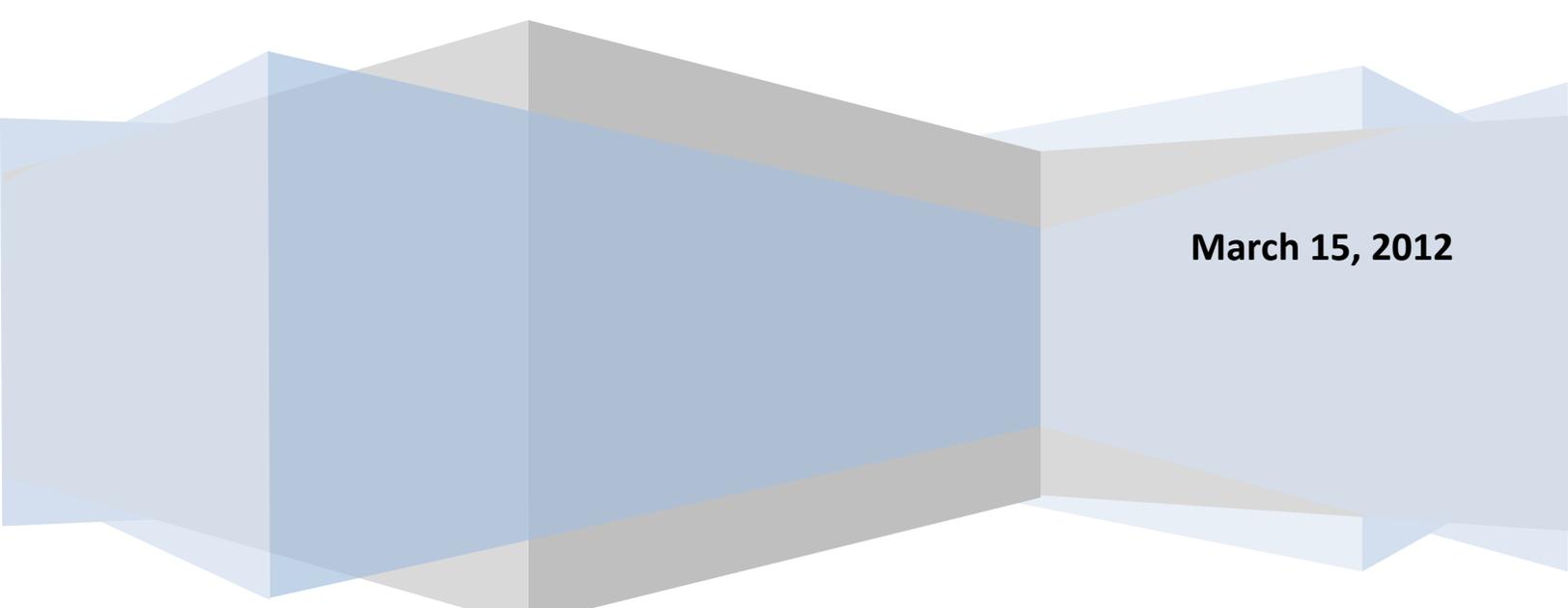


Censuses and Surveys of Governments: A Workshop on the
Research and Methodology behind the Estimates

The Implementation of Dashboards in Governments Division Surveys

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Abstract

Dashboards have gained popularity as a quick way to monitor metrics in manufacturing, business, healthcare, and even in election polling. After facing challenges with low unit response rates and Total Quantity Response Rates (TQRRs) for the 2007 Census of Governments: Finance Component, we decided to develop a dashboard that would monitor response in the very early stages of processing. The initial dashboard developed for the Annual Survey of Local Government Finances attempts to yield compliant unit response rates for each state by type of government, compliant TQRRs for each state by key item by type of government, and an adequate number of responses and acceptable response rate in each imputation cell. This dashboard has been used as a prototype for monitoring response for other surveys of governmental units. Initial dashboards have been developed for the Annual Survey of Local Government Finances, Annual Survey of Public Employment and Payroll, and Quarterly Survey of Property Tax Collections. This paper presents the conceptual and operational challenges that we faced in constructing each dashboard.

