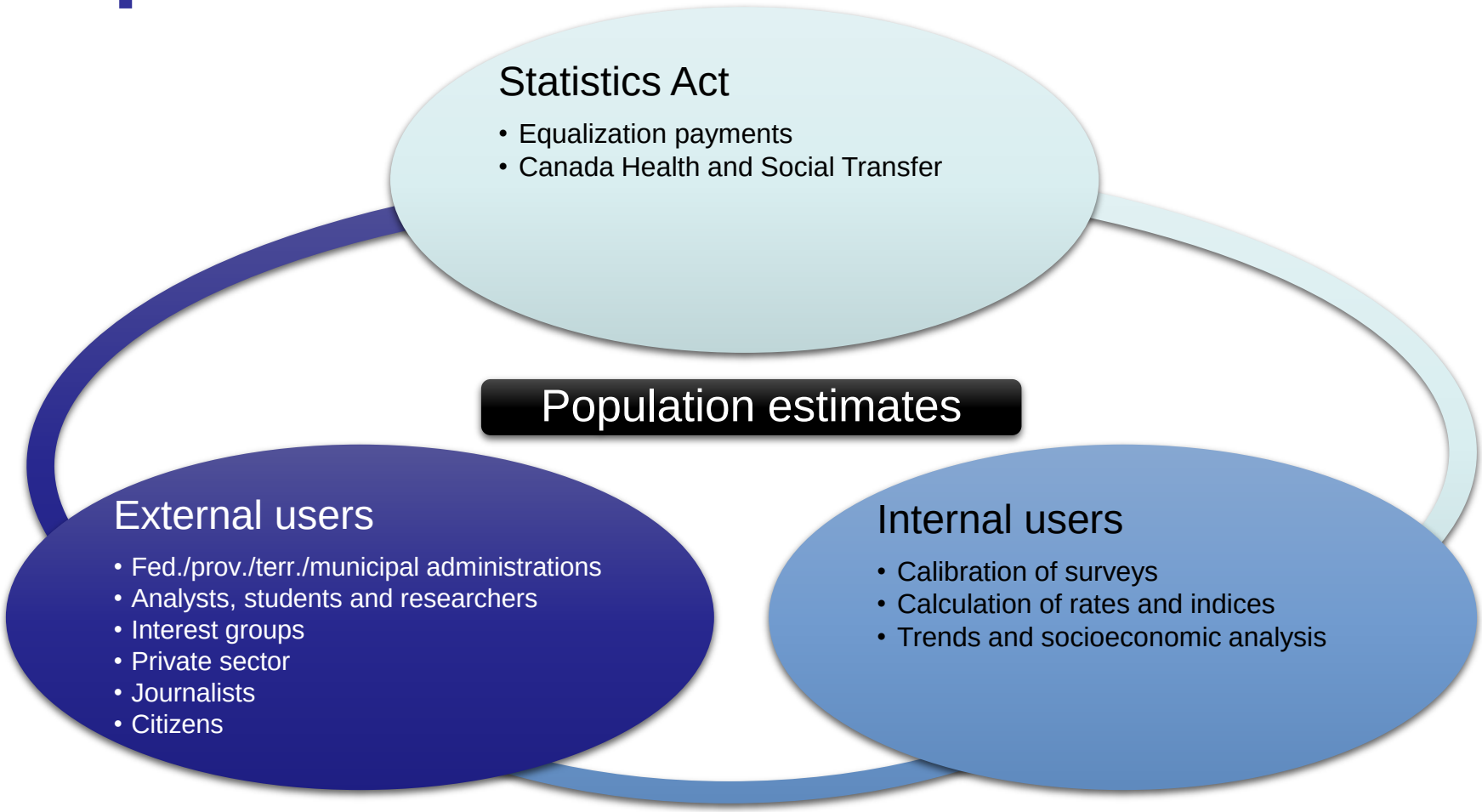
Outline of presentation

- Overview
  - Introduction to population estimates
  - Geographical concepts
  - Recent population trends
- Methodology to produce subprovincial population estimates
  - CDs
  - CSDs
  - Towards using fiscal data to estimate CSD population
    - Preliminary findings
- Products

Overview

Why are population estimates important?



What are the differences between Statistics Canada's census counts and population estimates?

Census:

- Detailed information on the population at a single point in time, every five year.
- Many subjects and sub-populations are covered (income, education, immigrants, Aboriginals, etc.)
- Provide counts and profiles for small geographical areas.
- Some people may be missed; some people may also be counted more than once.
  ➔ Coverage studies

Population estimates:

- Provide a more accurate measure of population counts.
- Provide a more timely measure of population counts.
- Measure the evolution of the population between censuses.

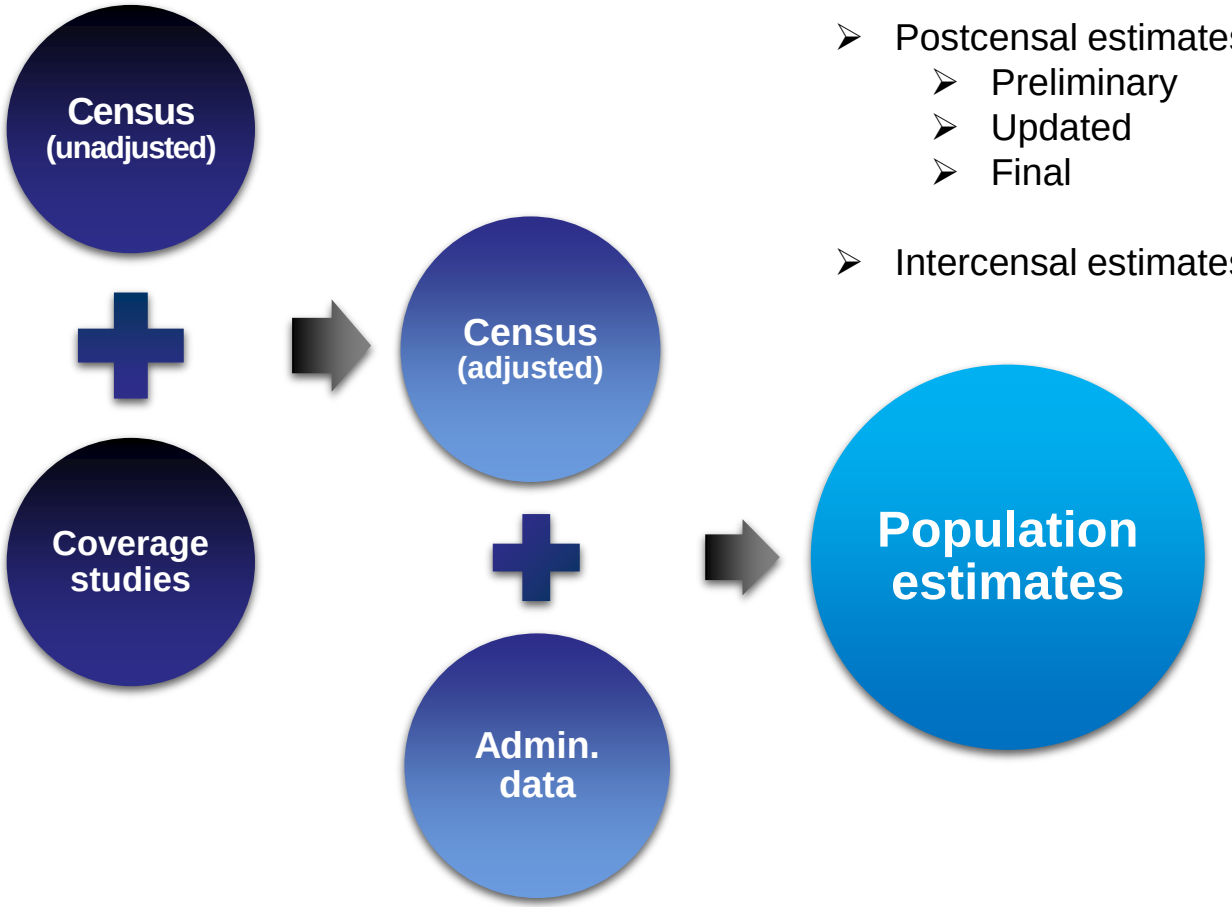
Population estimates are essential to measure major demographic trends and milestones in a more timely manner

