

## Examining Patterns of Coverage: A Comparative Analysis of Canadian and U.S. Censuses

Julien Bérard-Chagnon, Statistics Canada  
Eric B. Jensen, U.S. Census Bureau

### *Short abstract*

Censuses play a central role in demography by providing profiles of the population, data for research and planning, and weights for household surveys. Although the goal of the census is to fully enumerate the population, there may be errors in coverage where some groups are over or undercounted. Both the United States and Canada evaluate the coverage of their censuses; however, they use different methods. Canada measures coverage using the Reverse Record Check and the Census Overcoverage Study while the United States uses Demographic Analysis and the Post-Enumeration Survey. In this paper, we compare patterns of coverage errors for Canadian and U.S. censuses, focusing on similarities and differences by demographic characteristics. While the two countries share many similarities in terms of overall statistical infrastructure, society, culture and economy, we find many differences in patterns of coverage. This presentation is a joint effort by Statistics Canada and the U.S. Census Bureau.

### *Extended abstract*

Censuses play a central role in demography by providing profiles of the population and data for research and planning of many services such as public transportation, schools and hospitals. Census data are often used to create post-stratification weights for household surveys. Moreover, in the United States as well as in Canada, census data is used to allocate funding to state and local governments. In addition, census data are used to determine the number of Members of Parliament or apportion representatives in the U.S. House of Representatives.

Although censuses aim at enumerating the entirety of the population, complete coverage and accuracy are unattainable goals in practice (UNECE, 2015 : §366). After each census, coverage evaluations are undertaken. These evaluations provide very valuable insight on the quality of census data to inform users and improve the quality of censuses. The importance of measuring census coverage is further highlighted in Canada where data used as the base population for population estimates and projections is adjusted for coverage.

The United States and Canada have long withstanding traditions of taking censuses. The two countries also share many similarities in terms of overall statistical infrastructure, society, culture and economy. However, the approach that each country takes to evaluate coverage in their censuses is very different. Canada measures coverage using the Reverse Record Check (RRC)

and the Census Overcoverage Study (COS) while the United States uses Demographic Analysis (DA) and the Post-Enumeration Survey (PES). There are also differences in which groups are overcounted and undercounted in the Canadian and U.S. censuses.

In this paper, we compare patterns of coverage errors for Canadian and U.S. censuses, focusing on similarities and differences in coverage by demographic characteristics. Using coverage evaluation data from Statistics Canada and the U.S. Census Bureau, we highlight populations that are hard-to-count in both the Canadian and U.S. censuses. Next, we show populations that are undercounted in one country but are overcounted (or have full coverage) in another country. Finally, we discuss how differences in census design, socioeconomic conditions, and coverage evaluation methodology may explain the results of the analysis. This presentation is a joint effort by the United States Census Bureau and Statistics Canada demographers to deepen our understanding of census coverage.

## Data

The data for this analysis come from the results of the coverage evaluations conducted following the 2011 and 2016 Canadian censuses and the 2010 Census of the United States. In Canada, census coverage is measured by two studies. First, the RRC is used to estimate undercoverage. A survey frame independent of the census that is being evaluated is built using administrative data and data from the previous census and RRC. Then a sample is drawn and each selected person is classified as being enumerated (found on census), missed (not found on census but should have been enumerated) or out of scope (i.e. deceased or has emigrated) using record linkages and field operations.

The second study used to evaluate census coverage in Canada is the COS. It uses record linkages to link the census with itself and with a database built from administrative data to find people who were enumerated more than once (overcoverage). Net census undercoverage is then computed by subtracting overcoverage from undercoverage for many demographic characteristics such as age, sex, jurisdiction and mother tongue.

In the United States, census coverage is measured using two methods. The first is Demographic Analysis (DA), which uses historical and current vital statistics records, data on international migration, and sources to develop national-level estimates of the U.S. population. The DA

estimates are compared to the census counts to estimate net coverage error. The second method used by the U.S. Census Bureau to measure coverage is dual-system estimation using a Post-Enumeration Survey (PES). The PES is a survey conducted shortly after the census. Records from the PES are matched to the Census using clerical and computer matching methods to produce estimates of net coverage errors and components of coverage errors.

### Preliminary Results

We compared net undercount rates by age groups and sex for the 2011 Canadian Census and the 2010 United States Census (Figure 1). For the United States, we show results from the PES and DA estimates. In Canada, net undercoverage peaks for young adults. This is likely linked with important life course transitions such as leaving the family home, often while keeping strong ties with more than one household. Net undercoverage for these age groups is more important for males than for females. Canadian censuses tend to show net overcoverage for children (5-9 and 10-17) and older adults but for different reasons. The results for children are mostly attributable to shared custody when the two parents enumerate their child. For older adults, it is likely that the number of imputations caused some overcoverage.