I. Background

In response to the 21 recommendations issued in 2007 by the Committee on National Statistics in its report, *State and Local Government Statistics at a Crossroads*, the U.S. Census Bureau's Governments Division (GOVS) launched a massive modernization and re-engineering effort. As a part of its re-engineering efforts, GOVS implemented the use of dashboards to guide non-response follow-up and to help ensure that the Census Bureau Statistical Quality Standards on response rates are met.

Responsive design has been widely used in household surveys. Real-time paradata provide tools that survey analysts can use to monitor survey processes to yield better quality statistical estimates. Groves and Heeringa (2006) presented examples of using paradata to monitor survey processes to increase response. Laflamme and Mohl (2007) and Laflamme, et al (2008) discussed changes in the field collection procedures for Statistics Canada surveys to actively manage survey quality. Axinn, Link, and Groves (2009) offered a suite of tools for the survey methodologists to use to improve the representative qualities of surveys. At the same time dashboards have

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gained popularity as a quick way to monitor metrics in manufacturing, business, and healthcare. It is only natural to look towards dashboards as a way to monitor survey processes paradata to actively manage survey quality. Although there is not a vast literature on using paradata and responsive design in establishment surveys, it is thought that such an approach should certainly be researched as a way to improve the quality of the estimates from our surveys of governments. To monitor the process, we developed nonresponse follow-up dashboards to guide analysts in their nonresponse follow-up.

In this paper, the description of the implementation and development of our initial dashboard for monitoring non-response follow-up is in Section II. Section III describes the alterations to the initial dashboard to fit other GOVS surveys. Section IV provides some results from our use of dashboards to monitor survey processes. Section V describes how we plan to expand the use of dashboards for other facets of the survey process for GOVS surveys.

II. Dashboard Implementation in Governments Division

The Census Bureau Statistical Quality Standards set requirements on levels of response using two basic response rates: the Unit Response Rate (URR) which measures the percentage of units responding to the survey and the Total Quantity Response Rate (TQRR) which yields a rate that reflects the portion of the estimate that is from the respondents. During the preparations for the release of the 2007 Census of Governments: Finance Component (CoG-F), the review of the Total Quantity Response Rates and the Unit Response Rates, by state, revealed two things. First, the URR was low in two states (below the required 60 percent specified in the Census Bureau's Statistical Quality Standards). Second, the low URR in those states was not a critical factor because the TQRRs were well above the statistical standards requirement for TQRRs of 70 percent. Looking at the TQRRs in the other states where the URR met the statistical standards showed about six states were below the statistical standard of 70 percent. In a plan to increase future response rates Governments Division offered as a mitigation strategy a dashboard that would guide the analysts through nonresponse follow-up (NRFU) to decrease the number of noncompliant states in the future.

Governments Division conducts the Census of Governments every five years in years ending in 2 and 7. This Census has three components: Organization, Finance, and Employment. The Organization component provides counts of the number of general purpose and special purpose governments. General purpose governments are counties, municipalities, and townships, which cover multiple governmental functions (police, fire, education, administrative, etc.) Special purpose governments generally cover a single or very limited number of purposes. For example, school districts provide data on the education function. Special districts (airport authorities, regional libraries, housing authorities, drainage ditch districts, etc.) provide data on their single

function. The Finance component of the Census provides data on revenue, expenditures, debt, assets from state and local governments and pension systems. The Employment component provides data on full-time and part-time employees and payroll for state and local governments by function. Between censuses, various annual and quarterly surveys provide more current estimates for our data users. The annual sample surveys and the censuses have historically used the same questionnaires.

