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Health Disparities: Measuring Health Care Use and Access for Racial/Ethnic Populations

Final Report

Part 1

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EXECUTIVE SUMMARY (PART ONE)

The final report for this project has been prepared in two parts. Part One deals primarily with the methodology and data used to assess and improve race/ethnicity classification on the enrollment database (EDB). Part Two addresses in a detailed fashion issues associated with access to and utilization of various health services according to race/ethnicity, using the improved race/ethnicity classification scheme described in Part One of the final report.

Purpose

The impetus for this project is the continuing interest of the Centers for Medicare & Medicaid Services (CMS) in improving its ability to more accurately identify the race/ethnicity of its beneficiaries. This is an important issue because of the need to properly assess access to care and service use among disadvantaged or vulnerable populations.

Background

Historically, the Medicare program has received its race/ethnicity code for beneficiaries listed on the enrollment database (EDB) from the Social Security Administration's (SSA) master beneficiary record (MBR). Until 1980, the SS-5 form that the SSA used to collect this information only allowed for three codes: White, Black, or Other. As a result, the EDB was only able to include these three codes for race/ethnicity along with Unknown for those who did not respond to the SS-5 race item.

In 1980, the race/ethnicity categories on the SS-5 form were expanded to five, plus "Unknown." The expanded categories included: non-Hispanic White; non-Hispanic Black; Hispanic; Asian, Asian-American, or Pacific Islander; and American Indian or Alaska Native. Despite the expanded categories available from the MBR, the EDB continued to classify race/ethnicity into three categories plus "Unknown", by collapsing the five expanded MBR race/ethnicity codes into the original three codes – White, Black, or Other. In 1994, the expanded race data from the SS-5 forms were used to correct erroneous and missing race/ethnicity information on the EDB. This resulted in changes to the race/ethnicity of more than 2.5 million beneficiaries. This enhancement was done again and in 1997 and 2000, and has been done annually since then.

Also in 1997, the Health Care Financing Administration (now CMS) conducted a survey of nearly 2.2 million persons with Hispanic surnames or countries of birth and persons with Other or Unknown race. Analysis of self-reported race/ethnicity data from this survey resulted in changes in the race/ethnicity of more than 850,000 beneficiaries. Further, CMS has in the past two years entered into an agreement with the Indian Health Service (IHS) to identify Medicare beneficiaries who are recognized as American Indian or Alaskan Native by IHS. This project is the latest effort by CMS to improve the accuracy of the EDB race/ethnicity codes.

Report Objectives

The key objectives of Part 1 of the final report were to: (1) estimate the accuracy of the race and ethnicity data for beneficiaries included on the mid-2003 EDB, (2) assess the extent of bias in estimates of health services utilization for selected conditions and procedures categorized according to the EDB race/ethnicity code, and (3) develop algorithms using surname and other information available on the EDB to more accurately classify Medicare beneficiaries according to their race/ethnicity. The specific focus of this project was on improving the classification of beneficiaries who are Hispanic and Asian/Pacific Islander.

Additional objectives addressed in Part 1 of the final report included (4) describing the procedures employed to geo-code the addresses of the beneficiaries listed on the EDB to allow merging with census measures of socio-economic status, and (5) assessing how representative the racial/ethnic subgroup composition of the Medicare Current Beneficiary Survey (MCBS) is relative to the entire nation.

Methods, Data, and Approach

The accuracy of the Medicare EDB race/ethnicity code was assessed by comparative analysis with self-reported race/ethnicity data obtained from 830,728 respondents to the Medicare CAHPS surveys. The self-reported race/ethnicity of CAHPS respondents came from three different surveys conducted over three consecutive years:

- CAHPS Medicare Fee-for-Service (MFFS) surveys for the years 2000 through 2002,

- CAHPS Medicare Managed Care Enrollee (MMCE) surveys for the years 2000 through 2002, and

- CAHPS Medicare Managed Care Disenrollee (MMCD) surveys for the years 2000 through 2002.

The EDB race/ethnicity for the same Medicare beneficiaries was extracted from the mid-2003 EDB.

The analysis investigated the accuracy of the six race/ethnicity classifications used in the EDB race/ethnicity code (non-Hispanic White, non-Hispanic Black, Hispanic, Asian/Pacific Islander, American Indian/Alaska Native, and Unknown/Other). The measures calculated to estimate the accuracy of the EDB codes included: sensitivity,[1] specificity,[2] positive predictive value[3] (PPV), negative predictive value[4] (NPV), and the Kappa[5] coefficient of inter-rater reliability.

[1] The percentage of persons who self-reported themselves to be of a particular race/ethnicity who are coded as being of that race on the EDB.