In the United States, the largest net undercoverage was for young children aged 0 to 4 using the DA estimates. However, the PES results do not show the same large undercoverage for this age group, likely because of correlation bias between the PES and the census. In contrast, the Canadian census does not show a significantly higher net undercoverage rate for young children aged 0 to 4 than for other age groups. The U.S. 2010 Census also showed a large net undercoverage for males aged 30 to 49 (Figure 1). While females aged 30 to 49 show net overcoverage in the U.S. census, there was undercoverage for this group in the Canadian census.

### Conclusion

Evaluating the coverage of censuses is a key part in understanding the quality of census data and planning for the next census. Although the coverage of Canadian and U.S. censuses is very good, some segments of the population are still facing coverage issues. The preliminary results show differences in net undercoverage rates by age groups and sex between the two countries. These differences could be explained by census design, racial and ethnic compositions, or the methods used to evaluate coverage. For instance, Canadian coverage studies rely a lot on record linkages

with administrative data. This approach not only reduces operational costs but can also decrease the impact of potential correlation bias. Coverage studies in the United States use the PES, which may be susceptible to correlation bias. DA would not have correlation bias, but the method still has potential bias from estimation and classification errors. We hope that, through this joint effort by Statistics Canada and the U.S. Census Bureau, we can deepen our understanding of census coverage and potentially improve the programs that measure the coverage of our censuses.

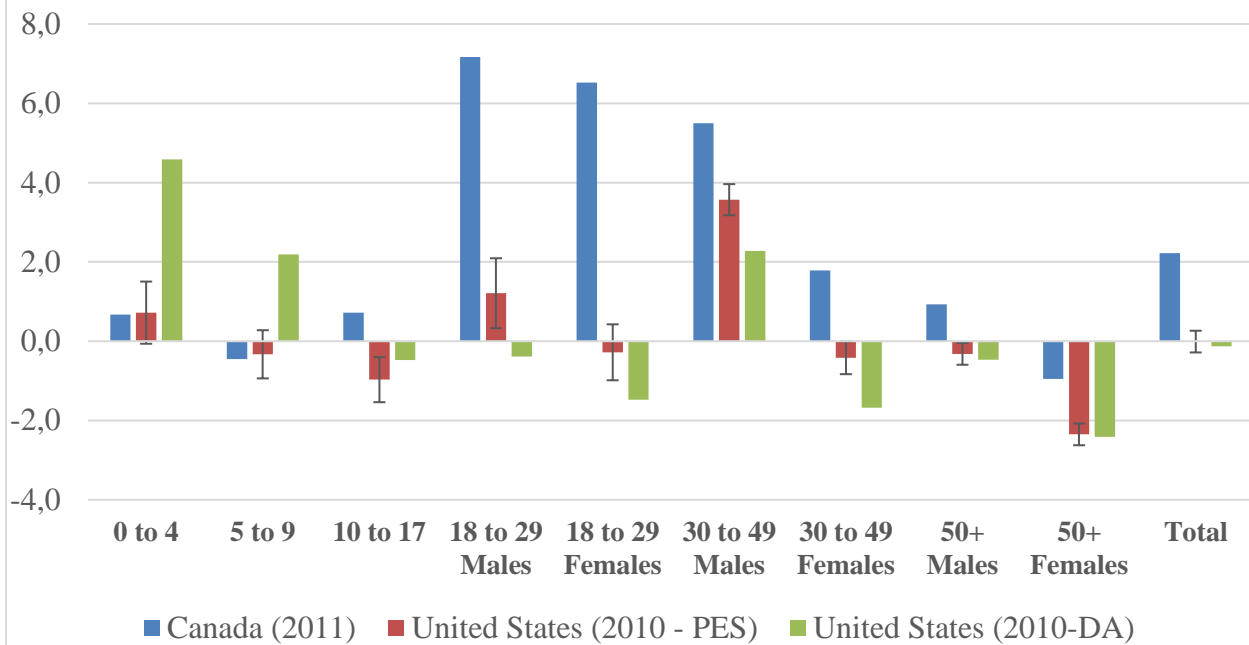
## References

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**Figure 1. Net Coverage Error by Age in the 2011 Canadian Census and the 2010 U.S. Census**



Note: A positive value implies a net undercount.

Note: Canada's numbers shown here are smoothed by jurisdiction, age and sex.

Source: Statistics Canada, Mule 2012 (U.S. CCM), and U.S. Census Bureau 2012 (U.S. DA).