The first dashboard that we developed was for the Annual Survey of Local Government Finances (ALFIN). For this survey, we decided to monitor check-in rate as a surrogate for the URR, a preliminary TQRR for key estimates, and an estimated response rate for each imputation cell. In order to raise the TQRRs, the most efficient method would be to follow-up large units that would contribute the most to the TQRRs. Monitoring solely on the URR could increase the sample's representativeness if the effort did not focus on following up only the large units. Because most nonrespondents tend to be small- and medium-sized units, increasing response from those units by emphasizing imputation cell response rates should improve the representativity. The monitoring of all three sets of response rates, (URR, TQRR, and Imputation Cell), should yield a responsive design that will be representative and will satisfy the Census Bureau Statistical Quality Standards.

a. Check-in Rate

The check-in rate is used to give us a predicted response rate. This rate is not an accurate reflection of the URR because it does not account for the quality of the response. After editing, the unit may be found to lack sufficient reported data to be deemed a unit respondent. Consequently, in building the dashboard to monitor when the Quality Standards URR level has been obtained, some allowance was added in, that is, rather than striving to obtain a URR of 60 percent, the dashboard is set to obtain a rate higher than 60 percent. The amount of allowance depends on several factors, such as, historical patterns of check-in quality. To calculate the check-in rate, the unit's status code is used to determine if it should be included in both the numerator and denominator (as a response) or just in the denominator (as a nonresponse). A check-in response rate was calculated for the whole state and by type of government (county, city, township, special district, independent school district).

The state check-in response rate is displayed as a bar chart, as shown in Figure 1. If the check-in response rate is less than 70 percent the bar is red. If the check-in response rate is equal to or greater than 70 percent the bar is green. For the ALFIN, there is also a measure indicator behind the bar. The measure indicator is set up like a traffic light with red indicating that the response rate is in the 0 percent to 70 percent range (which is unacceptable), yellow from 70 percent to 75 percent, and green from 75 percent to 100 percent. The yellow area is called 'padding.' When a unit falls in this area it indicates that the state could fall below 70 percent once the data are reviewed. Therefore, if time permits the analyst

should follow-up with this state to increase the check-in response rate. We attempt to get a check-in response rate of greater than 75 percent. This will give a better chance of achieving a final response rate greater than 60 percent for the state, thus meeting the Quality Standards. Below the state check-in rate bar there is a state summary that lists the number of school districts and major local county and city governments. This will give the analyst a summary of everything that is needed for that state and what is counted in the check-in rate. It also lists the check-in rate, the number of units checked in, and the number of units in the survey. The analyst has the option to view all local government units in the state if he/she would like to identify specific units that have or have not been checked in. Reported data for a unit can be viewed if the unit has been checked in with data.

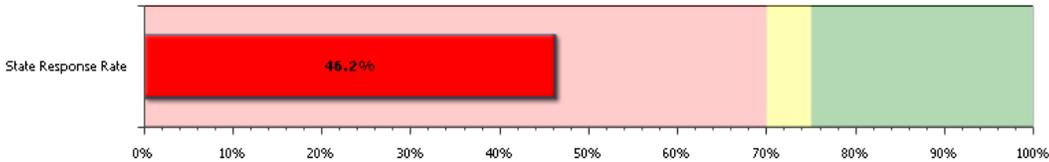


Figure 1-SOURCE: U.S. Census Bureau, 2007 Census of Governments – Finance Component

The check-in response rates by type of government are displayed as dials. The red section of the dial is 0 percent to 60 percent. The yellow section of the dial is 60 percent to 70 percent. The green section of the dial is 70 percent to 100 percent. If the type of government has a check-in rate less than 70 percent, the summary section (showing number in survey, number checked in, check-in rate and the additional number of responses needed to meet the goal) is written with a red background; otherwise it has a grey background, thus allowing the analyst to easily see on which types of governments they should focus their non-response follow-up. Figure 2 below shows the type of governments response rates for the same state as Figure 1. Therefore, it is evident that follow-up is needed for special districts in this state.