[2] The percentage of persons who self-reported themselves not to be of a particular race/ethnicity who are coded as not being of that race on the EDB.

[3] The percentage of persons coded in a particular race/ethnicity category on the EDB who really were of that race according to their self-report.

[4] The percentage of persons not coded in a particular race/ethnicity category on the EDB who really were not of that race according to their self-report.

The development of an algorithm to more accurately classify the race/ethnicity of Medicare beneficiaries employed Hispanic (Word and Perkins, 1996) and Asian/Pacific Islander (Falkenstein and Word, 2002) surname lists compiled after the 1990 and 2000 Census and surname and other information available on the EDB. In each of the surname lists, a percentage was associated with each name representing the frequency that households with that name were Hispanic (or Asian/Pacific Islander). Improvement in accuracy using the algorithm was assessed by comparing the race/ethnicity resulting from the algorithm to that self-reported in the CAHPS surveys.

An assessment of the bias in measures of health services utilization and access was performed by dividing the number or proportion of persons in each self-reported racial/ethnic group using particular services by the number or proportion of persons using that service according to their race/ethnicity as found on the EDB. The resulting ratios indicated the potential over- (for ratios greater than 1.00) or underestimate (for ratios less than 1.00) of health services utilization. The measures of utilization were based on Medicare claims and were only available for CAHPS respondents in two of the three years (2000 and 2001) and only one of the surveys (Medicare fee-for-service), totaling 221,387 respondents.

Major Findings

Accuracy of the EDB Race/Ethnicity Code

Relative to self-reported data, the accuracy of the EDB was greatest for non-Hispanic Black Medicare beneficiaries: sensitivity was 97.4 percent, specificity was 98.8 percent, PPV was 86.3 percent, NPV was 99.8 percent, and a Kappa coefficient of 0.91 was observed. Non-Hispanic White beneficiaries were the next most accurately identified group on the EDB. Sensitivity was high (99.3 percent), but specificity was just 61.7 percent, suggesting that a sizeable proportion of beneficiaries who were not White were incorrectly coded as White. The PPV and NPV were 91.7 and 95.7 percent, respectively, and the Kappa coefficient was in the substantial range at 0.71, but still clearly reflecting the low level of specificity. Sensitivity for American Indian/Alaska Native beneficiaries was very low at 35.7 percent, and the PPV was low at 59.9 percent. Specificity and NPV for this group, however, were exceptionally high at 99.9 and 99.7 percent, respectively. The low Kappa coefficient of 0.45 reflects the low sensitivity of the EDB for this group.

The focus of this project, however, was on Hispanic and Asian/Pacific Islander beneficiaries because earlier research had shown that the sensitivity of the EDB was especially low for these groups. Indeed, sensitivity of the EDB for Hispanic beneficiaries was only 29.5 percent, but specificity (99.9 percent), PPV (92.7 percent), and NPV (96.2 percent) were very high. The Kappa agreement coefficient of 0.43 reflected the low level of correct identification of Hispanic beneficiaries on the EDB represented in its low sensitivity. The situation on the EDB was somewhat better for Asian/Pacific Islander beneficiaries. Here, sensitivity was 54.7 percent, correctly identifying only slightly more than half of this group. Specificity and NPV were both

[5] Kappa measures agreement between two independent race/ethnicity codes for the same person being coded, in this case between the self-reported and EDB race/ethnicity codes, where a coefficient of 1.00 represents perfect agreement and 0.00 is an absolute lack of agreement.

very high at 99.8 and 99.2, respectively. Even the PPV was respectable at 84.5 percent, and the Kappa coefficient at 0.66 was only slightly lower than for White beneficiaries, reflecting the low sensitivity.

Development of an Algorithm to Improve EDB Race/Ethnicity Coding

In light of the low sensitivity of the Hispanic and Asian/Pacific Islander race/ethnicity categories on the EDB, a multi-stage process was developed through which separate algorithms were developed using several pieces of information on the EDB to improve the correct racial/ethnic identification of both groups. The algorithms started with the EDB race/ethnicity code and changed it based on the following information: the beneficiary's surname was identified as Hispanic or Asian/Pacific Islander by 70 percent or more of persons in the US Census with that surname; the first name was among the most common Hispanic or Asian/Pacific islander first names; place of residence (Hawaii or Puerto Rico); whether source of the EDB race/ethnicity code was self-identified through a special survey, and the indicated language preference for communications with the beneficiary, i.e., English for residents of Puerto Rico, and Spanish for residents of the remainder of the U.S.