Greying nation: Canada has more seniors than kids for the first time ever. Here's what that means

Metro Toronto population blasts above six million according to Stats Can. Montreal at four million

320,000 newcomers came to Canada in past year, highest number since 1971

How are population estimates produced ?



- Postcensal estimates
  - Preliminary
  - Updated
  - Final
- Intercensal estimates

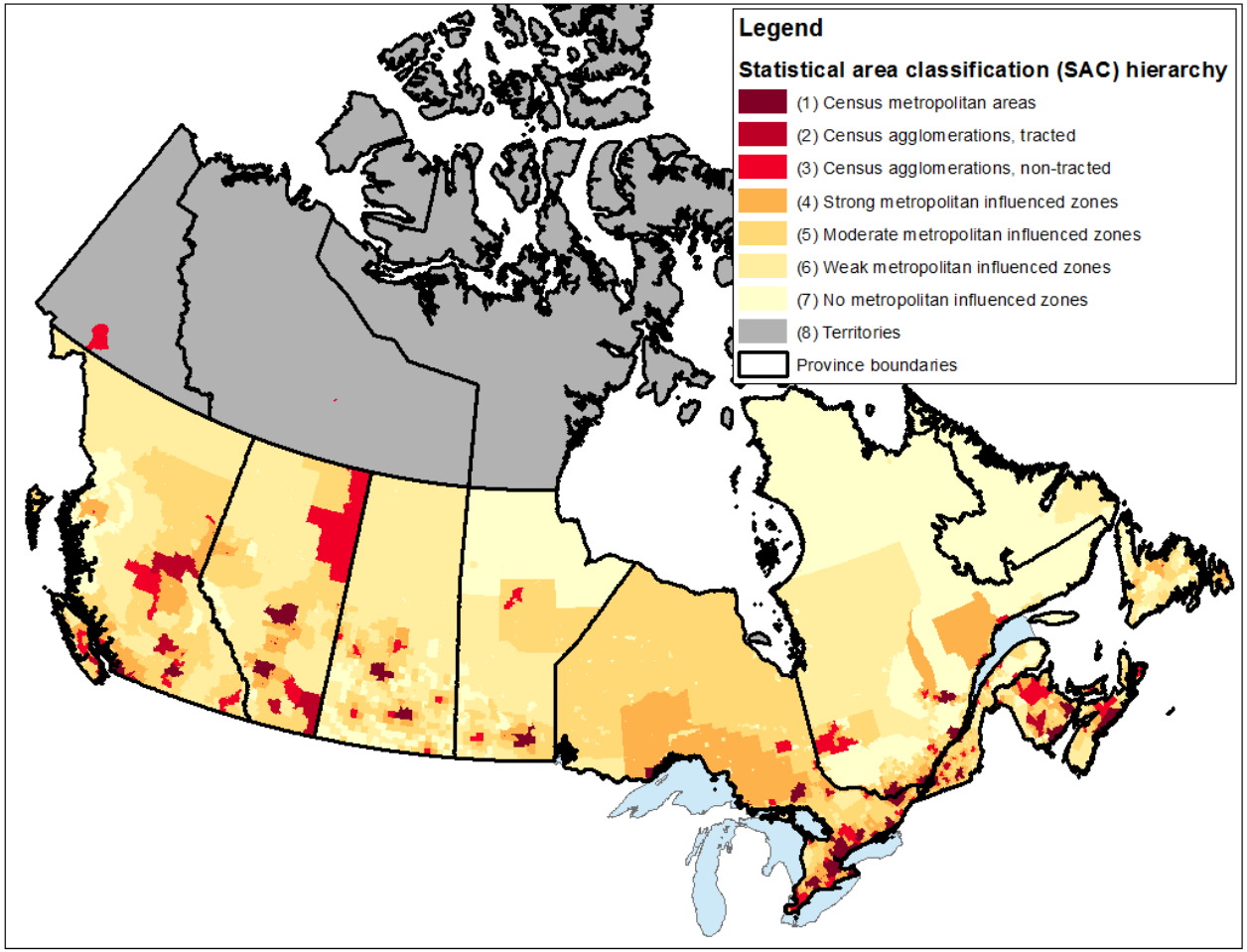
Definitions of some geographical concepts

Census subdivision (CSD)
Municipalities or areas treated as municipal equivalents for statistical purposes (e.g., Indian reserves, Indian settlements and unorganized territories).

Census division (CD)
Intermediate geographic areas between the province/territory level and the municipality (CSD).

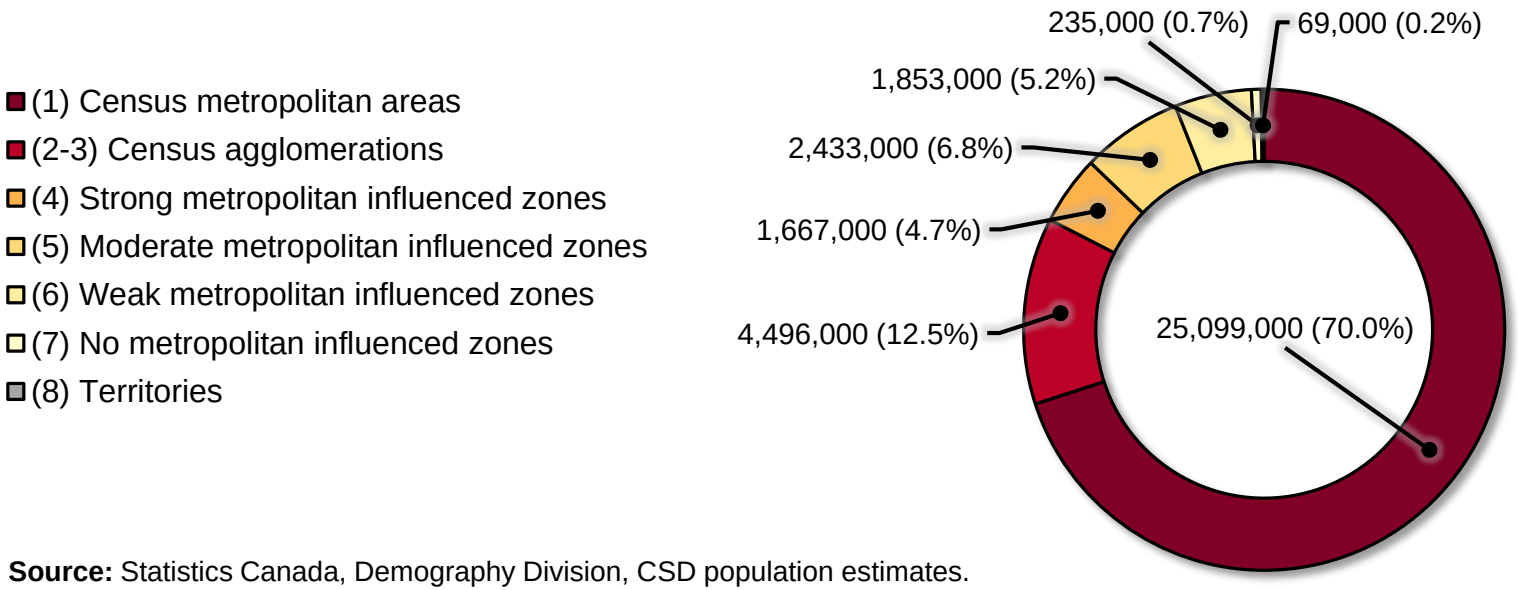
Statistical Area Classification (SAC)
CSDs grouped according to whether they are a component of a census metropolitan area, a census agglomeration or a census **metropolitan influenced zone** (MIZ).