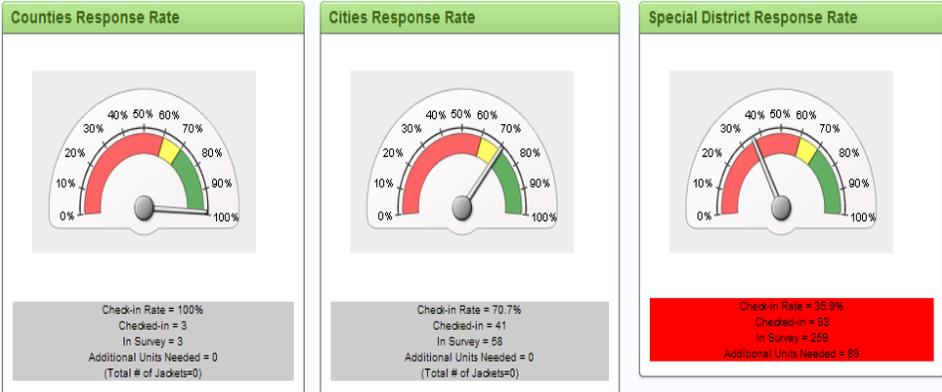


Figure 2-SOURCE: U.S. Census Bureau, 2007 Census of Governments – Finance Component

b. TQRR

For the ALFIN, TQRRs are tracked for four key estimates: Total Revenue, Total Expenditures, Outstanding Debt, and Total Assets. For each variable, an estimate of the current year’s total forms the denominator. This estimate is the sum of each government’s weighted current year response or prior year response if the current year is not yet available. The weighted values for the current year respondents form the numerator. The top of the TQRR dashboard page also contains a bar chart like the check-in page. There is one bar for each key estimate. The bottom of the page contains the dials for each type of government. The first aggregate shown is Total Revenue. There is a drop down menu from which the analyst may select the key estimate to be displayed. The analyst can use this page to see if the TQRR for the state might meet Quality Standards, as well as which aggregates might not meet Quality Standards. This information is used to help determine which states non-response follow-up should occur and where it should occur. The TQRR tab also has an option for the analyst to see individual units, as in the check-in tab. Figure 3 shows the TQRR bars for the same state that is shown in the previous two figures. It shows that although the check-in rate does not meet the Quality Standards, the TQRRs do. The lowest TQRR is 95.0% for Total Assets. Figure 4 shows the TQRR for Total Assets by Type of Government. The Special Districts dial shows the lowest TQRR. Because it is over 70%, the analyst should focus on raising the URR for Special Districts in this state.

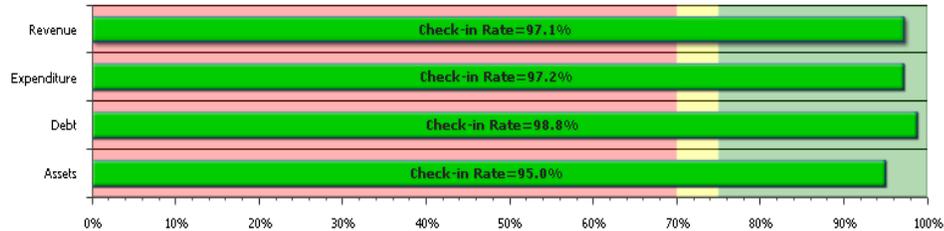


Figure 3-SOURCE: U.S. Census Bureau, 2007 Census of Governments – Finance Component



Figure 4-SOURCE: U.S. Census Bureau, 2007 Census of Governments – Finance Component

c. Imputation Cell

We define the imputation cells by state, type of government, and sometimes population. Independent school districts are excluded from the imputation cell tab because school district data are collected in a different survey. Likewise, special districts are excluded because we independently develop the imputation cells to ensure at least 15 respondents and at least a 50 percent response rate exists in each imputation cell. The methodology begins at the state level, and then will go to the Census Division level, then the Census Region level, and lastly nationally. Prior to developing the dashboard, a general purpose response file would be reviewed to target states that had imputation cells that did not meet the response criteria. The non-responding units in those imputation cells would be targeted for non-response follow-up. By having this information in the dashboard, this step is eliminated, and when it is time for imputation, the cells most likely will meet the response requirements needed. The dashboard page displays a dial for each imputation cell. As in the other tabs, we allowed ‘padding’ because the quality of the response and the prior year response is not known using the check-in information. Therefore, the red section on the dial is 0 to 60 percent, the yellow section is 60 to 70 percent, and the green section is 70 to 100 percent. Beneath the dial the analyst can see the imputation cell response rate, the number of responses, the total number of units in that imputation cell, the definition of the imputation cell, and the number of additional units needed to get the dial into the green section. The background of the information written under the dial is red if more units are needed, gray otherwise.