The algorithms made a very significant improvement in the measures used to assess the accuracy of the race/ethnicity categorization of Hispanic and Asian/Pacific Islander Medicare beneficiaries. Among Hispanic beneficiaries, sensitivity improved from 29.5 to 76.6 percent, the Kappa coefficient rose from 0.43 to 0.79, and the other measures were virtually unchanged. The improvement for Asian/Pacific Islander beneficiaries was equally impressive – sensitivity rose from 54.7 to 79.2 percent, Kappa increased from 0.66 to 0.80, and the other measures were not materially changed. Analysis of the improvements indicated that among both groups there were somewhat more males correctly identified than females (possibly due to intermarriage and surname changes for ethnic females), and more 65-74 year olds than those older than 74 (probably because there were more in the younger age group).

The two algorithms were combined and applied to the entire 41.7 million active records in the 10 segments of the mid-2003 unloaded EDB. As with the results for the CAHPS data, the percentage of Hispanic and Asian/Pacific Islander beneficiaries increased, while the percentage of White, Black, and Other beneficiaries decreased. Overall, the combined algorithm recoded the race/ethnicity of 2,290,027 Medicare beneficiaries, substantially improving the EDB race/ethnicity coding.

A total of 1,998,909[6] beneficiaries had their race/ethnicity recoded to Hispanic as a result of the combined algorithms. Most of these beneficiaries were originally classified on the EDB as White (83.5 percent), followed by Other/Unknown (11.1 percent), and Black (3.8 percent). Very few beneficiaries were originally coded as Asian/Pacific Islander (1.5 percent) or American Indian/Alaska Native (less than 0.05 percent). Overall, more female beneficiaries (1,068,033) than males (930,875) were recoded to Hispanic. The largest number of "new" Hispanic beneficiaries was created in the group of 65-to-74-year-olds.

[6] This excludes 266 beneficiaries who were originally coded as missing on the EDB but are now coded as Hispanic. Beneficiaries who were already coded as Hispanic on the EDB are also not included in this total.

Among Asian/Pacific Islander beneficiaries, 290,748[7] were recoded as a result of applying the combined algorithm. Unlike the Hispanic beneficiaries who were recoded, the majority of the new Asian/Pacific Islander beneficiaries were originally coded as Other/Unknown on the EDB. Exactly 82.0 percent of the newly coded Asian/Pacific Islander beneficiaries had been originally coded as Other/Unknown. In addition, 16.4 percent were originally coded in the EDB as White, 1.5 percent as Black, and 0.2 percent as American Indian/Alaska Native. No beneficiaries originally coded as Hispanic on the EDB were recoded to Asian/Pacific Islander. In total, 155,744 females were recoded to Asian/Pacific Islander compared to 135,004 males. As with Hispanic beneficiaries, the group 65 to 74 years of age had the most recodes, while the group 85 and older had the least.

Extent of Bias Using the EDB Race/Ethnicity Code

To examine the extent of bias in estimates of health services utilization based on the EDB race/ethnicity code, Medicare claims for one year for the following services were examined:

- four cancer screening procedures,
- four preventive services for persons with diabetes,
- hospital or emergency department admissions for 15 ambulatory care sensitive conditions (ACSCs),
- use of six different types of Medicare covered services, and
- hospital care for five selected chronic and acute conditions.

In this analysis, two estimates of utilization were examined for services relating to: cancer screening services, diabetes prevention services, and ambulatory care sensitive conditions. The first estimate was the number of beneficiaries using the specified service, and the second estimate was the percentage of beneficiaries using the service. In addition to number and percentage estimates, the mean payment was also estimated for types of Medicare covered services and the mean length of stay was further added for hospitalization for selected conditions. These four estimates (number, percentage, mean payment, and mean length of stay) were created from claims for each racial/ethnic group using the EDB race/ethnicity classification and also using the self-reported race/ethnicity classifications. Bias for each estimate was assessed by calculating a ratio of the results using the EDB race/ethnicity classification divided by the results using the self-reported race/ethnicity. The different estimates and the level of bias are described below for each set of services listed above.

Cancer Screening Services. In comparisons of cancer screening services according to EDB race/ethnicity and self-reported race/ethnicity data, estimates of the number who used cancer screening services were, on average, slightly higher for White (four percent) and Black beneficiaries (11 percent). For Hispanic and American Indian/Alaska Native beneficiaries, the

[7] This excludes 68 beneficiaries who were originally coded as missing on the EDB but are now coded as A/PI. Beneficiaries who were already coded as A/PI on the EDB are also not included in this total.

bias was much larger -- between 207 and 318 percent underestimated, respectively – while for beneficiaries who were Asian/Pacific Islander cancer screening service use was underestimated but only by 45 percent on average.