Canada census subdivisions divided by types of the SAC



About 1 Canadian out of 6 lives outside metropolitan Canada

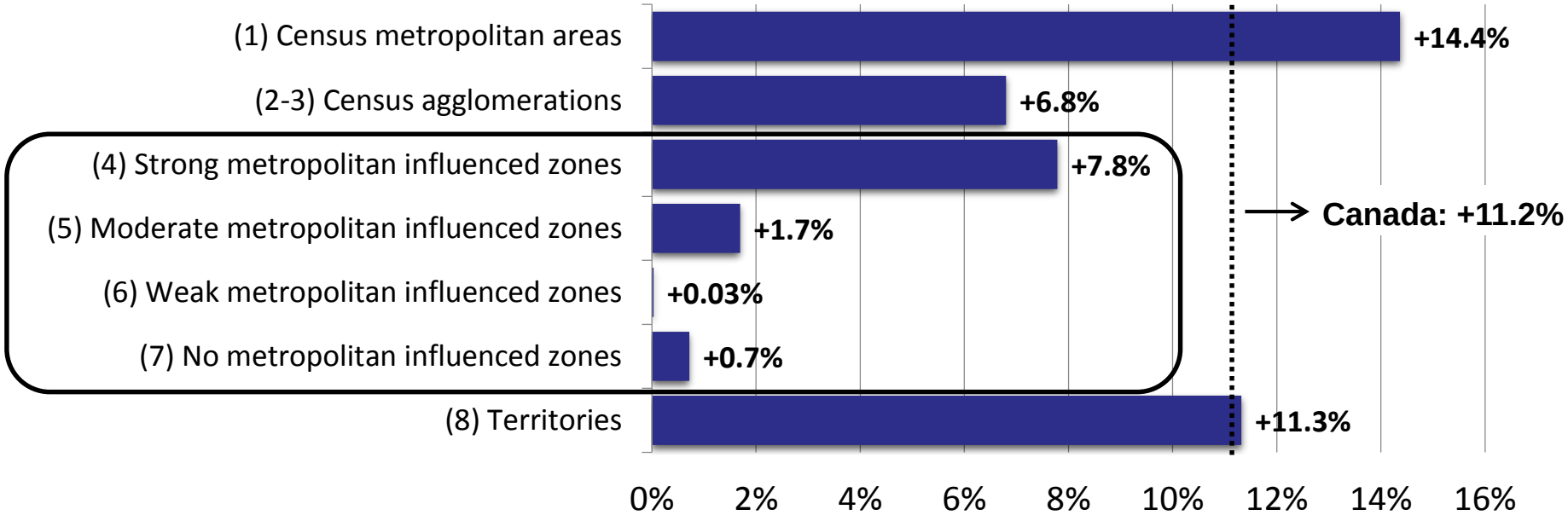
Population distribution according to the Statistical Area Classification, July 1, 2015



Source: Statistics Canada, Demography Division, CSD population estimates.

Population growth is stronger in CMAs and weaker in lesser influenced metropolitan zones

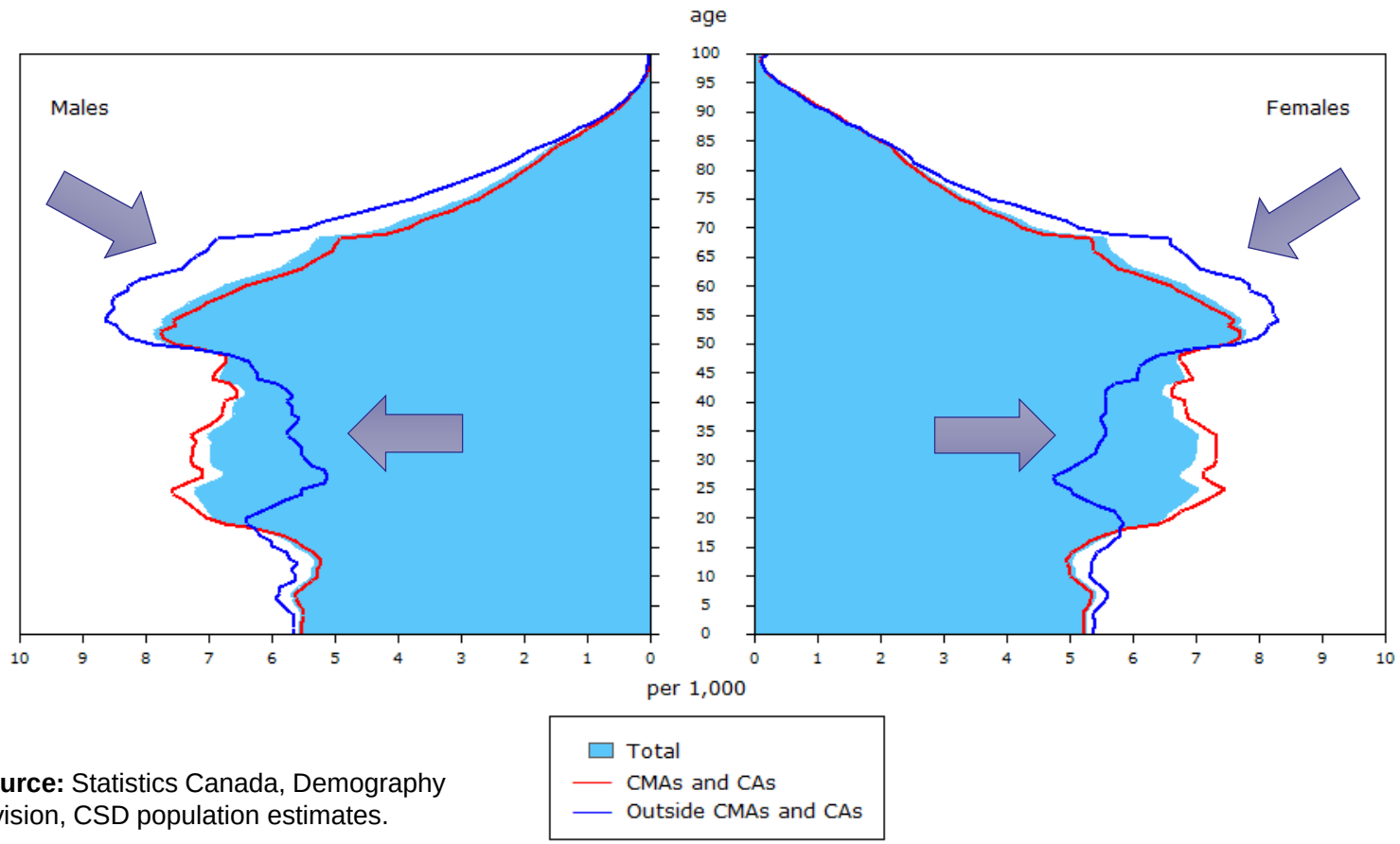
Population variation, by category of the Statistical Area Classification, 2005/2015



Source: Statistics Canada, Demography Division, CSD population estimates.