Once the ALFIN dashboard was developed, we began working on other survey dashboards that would require minor adjustments to the basic structure set forth in the ALFIN dashboard.

III. Customization of Dashboards for the Governments Division Surveys

In addition to the dashboard developed for the Annual Survey of Local Government Finance, dashboards have been developed for the Annual Survey of Public Employment and Payroll (ASPEP), the Quarterly Survey of Property Tax Collection (F-71), the Medical Expenditure Panel Survey - Public (MEPS), and the Government Units Survey (GUS).

a. Annual Survey of Public Employment and Payroll

The ASPEP is an annual survey that collects full- and part-time data on public employment and payroll from state and local governments. For most economic surveys, the TQRRs are very high if the large units respond, but the URRs are generally low because small units, which are numerous but contribute little to the

TQRRs, are not followed up. For ASPEP, data on number of employees is not as skewed as most economic data. Therefore great effort is placed on URRs. Although the national URR is usually above 85.0 percent, the TQRRs on number of employees and payroll may not pass the Quality Standards requirement of 70 percent. Obtaining major city and county data may not be enough to bring the TQRRs up to an acceptable level. Many more medium-sized governments must report also.

For the ASPEP the data are processed differently. When we receive the files for imputation we impute special districts first, then dependent and independent schools, and lastly general purpose governments. For the check-in tab, a dial for schools and state agencies was added to the dashboard. If the check-in rate is below 70 percent, the bar is red. The 'padding' is 70 to 75 percent. The bar is green if the check-in rate is 70 percent or above.

Because special districts typically have a low response rate, require more follow-up, and are the first group of data to go through imputation, the monitoring of them is important. A tab for special districts showing the check-in rate by special district function was added. There is also a button to see more information on each special district function; a table is displayed which lists the check-in rate, the number of units comprising the numerator and the number of units comprising the denominator.

There are two TQRR tabs: overall TQRR and by type of government TQRR. The key estimates displayed on the TQRR tabs are full-time employees, full-time pay, part-time employees, and part-time pay. There is the option of scrolling down to see all key estimates on one screen or to select one key estimate to be seen on a screen. The description background color at the bottom of the dial corresponds to the area to which the dial is pointing. This makes it easier for the analyst to see which states and types of governments need to be followed-up with.

On the imputation cell tab, using the drop down menu the general purpose, dependent schools, or independent schools imputation cells are displayed. The information at the bottom of the dial is similar to what is displayed on the ALFIN dials. As in ALFIN, this helps to eliminate the step of getting a file shortly before non-response follow-up, looking at the response/non-response information and sending a list of where the analyst should focus their non-response follow-up.

b. Quarterly Survey of Property Tax Collection (F-71)

The F-71 is mailed to property tax collectors each quarter. This survey has a compressed processing schedule, which makes the use of a dashboard extremely helpful in monitoring response.

The first tab of the dashboard, 'home page', displays a dial for the overall TQRR and URR for the current quarter being processed. The colors and percentages for

the dial are red if the response rate is less than 60 percent, yellow if it is between 60 percent - 70 percent, and green if it is >70 percent. This page gives the analyst a quick synopsis of how response is progressing for the current quarter.

The TQRR/URR tabs show the TQRR/URR for the current quarter and the previous quarters. Up to 11 previous quarters can be shown. The analyst can use this page to see how collection is compared with previous quarters. The dial has a red, yellow, and green color scheme, which is the same as on the home page.