In comparison to the estimated number of beneficiaries using cancer screening services, estimates of the percentage of beneficiaries using these same cancer screening services were much less biased for all races/ethnicities. There was on average no bias for Black beneficiaries. The bias for White, Hispanic and Asian/Pacific Islander beneficiaries was small -- underestimated by from two to six percent – and for beneficiaries who were American Indian /Alaska Native it was underestimated by 38 percent.

Diabetes Prevention Services. Among beneficiaries identified as having diabetes, the bias in the number estimated to have used preventive services was similar in magnitude to that for the cancer screening services. In comparisons of EDB race/ethnicity data to self-reported race/ethnicity, utilization was overestimated by seven percent and 10 percent for White and Black beneficiaries, respectively. However, utilization was underestimated on average by 153 percent, 34 percent, and 238 percent, respectively, for Hispanic, Asian/Pacific Islander, and American Indian/Alaska Native beneficiaries.

Similar to the situation observed among beneficiaries using cancer screening services, the bias in the percentage of beneficiaries with diabetes using preventive services were reasonably small relative to the estimates of the number of beneficiaries using these services (described in the preceding paragraph). There was no bias in the Black estimates of utilization on average, and for White beneficiaries the average bias in the percentage of users was only a one percent underestimate. Hispanic and Asian/Pacific Islander beneficiaries using these services were overestimated by only six and three percent, respectively, while estimates of American Indian/Alaska Native beneficiaries using preventive services for diabetes were underestimated by 32 percent.

Ambulatory Care Sensitive Conditions. Because there were so few hospital or emergency department admissions for the fifteen ambulatory care sensitive conditions (ACSCs), they were combined to analyze bias. The pattern of bias among beneficiaries with any of the 15 ACSCs is similar to what was found for cancer screening and preventive diabetes services. The number of White and Black beneficiaries with an ACSC admission was overestimated by seven and 10 percent, respectively, by the EDB to self-reported race/ethnicity comparison. For Hispanic, Asian/Pacific Islander, and American Indian/Alaskan Native beneficiaries, the bias resulted in underestimating the numbers by 161, 23, and 198 percent, respectively.

The estimated percentages of beneficiaries with an ACSC admission were much less biased than the estimated number of beneficiaries with an ACSC admission. Bias for the estimates of the percentage of White and Black beneficiaries with ACSC admissions were only one percent overestimated and one percent underestimated, respectively. Estimates for Hispanic, Asian/Pacific Islander, and American Indian/Alaska Native beneficiaries were nine, twelve, and one percent overestimated when compared to EDB race/ethnicity, respectively.

Types of Medicare Covered Services. In assessing the extent of bias in estimates of selected types of services billed to Medicare during the previous 12 months, payments were examined as well as the number and proportion of beneficiaries submitting claims for any service, for hospitalization, for physician services, for nursing home stays, for home health services, for durable medical equipment, and emergency department. The estimated number of White and Black beneficiaries with claims for any type of service was overestimated by six and 11 percent, respectively, when based on EDB race. The number of Hispanic beneficiaries with claims for the services was underestimated by 186 percent, Asian/Pacific Islander beneficiaries by 43 percent, and American Indian/Alaska Native beneficiaries by 212 percent.

The percentage of beneficiaries with claims for any services was much less biased. The percentage of Black beneficiaries with claims was estimated without bias, while the percentage of Hispanic beneficiaries was overestimated by one percent, and Asian /Pacific Islander and American Indian/Alaska Native beneficiaries were underestimated by two and four percent respectively, using EDB race.

The mean amount paid by Medicare for persons submitting claims for any services was unbiased for White and Black beneficiaries. The mean amounts paid for Hispanic, Asian /Pacific Islander, and American Indian/Alaska Native beneficiaries were all overestimated, respectively, by 10, 22 and seven percent.

Findings of bias in estimates for the use of the specific types of services are on average very similar (within one or two percentage points) to those reported for the use of any type of service for White, Black, and Hispanic beneficiaries for numbers, percentages and mean payments in dollars. However, the estimates for Asian/Pacific Islander beneficiaries by type of service used were on average about 16 percentage points lower for number of persons using, 14 percentage points lower for the percent using, but 11 percent higher in the amount of payments made for their service use. For American Indian/Alaska Native beneficiaries, the bias was consistently higher for estimates of number of persons, the percentage using, and mean payment for utilization for the individual types of services, on average by 18, eight, and five percentage points.

Hospitalizations for Selected Conditions. Estimates of bias in four utilization measures —number hospitalized, percentage hospitalized, mean payment, and mean length of stay—were examined by race/ethnicity. We examined hospitalizations occurring during a one year period for persons with diagnoses of heart disease, stroke, pneumonia, cancer, and fractures.