Areas outside CMAs and CAs have a larger share of seniors and a smaller proportion of working-age adults

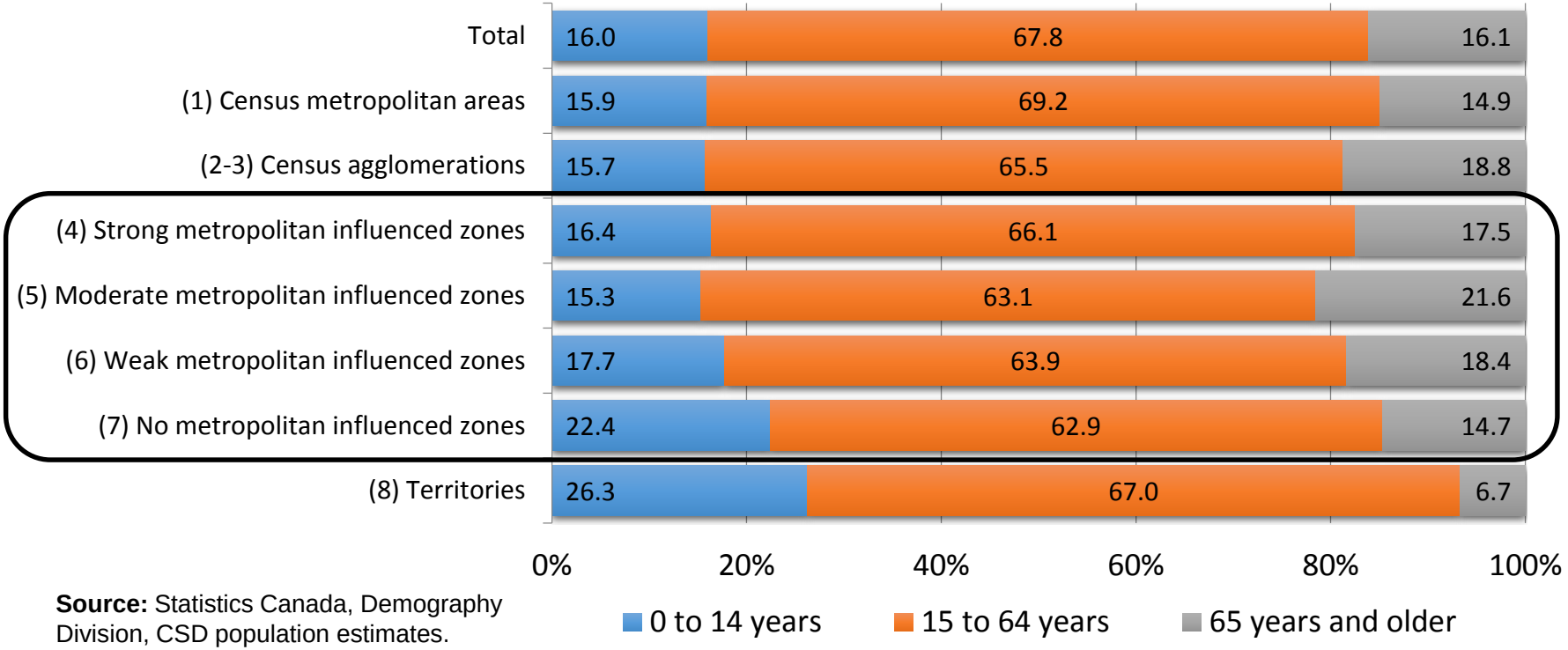
Age pyramid of population estimates as of July 1, 2015, Canada



Source: Statistics Canada, Demography Division, CSD population estimates.

Seniors (65+) outnumber children (0 to 14 years) in strong, moderate and weak metropolitan influenced zones

Distribution of population by age group according to the Statistical Area Classification, 2015



Source: Statistics Canada, Demography Division, CSD population estimates.

Methodology for preparing subprovincial population estimates

Base population

Unadjusted Census (May 10 2011)	• 33,476,688
Adjustment for net undercoverage	• 759,125 (Net undercoverage) • 37,392 (Incompletely enumerated Indian reserves)
Adjusted Census (May 10 2011)	• 34,273,205
Demographic growth until July 1st 2011	• 69,575
Demographic estimates (July 1st 2011)	• 34,342,780

Base population

Using the component method

Component-method formula (for CDs)

$$P_{(t+1)} = P_{(t)} + B_{(t,\,t+1)} - D_{(t,\,t+1)} + I_{(t,\,t+1)} - \left(E_{(t,\,t+1)} + \Delta TE_{(t,\,t+1)}\right) + RE_{(t,\,t+1)} + \Delta NPR_{(t,\,t+1)} + \Delta Ninter_{(t,\,t+1)} + \Delta Nintra_{(t,\,t+1)}$$

where, for each subprovincial area:

$(t, t+1)$	=	interval between times t and t+i;	
$P_{(t+1)}$	=	estimate of the population at time t+i;	
$P_{(t)}$	=	base population at time t (census adjusted for census net undercoverage or the most recent estimate);	
$B_{(t,\,t+1)}$	=	number of births;	Natural increase
$D_{(t,\,t+1)}$	=	number of deaths;	
$I_{(t,\,t+1)}$	=	number of immigrants;	Net international migration
$E_{(t,\,t+1)}$	=	number of emigrants;	
$\Delta TE_{(t,\,t+1)}$	=	net temporary emigration;	
$RE_{(t,\,t+1)}$	=	number of returning emigrants;	
$\Delta NPR_{(t,\,t+1)}$	=	net non-permanent residents;	
$\Delta Ninter_{(t,\,t+1)}$	=	net interprovincial migration;	Net interprovincial migration
$\Delta Nintra_{(t,\,t+1)}$	=	net intraprovincial migration.	Net intraprovincial migration

Sources of postcensal population estimates

Factor of population growth	Data sources
Base population	• Census of Population adjusted for census net undercoverage
Natural increase	• Vital statistics
Net international migration	• Immigration Refugees Citizenship Canada (IRCC) data • T1 Family File (T1FF) • Canada Child Benefit (CCB) • U.S. Department of Homeland Security data • Reverse Record Check (RRC) data • Census distributions
Net interprovincial migration	• T1 Family File (T1FF) • Canada Child Benefit (CCB) • Census distributions
Net intraprovincial migration	• T1 Family File (T1FF) • Census distributions

Estimating population estimates at the CSD level

- After calculating CD populations, we calculate growth rates by age and sex for each CD.

- Then we apply the CD-level growth rates by age and sex to the base population of the corresponding CSDs.

- Finally, in order to ensure consistency between CSD- and CD-level population estimates by age and sex, we use calibrating techniques.

The error of closure: a data quality indicator

- **Goal**: To measure the exactness of the final postcensal estimates.