The imputation cell tab shows the imputation cells at the highest level as a horizontal bar chart. The bar is red if more units are needed in the imputation cell. It is green otherwise.

c. Medical Expenditure Panel Survey - Public (MEPS)

MEPS is a reimbursable survey done on behalf of the Agency for Healthcare Research and Quality in the U.S. Department of Health and Human Services. Governments Division collects, processes, and reports data for the public sector. Another division handles the private sector. The MEPS dashboard was developed using a SAS program. The SAS program was given to the analysts so they can obtain the metrics whenever needed. They also had the option to examine the units in their workload or all the units in the survey. The output from the SAS program is saved as a .pdf file and therefore can become a static report.

The metrics included in the MEPS dashboard that differ from the finance dashboard are listed below:

- a pie diagram showing check-in rate by type of submission (mail vs. web),
- a pie chart showing unit edit status,
- a line graph showing the response rate over time, and
- a map of the United States showing when states have been received, the number of responses received to the number expected, and the percent received. The map is color coded as show in the table below.

State Color	Response Percentage
Red	< 20%
Orange	20 – 40%
Yellow	40-60%
Light Green	60-80%
Dark Green	≥ 80%

d. Government Units Survey (GUS)

Dashboards will be developed for all components of the 2012 Census of Governments: the Government Units Survey, the Employment component, the Finance component. One added feature to the Census of Governments dashboards is a one-page summary that can be pulled and printed at any time to inform upper management of the current survey status.

The first dashboard for the 2012 Census of Governments is for the Government Units Survey (GUS). This survey has a pie chart with the check-in by mode of collection. The number of forms checked in each month is displayed. The display for the check-in by state is shown below. When you hover over a state the information displayed will indicate the number of forms received, the number of forms expected and the check-in rate. We are working on incorporating the .pdf summary report in this dashboard.

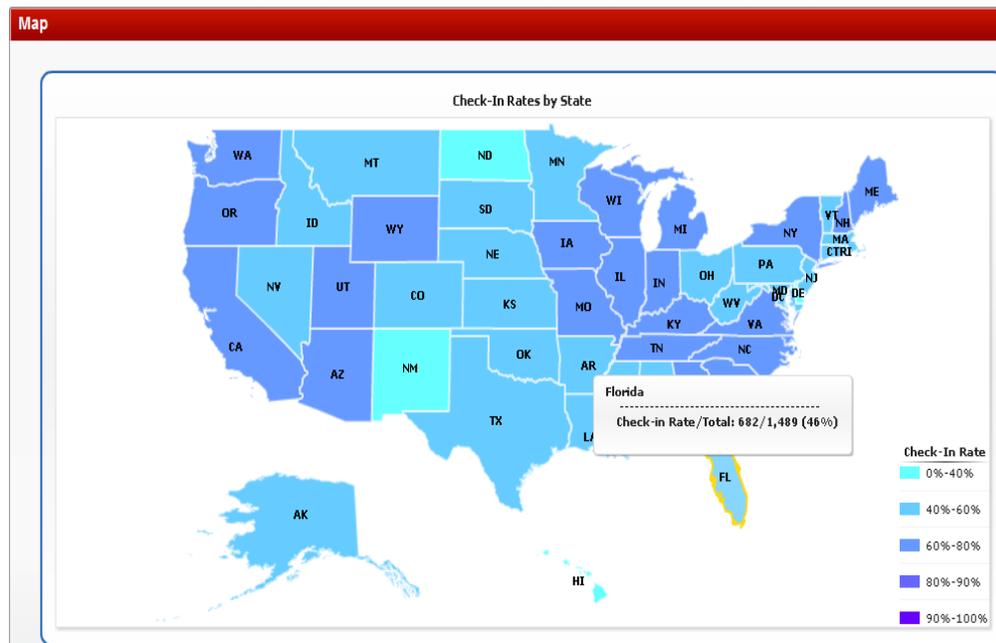


Figure 5-SOURCE: U.S. Census Bureau, 2012 Census of Governments – GUS Dashboard

IV. Results

The implementation of dashboards has enabled staff to monitor the check-in response rates and determine where follow-up should be focused. In the ALFIN, it has given staff the opportunity to see where there are problems and attempt to mitigate them prior to the scheduled data release, thus allowing Census to release estimates that meet the Census Bureau's Quality Statistical Standards. The number of states failing the Quality Standards at the time of preliminary data release fell from 6 states in 2007 to 2 states in subsequent years. Table 1 shows the number of states failing the Quality Standards at the time of preliminary data release in 2007, 2008, and 2009.