As with the other results presented above, the bias, regardless of specific race/ethnicity, when using EDB race/ethnicity, compared to self-reported race/ethnicity, is greatest for estimates of the number of persons hospitalized than it is for the proportion of persons hospitalized for one of these conditions. On average across all five conditions, the estimated number of White beneficiaries hospitalized was overestimated by six percent, and for Black beneficiaries it was overestimated by 10 percent. However, for Hispanic, Asian/Pacific Islander, and American Indian/Alaska Native beneficiaries, the estimated numbers were low, on average by 183, 13, and 291 percent.

Estimates of the percentage with hospitalizations were much more accurate on average across the five conditions especially for White, Black, and Hispanic beneficiaries – within one percent. For Asian/Pacific Islander and American Indian/Alaska Native beneficiaries, the estimates of the percentage hospitalized were 20 percent too high and 30 percent too low, respectively.

Much the same situation was found with respect to the bias in mean payments in dollars and mean lengths of stay in days. The average for both of these means across all five conditions for White beneficiaries was unbiased, and it was not biased for Black beneficiaries with respect to the mean payments made. The mean length of stay in days for Black beneficiaries, however, was overestimated by three percent when based on EDB race. The situation for Hispanic beneficiaries showed them to have had both of these means underestimated, by six and sixteen percent, respectively. The same was true for American Indian/Alaska Native beneficiaries, except the level of underestimates was higher, 24 and 97 percent, respectively. For Asian/Pacific Islander beneficiaries, the situation was reversed. For them, estimates of both means were overestimated, by nine and 34 percent, respectively.

Success Geo-Coding Medicare Beneficiary Addresses to Link with Census

Beneficiary addresses were successfully geo-coded using codes consistent with the US Census (FIPS or Federal Information Processing Standards codes) in order to link their residential area (block group) to socioeconomic status (SES) indicators available in the US Census. No SES measures *at the person level* are currently available as part of the Medicare enrollment database (EDB), and despite certain limitations and errors inherent in using residential area rather than person-level measures of SES, the benefit of incorporating SES information with Medicare data seemed obvious.

Overall, 86.8 percent of the total 41,742,407 addresses of Medicare beneficiaries were successfully geocoded by the software leased from GeoLytics Inc. Addresses of beneficiaries residing in foreign countries (including Puerto Rico) or with post office boxes or rural route delivery numbers (5,223,766 or 12.5 percent) could not be processed. Ninety-nine and two-tenths (99.2) percent of the addresses that were processed (36,223,053 or 86.8 percent of the total) were successfully matched to a FIPS code block group. Sixty-one (61.0) percent of the matches made were exact with the addresses that were input, and the remaining 25.6 percent employed one of the available options.

Accuracy of MCBS Race/Ethnicity Subgroup Representation

The objective of this analysis was to assess whether the primary sampling units (PSUs) used in the Medicare Current Beneficiary Survey (MCBS) were representative of the major Hispanic (Mexican, Puerto Rican, Cuban, other) and Asian/Pacific Islander (Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, Pacific islanders, others) national origin subgroups participating in the Medicare program. Because there is no information available from the EDB on Medicare beneficiary ethnic subgroup enrollment, the mixture of persons 65 years of age and older reported in Hispanic and Asian/Pacific Islander subgroups by the US Census in the nation as a whole was adopted as a proxy standard.

Analyses were conducted separately for Hispanic and Asian/Pacific Islander subgroups. Comparison of the proportion of elderly persons in each national origin subgroup in the MCBS PSUs to the proportion of elderly persons in each national origin subgroup in the nation as a whole formed the basis of conclusions regarding subgroup representation in the MCBS PSUs. The analysis found that elderly persons of Mexican origin (46.7 percent of the nation's Hispanic population) are underrepresented by 18 percent, and that elderly persons of Puerto Rican and Cuban origins (11.0 and 13.2 percent of the nation's Hispanic population, respectively) are overrepresented by 41 and 17 percent, respectively. The pool of elderly Other Hispanics (the remaining 29.1 percent of the nation's Hispanic population) is represented at about the right level overall, although within the pool, persons from the Dominican Republic, Central America, and South America are overrepresented by from 25 to 36 percent; Spaniards are approximately correctly represented; but the remaining Other Hispanics as a group are underrepresented by about 15 percent.

The situation with respect to representation of elderly persons of Asian/Pacific Islander origins is slightly better insofar as the Japanese (who make up 20.1 percent of the nation's Asian population) are the only subgroup underrepresented (by 36 percent), and the Chinese (comprising 29.5 percent of the nation's Asian population) are the only subgroup overrepresented (by 20 percent) by reasonably large amounts. The remaining Asian subgroups – Filipino, Korean, Asian Indian, Vietnamese, and the pool of Other Asians – account for 48.6 percent of the nation's Asian population and are either just slightly overrepresented (by as little as 12 percent) or slightly underrepresented (by as little as four percent) Elderly persons of Native Hawaiian and Other Pacific Island origin are in the pool of Other Asians. They represent only 2.5 percent of the nation's population, but are underrepresented in the MCBS PSUs by 44 percent.