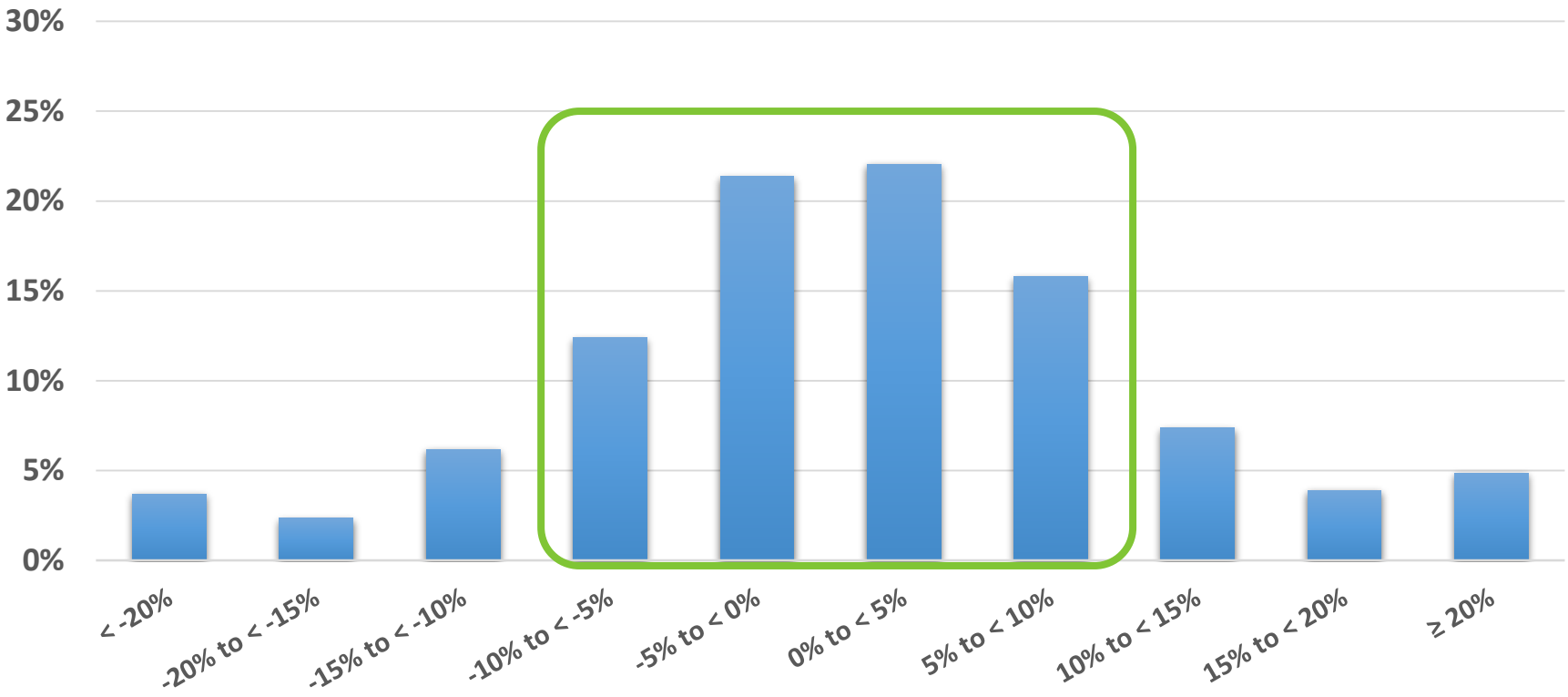
Error of closure =

(Final postcensal population estimates on census day**) -**

(Enumerated population of census adjusted for census net undercoverage**)**

Most CSDs recorded an error of closure within the acceptable range

Distribution of CSDs according to the error of closure for total population, using the actual and proposed methods, Canada, 2006/2011 cycle



Advantages of the actual methodology

- Simple and intelligible
- Consistent with the classical approach in small area estimation

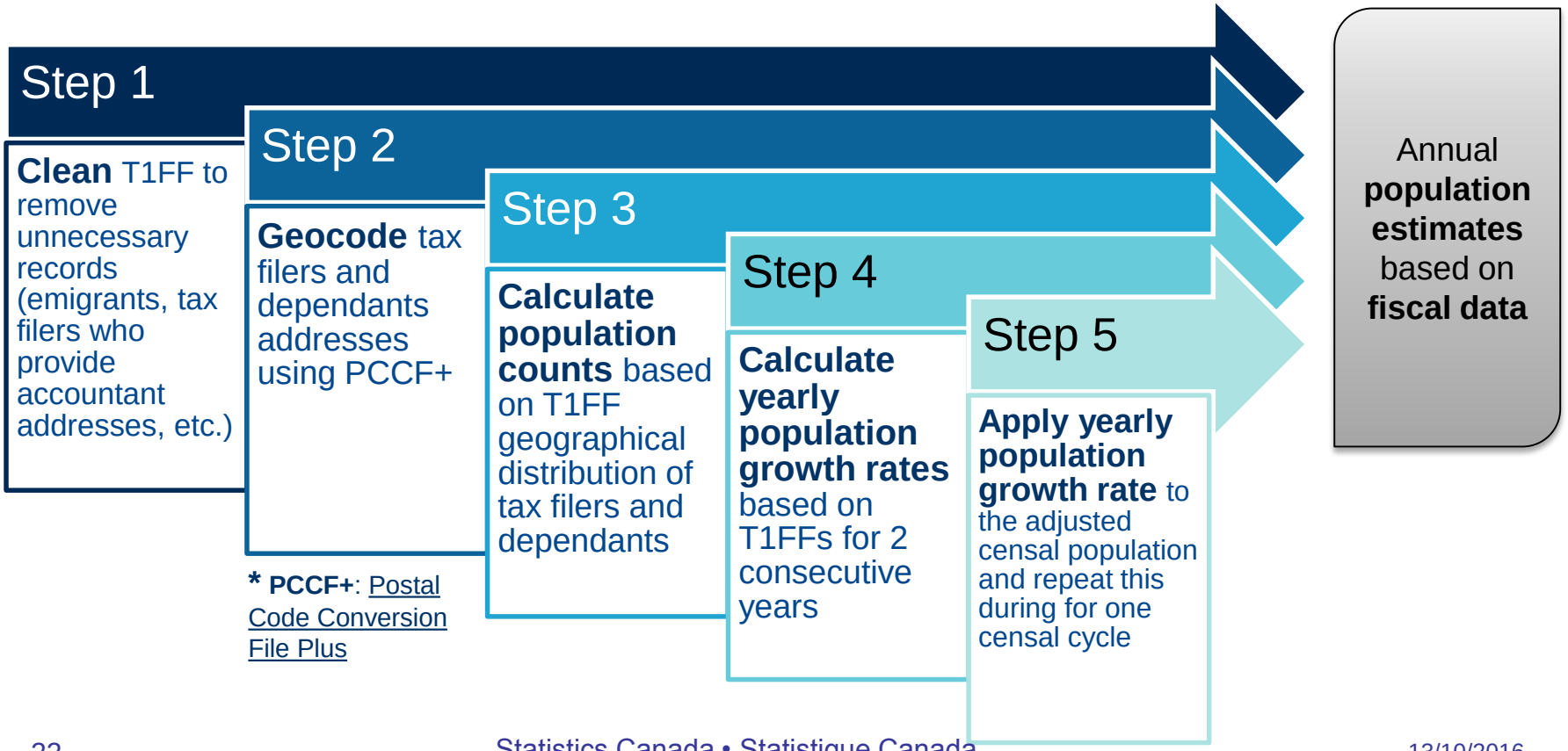
Limitations of the actual methodology

- Artificially drives the CSD population growth rate to echo the value of its corresponding CD.