Table 1: Number of Noncompliant States in ALFIN: 2007 - 2009

	2007	2008	2009
Number of Noncompliant States for URR	2	0	0
Number of Noncompliant States for TQRR			
Revenue	0	0	0
Expenditure	1	0	0
Debt	5	1	1
Assets	4	2	2

SOURCE: U.S. Census Bureau, 2007 Census of Government: Finance Component, 2008 and 2009 Annual Survey of Local Government Finances.

V. Future Dashboards in Governments Division Surveys

a. Dashboard Evaluations

The evaluation of the dashboards to indicate how the use of the check-in rate estimates the response rate, for the state, state by type of government, and imputation cells. It will also indicate how using prior year data for the non-respondents in the total quantity response rates compares with the final total quantity response rates. The results will indicate whether the ‘padding’ set is sufficient and whether another way to calculate the nonrespondents portion of the total quantity response rate is necessary.

b. Prioritized Unit Follow-up Listing

Currently, for some dashboards it is possible to see the individual units. This listing would be more useful if it strategically prioritized listing units by those that are expected to have the most impact on the estimate or for chronic non-respondents where their size is not known. Each unit will be given a score based on information unique to the survey, such as the last time the unit reported, the value of certain key variables, and their survey weight. Eventually, it is hoped that this dashboard listing will be incorporated into the nonresponse tracking application and then integrated into the Governments Master Address File.

c. Integrated Review Dashboard

The planned integrated review dashboard is one that will work to monitor the processes for the Finance surveys. The Annual Summary of State and Local Government Finances is an aggregation of several different data collections: web collection, paper collection, and compilations from administrative records for

local governments, school district compilations, pension plan compilations, and data from the Integrated Post-secondary Education Data System from the National Center for Education Statistics. These data must all be available concurrently to release the Annual Summary. A dashboard can monitor the timing, but also insure that the quality of the data is compliant with the Quality Statistical Standards.

d. Macro Review Dashboard

Prior to data release, a dashboard to guide the analyst through the final macro review of the estimates in a survey year or aggregates in a census year would be beneficial. The macro review will examine trends of important variables over time. Influential values will be flagged for further investigation with indications of the most important detail item weighted contributors to the outlier. Coefficients of variation that are noncompliant with standards and those that have displayed substantial changes since the prior year will also be identified. Quality checks of summations, counts, etc. and HB ratio edits on final macro level estimates will be put into the dashboard.

VI. Conclusion

The massive modernization and re-engineering effort has begun. We continue to enhance the current dashboards and expand the use of dashboards for other Governments Division Surveys. The current dashboards in conjunction with our future dashboard plans will ensure that the Census Bureau's Statistical Quality Standards are met and that the Census Bureau continues to release quality data products to its users.

References

Axinn, William, Cynthia F. Link, and Robert M. Groves (2009). "Responsive Survey Design, Demographic Data Collection, and Models of Demographic Behavior." NSFG Paper No. 09-005. October 2009.

Groves, Robert and Steven Heeringa (2006). "Responsive Design for Household Surveys: Tools for Actively Controlling Survey Errors and Costs." *Journal of the Royal Statistical Society, Series A*, Volume 169, Part 3. pp. 439-457.

Laflamme, Francois, Mike Maydan, and Andrew Miller (2008). "Using Paradata to Actively Manage Data Collection Survey Process." *Joint Statistical Meetings Proceedings of the Section on Survey Research Methods*.

Laflamme, Francois and Chris Mohl (2007). "Research and Responsive Design Options for Survey Data Collection at Statistics Canada." *Joint Statistical Meetings Proceedings of the Section on Survey Research Methods*.

National Research Council, Committee on National Statistics, *State and Local Government Statistics at a Crossroads*, September 2007.