Summary and Conclusions

The accuracy of the Medicare EDB race/ethnicity variable was assessed by comparison to self-reported race/ethnicity for a sample of more than 830,000 Medicare beneficiaries. It was found to be excellent for Black and White beneficiaries, each having a sensitivity of 99 percent. However, the sensitivity of the EDB race/ethnicity ranged from low to extremely low for Asian/Pacific Islander (55 percent), American Indian/Alaska Native (36 percent), and Hispanic (30 percent) beneficiaries.

An algorithm using surnames, first names, and information from the EDB including language preference and state of residence was developed to improve the coding of race/ethnicity for beneficiaries of Hispanic or Asian/Pacific Islander origins. The algorithm was run on the same sample of 830,000 Medicare beneficiaries and the sensitivity of the new race/ethnicity code was much improved, reaching good levels for both groups – 77 percent for Hispanic and 79 percent for Asian/Pacific Islander beneficiaries.

The algorithm was next run on the entire 41.7 million active records in the mid-2003 EDB. Nearly 2.3 million beneficiaries were given a new race/ethnicity. Of those, the race/ethnicity of approximately 2 million beneficiaries were recoded to Hispanic, and almost 300,000 were recoded to Asian/Pacific Islander. Nearly 84 percent of the newly identified Hispanic beneficiaries were originally coded as White in the EDB, and 82 percent of the newly identified Asian/Pacific Islander beneficiaries were original coded as Other/Unknown. In both groups, the newly identified included slightly more females than males and 65-74 year olds than older ages.

The amount of bias associated with estimates of health services utilization when analyzed according to EDB race/ethnicity was also investigated. Claims for the sample of more than 220,000 Medicare fee-for-service beneficiaries were used to compute several measures of utilization – the number and proportion using, and where applicable, the mean payment for the service and the mean length of stay – by EDB and self-reported race/ethnicity. Comparisons of estimates for the same service according to the two race/ethnicity measures were examined for a number of areas of utilization – cancer screening, diabetes prevention, ambulatory care sensitive conditions, different types of services, and hospitalization.

Across all five areas of utilization, the number of White and Black beneficiaries using the services was always overestimated when categorized by EDB race/ethnicity, but consistently underestimated for Hispanic, Asian/Pacific Islander, and American Indian/Alaska Native beneficiaries. The magnitude of the overestimates for White and Black beneficiaries ranged from four to 11 percent, the size of the underestimate for Asian/Pacific Islander beneficiaries was from 13 to 45 percent, but the size of the underestimates for Hispanic and American Indian/Alaska Native ranged from 153 to 318 percent.

The situation was quite different analyzing bias in the percentages using services across all five areas of utilization when categorized by EDB race/ethnicity. There was either no bias in the estimates for White and Black beneficiaries, or there was a one or two percent underestimate or overestimate. Typically, Hispanic and Asian/Pacific Islander beneficiaries had underestimates ranging from three to 12 percent, while for American Indian/Alaska Native beneficiaries the underestimates ran as high as 38 percent.

With respect to the estimates of mean payments made for White and Black beneficiaries, there was no bias. For mean length of stay, there was no bias for White beneficiaries and it was overestimated by three percent for Black beneficiaries. There was greater variation and no consistent pattern for bias across the other racial/ethnic groups for these two measures, but the estimates were clearly more biased than for White and Black beneficiaries.

The algorithm developed in this project greatly improved the accuracy of the EDB race/ethnicity variable, especially regarding identification of Hispanic and Asian/Pacific Islander beneficiaries. Use of this improved variable in future analyses of utilization differences by race/ethnicity will result in less biased numerical, proportional, and mean estimates than is possible with the existing EDB race/ethnicity variable.

CHAPTER 1
OVERVIEW OF PART 1 OF THE FINAL REPORT

The overall goal of this project has been identify disparities in health services utilization and expenditures among the different Medicare beneficiary racial/ethnic groups as evidenced in their claims. However, before we could proceed to identify disparities, we needed to confirm the accuracy and completeness of, and where possible to improve, the coding of race/ethnicity in the EDB, the repository of Medicare's race/ethnicity data. With the growth of minority populations in the U.S., there has been considerable interest and initiatives by Government agencies to reduce and eliminate racial/ethnic health disparities. With this project, the Centers for Medicare & Medicaid Services (CMS) has indicated a commitment to improving its data to permit more extensive analyses of the Medicare program to identify and eliminate barriers to the access to care that can result in racial/ethnic health disparities.