- The actual method is not appropriate when CSDs among a single CD are highly heterogeneous, for example:
  - Highly urban CSDs, booming suburban CSDs and rural CSDs;
  - CSDs with considerable aboriginal populations and CSDs with no aboriginal population;
  - CSDs specialized in diverse types of economies.

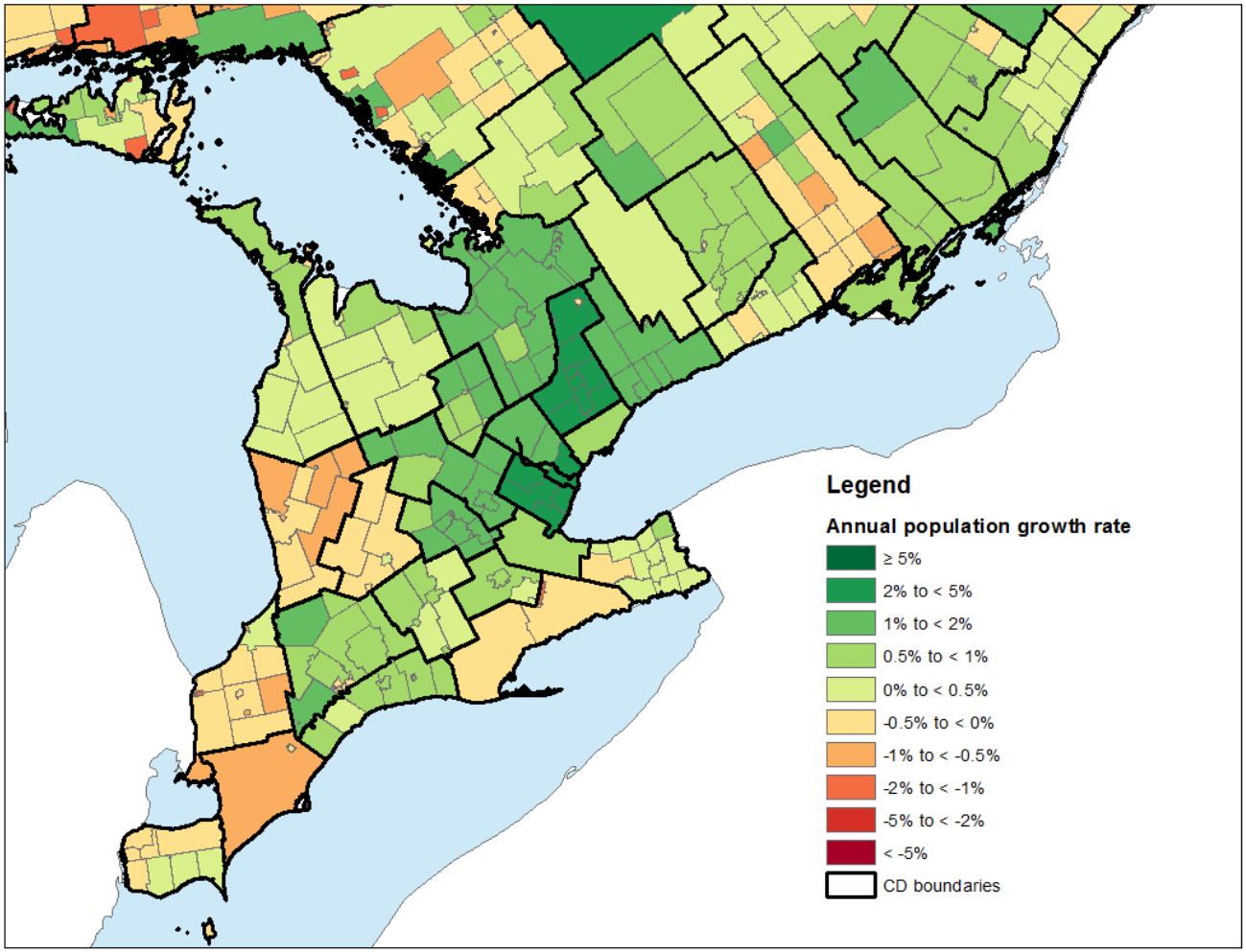
Towards using fiscal data to estimate CSD population

- **Objective**: Calculate population estimates for small areas on the basis of fiscal data from T1 Family Files (T1FF)



Findings

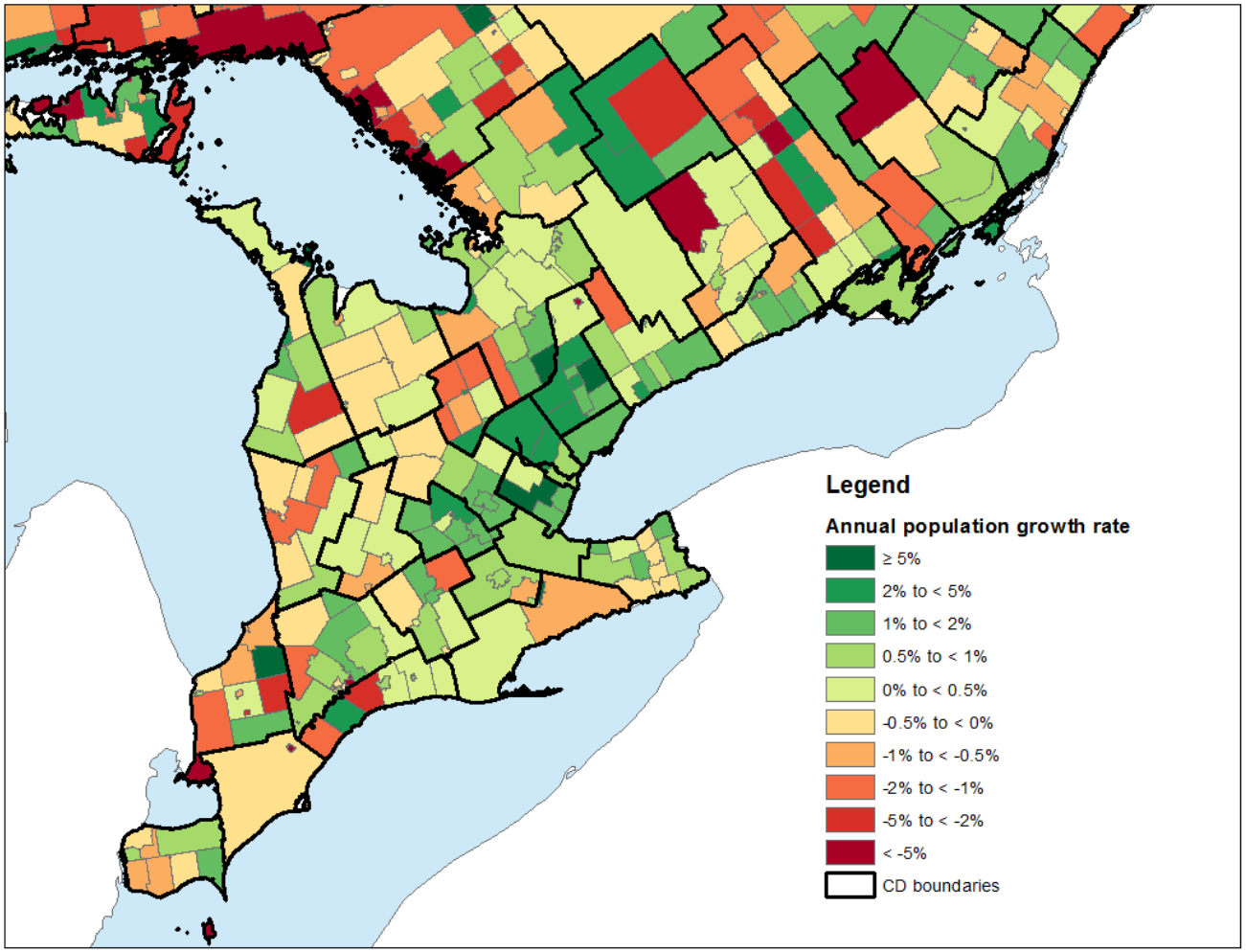
Population growth rate based on the actual method, 2010/2011, by CSD, Southern Ontario



Findings

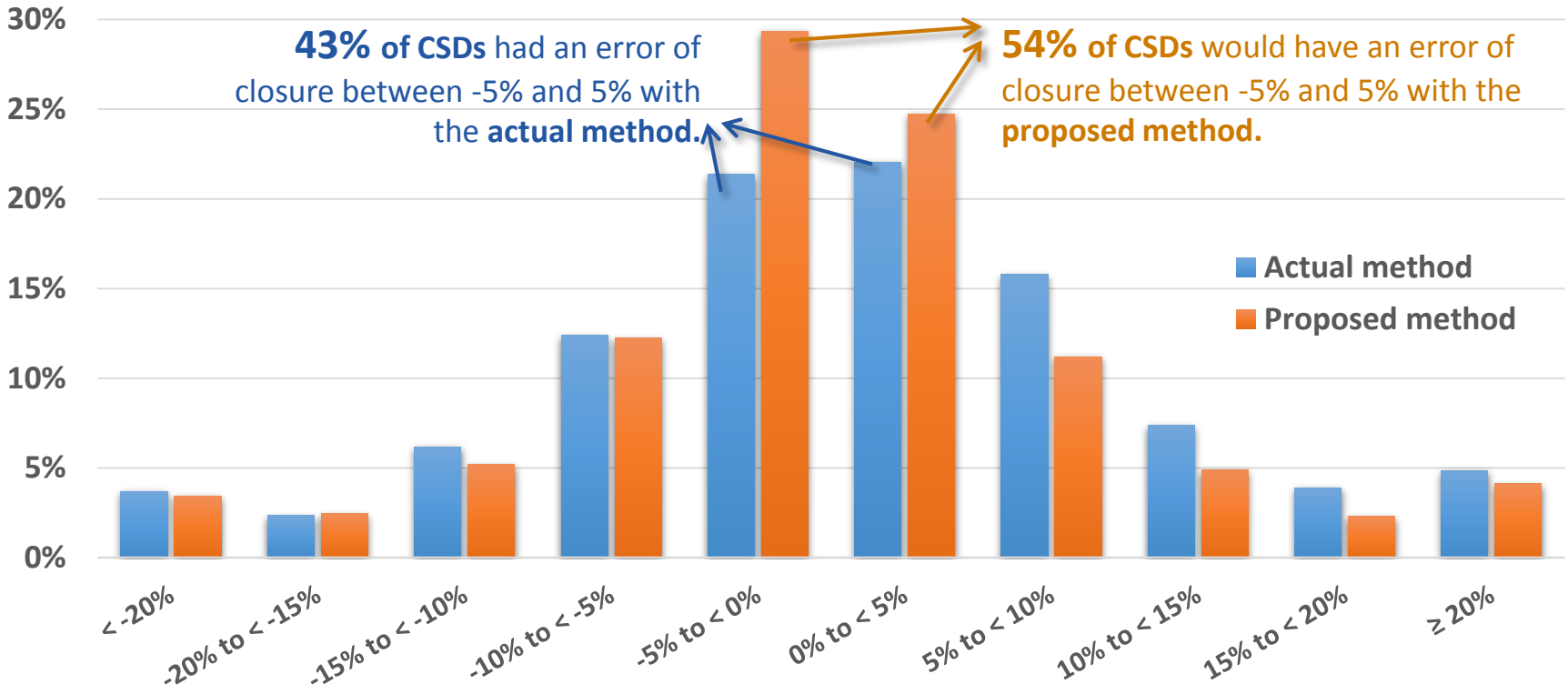
- Higher diversity in CSD population growth rates among single CDs
- Population growth targeted to CSDs that are actually expected to expand, such as suburbs around urban cores.

Population growth rate based on the proposed method, 2010/2011, by CSD, Southern Ontario