This document, which is Part 1 of a two-part final report, describes the work performed on three separate but related topics as part of this project's Task 2 requirements:

1. The first topic recounts the efforts made to assess and improve the race and ethnicity coding of Medicare beneficiaries listed in the Medicare enrollment database (EDB). This topic addresses the most complex portion of the work discussed in this part of the final report. Successful completion of this project was premised on having improved and acceptable race/ethnicity data to use to more correctly classify beneficiaries in analyses intended to identify disparities in service utilization.
2. The second topic describes the assignment of geo-codes to the Medicare beneficiaries listed in the EDB. Our goal was to link Medicare beneficiaries to U.S. Census data that describe the socioeconomic status (SES) of the place where beneficiaries reside. To avoid repetition in the body of this report, we have included some of the detailed description of the work in appendices. We performed this work so that our project team and other researchers could attempt to separate the impact of socioeconomic status from that of race/ethnicity in subsequent analyses of disparities in service use and access to care.
3. The third topic presents the work done to compare the distribution of the national origins of racial/ethnic subgroups in the entire U.S. population to that of the areas (primary sampling units or PSUs) represented in the Medicare Current Beneficiary Survey (MCBS). This comparison is important because race/ethnicity is self-reported by the MCBS respondents. Therefore, the MCBS has been a source relied upon for correct information in a variety of analyses of racial and ethnic differences in service use among Medicare beneficiaries.

CHAPTER 2
ASSESSING AND IMPROVING THE ACCURACY AND COMPLETENESS OF RACE/ETHNICITY CODING ON THE MEDICARE ENROLLMENT DATABASE (EDB)

2.1 Introduction

The race/ethnicity code on the Medicare EDB is obtained from the Social Security Administration's (SSA's) master beneficiary record (MBR). From 1935 to 1980, the Social Security application form (SS-5) only allowed classification of a person's race into "White," "Black," or "Other" categories. In addition, "Unknown" was used to classify persons who did not report any race. The codes from the SS-5 were incorporated into the MBR. The number of race/ethnicity categories on the SS-5 form was expanded in 1980 to six: "White (non-Hispanic)"; "Black (non-Hispanic)"; "Hispanic"; "Asian, Asian-American, or Pacific Islander"; "American Indian or Alaska Native"; and "Unknown." In 1989, the SSA began to enroll new participants at birth, extracting data from birth certificates rather than requiring applicants to file form SS-5; however, the race/ethnicity information on the birth certificate was not included in the data extraction because it was considered unnecessary for the administration of the SSA program. Since 1989, the only persons filing an SS-5 form have been those requesting a new number or a name change (Scott, 1999).

In 1994, race data from the SS-5 forms with the expanded race/ethnicity codes were integrated into the EDB in an effort to correct erroneous codes and fill in missing ones. This action changed the race/ethnicity coding for more than 2.5 million beneficiaries (Lauderdale and Goldberg, 1996). This update using the SS-5 form was conducted again in 1997 and 2000, and has been conducted on an annual basis since then. The Medicare program has also been working with the Indian Health Service to improve the coding of American Indians and Alaska Natives.

To correct miscoded data and further reduce the amount of missing race/ethnicity information, in 1997 the Health Care Financing Administration (now the Centers for Medicare & Medicaid Services, or CMS) conducted a postcard survey of nearly 2.2 million beneficiaries. Included in the survey were beneficiaries with: Hispanic surnames, Hispanic countries of birth, or coded "Other" or missing race/ethnicity data. The survey resulted in code changes for approximately 858,000 beneficiaries (Arday et al., 2000). These efforts clearly improved the EDB's race/ethnicity data. Nonetheless, comparisons of the EDB race/ethnicity codes to the self-reported race/ethnicity from the Medicare Current Beneficiary Survey (MCBS) indicated that identification of Hispanic, Asian/Pacific Islander, and American Indian/Alaska Native beneficiaries was still incomplete and might result in biased analyses involving these groups (Arday et al., 2000).

2.2 Data

We conducted four analyses in the process of assessing and improving the race/ethnicity coding of Medicare beneficiaries listed in the EDB. The data we used in the analyses included the following:

1. Separate surname lists obtained from the 1990 and 2000 U.S. Census for Hispanic/Latino and Asian/Pacific Islander origins, respectively.
2. Separate first-name lists compiled from multiple Web sites persons of Hispanic/Latino and Asian/Pacific Islander origins.
3. The self-reported race/ethnicity of 830,728 Medicare beneficiary respondents from three different CAHPS surveys conducted over three consecutive years:
    a. CAHPS Medicare Fee-for-Service (MFFS) surveys for the years 2000 through 2002,

    b. CAHPS Medicare Managed Care Enrollee (MMCE) surveys for the years 2000 through 2002, and

    c. CAHPS Medicare Managed Care Disenrollee (MMCD) surveys for the years 2000 through 2002.