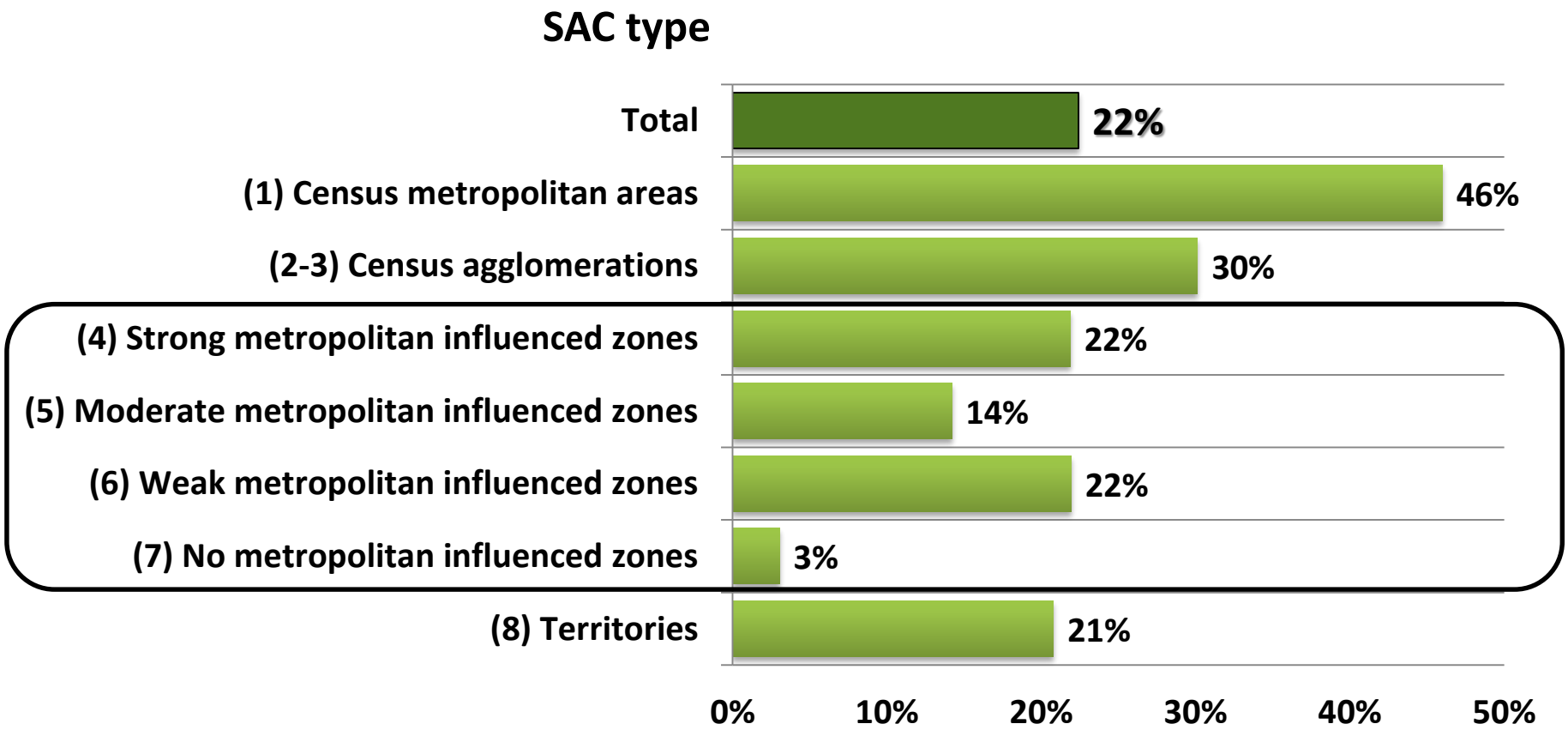


The error of closure is lower in more CSDs with the proposed method

Distribution of CSDs according to the error of closure for total population, using the actual and proposed methods, Canada, 2006/2011 cycle



Median decrease in error of closure using the proposed method, compared to actual method



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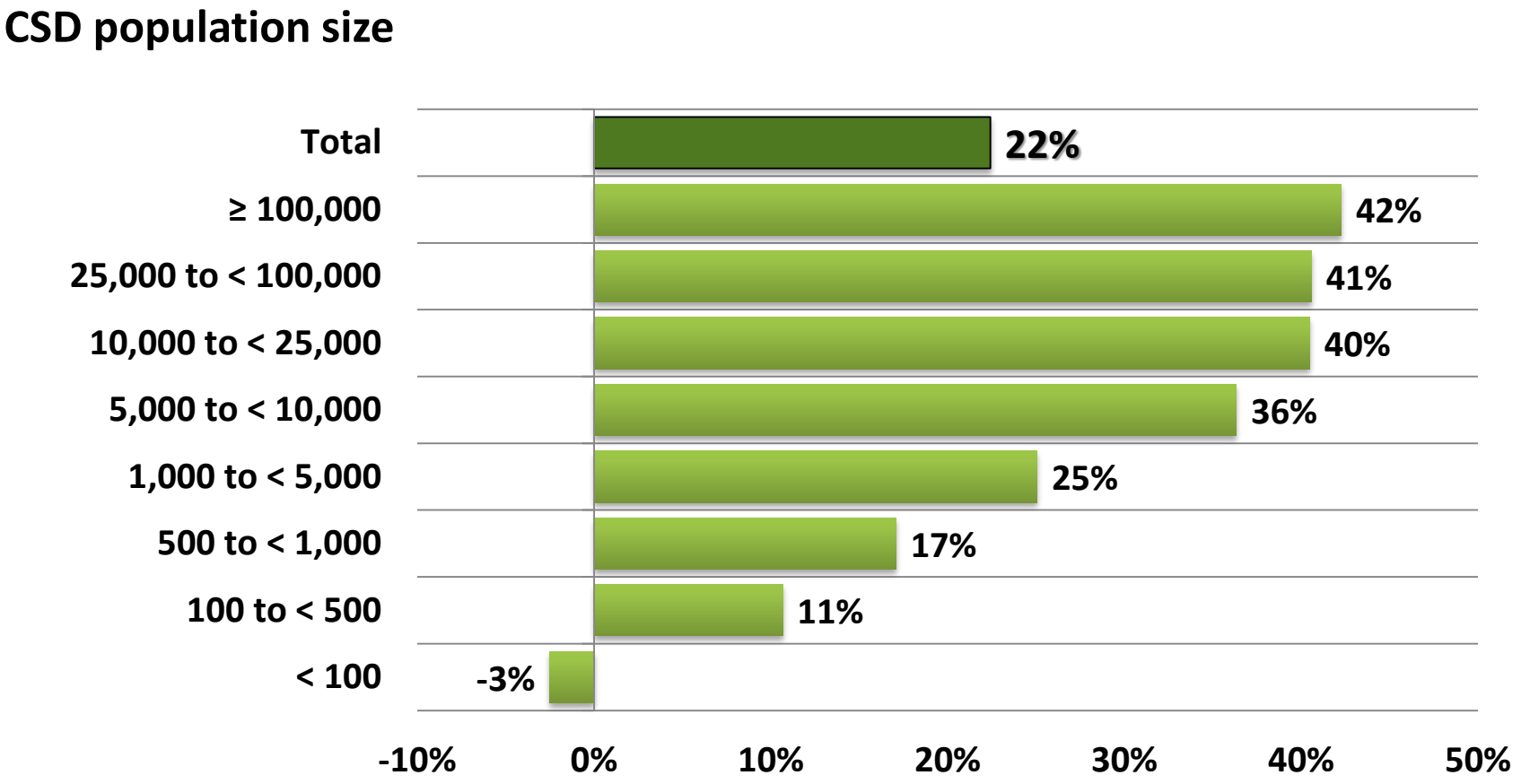

Next steps

- Repeat the testing of the proposed method with data for the 2011/2016 censal cycle
- Continue testing of the proposed method with other subprovincial areas (Health Regions, Federal Electoral Districts, Population Centres, etc.)
- Collaborate with provinces' and territories' statistical agencies and departments
- Age and sex estimates
- Investigate use of alternate sources to complement T1FF
- Improve accuracy of geocoding for rural postal codes

Products

Available subprovincial geographies for population estimates

Period	Available geographies	Available products	Types of estimates	Dissemination date	Dissemination type
Annual (as of July 1)	**CMAs** (Census metropolitan areas)	Population & Components	Total & Age and sex	February / March	CANSIM + Publication (No. 91-214)
	CDs (Census divisions)				
	ERs (Economic regions)				
	CAs (Census agglomerations)	Population			Cost-recovery files available upon request
	CSDs (Census subdivisions)				Cost-recovery files available upon request (Total population tentatively to be released on CANSIM in 2019)
	HRs (Health Regions)			May / June	CANSIM (data released by the Health Statistics Division)

Factors and components of demographic growth (for CMAs, CDs and ERs)

Factors	Components	CANSIM tables
Population		051-0056 (CMAs), 051-0059 (ERs), 051-0062 (CDs)
Natural increase	Births	051-0057 (CMAs), 051-0060 (ERs), 051-0063 (CDs)
	Deaths	
International migration	Immigrants	
	Emigrants	
	Returning emigrants	
	Net temporary emigration	
	Net non-permanent residents	
Interprovincial migration	Net interprovincial migration	
Intraprovincial migration	Net intraprovincial migration	
Residual deviation (intercensal estimates only)		
Internal migration (Interprov + Intra)	Origin-destination matrix	051-0065 (CMAs)
Interprovincial migration	In-migrants and out-migrants	Cost-recovery files available upon request (tentatively to be released on CANSIM in 2019)
Intraprovincial migration	In-migrants and out-migrants	

Useful resources from the Demographic Estimates Program

Annual Demographic Estimates: Subprovincial Areas
Catalogue number 91-214-X

Population and Family Estimation Methods at Statistics Canada
Catalogue number 91-528-X

Annual Demographic Estimates: Canada, Provinces and Territories
Catalogue number 91-215-X

Quarterly Demographic Estimates
Catalogue number 91-002-X

THANK YOU! ☺

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