    We refer to these data collectively as the CAHPS data. The self-reported race/ethnicity codes from these data are referred to as the SELFRACE variable in the remainder of this chapter.
4. Several variables found on the Medicare EDB that included the following:
    a. A Race/Ethnicity[8] variable that is referred to as the EDBRACE variable in the remainder of this chapter. The EDBRACE variable has eight different values and only allows beneficiaries one value each. The eight values and their meanings are:

        0 = Unknown

        1 = White (non-Hispanic)

        2 = Black (non-Hispanic)

        3 = Other

        4 = Asian/Pacific Islander

        5 = Hispanic/Latino

        6 = American Indian/Alaska Native

        Blank = Temporary Record

    b. A variable that identifies the language a beneficiary requested CMS (then HCFA) to use when sending the Medicare Handbook. English, Spanish, and blank (no preference specified) are the only allowed values. This variable is referred to as LANGPREF.

    c. A variable that identifies the language a beneficiary requested the Social Security Administration (SSA) to use when sending beneficiary notices. This variable is used by CMS for Medicare premium bills. English (for Puerto Rico

[8] The meanings of the codes listed for EDBRACE are what we believe to have been intended by the codes. The definitions for the race/ethnicity variable codes in the EDB codebook actually specify 0 = Unknown, 1 = White, 2 = Black, 3 = Other, 4 = Asian, 5 = Hispanic, 6 = North American Native, and Blank = temporary record.

zip codes only), Spanish, and blank (English assumed for non-Puerto Rico zip codes and Spanish assumed for Puerto Rico zip codes) are the only allowed values that HCFA supports. This code is referred to as LANGCD.

d. A variable that identifies the source of a beneficiary's race code (EDBRACE) in the EDB. This variable is referred to as RACESRC. Three values are allowed:

   A = Response from a one-time survey that was mailed to certain beneficiaries in 1995

   B = Indian Health Service

   Blank = Social Security Administration—Master Beneficiary Record (SSA-MBR) or for SS-5 (NUMIDENT) or Railroad Retirement Board (RRB)

e. A variable that identifies the state a beneficiary lives in. We identified beneficiaries living in Hawaii and Puerto Rico.

2.3 Limitations of the data

Most of the limitations of the data that we are aware of involve the American Indian/Alaska Native portion of the sample used in the assessments of accuracy and bias. First of all, there are only 3,344 out of over 830,000 that self –identified in the CAHPS surveys as American Indian/ Alaska Native, and the EDB only had 1,194 beneficiaries identified as American Indian/ Alaska Native. While such representation of American Indians/Alaskan Natives is quite large relative to surveys such a the Medicare Current Beneficiary Survey (MCBS), with such small numbers, estimates of relatively rare events like hospitalization for ambulatory care sensitive conditions can be quite unstable.

Again with respect to the American Indian/Alaska Native portion of the sample, despite an improvement in the completeness with which CMS has identified this segment of the Medicare population, it has been achieved through an arrangement with the Indian Health Service (HIS) and Tribal health facilities. Those facilities likely have the most information on the enrollment of American Indian/Alaska Native Medicare beneficiaries who live on tribal lands and who utilize services on or around tribal lands and in those few cities where there are urban facilities for American Indians/Alaska Natives.

Finally, with regard to the payments reported for American Indian/Alaska Native Medicare beneficiaries, we were told by CMS staff that HIS and Tribal facilities are often paid on what amounts to a "per capita" basis for certain kinds of services even though the beneficiaries are enrolled in the traditional fee-for-service Medicare. This means that despite having claims, the payment amounts may not be shown for all of the services provided.

Our last caveat concerns the comparability of the EDB and CAHPS race/ethnicity codes. The CAHPS data follow the OMB directive 15 with respect to how race/ethnicity data are collected, separately collecting Hispanic ethnicity from race, and allowing multiple responses to the race item. The CAHPS data were made to conform as closely as possible to the EDB codes which were based on the more limited race/ethnicity alternatives available on the SS-5 form that was used by Social Security Administration which did not permit more than a single race selection.

2.4 The Process and Results

For the purposes of this project, we treated the self-reported race information, the SELFRACE variable, collected via the various CAHPS survey instruments, as the "gold standard" in applying the comparative assessment techniques. The rationale for this decision is that the race/ethnicity of CAHPS respondents was self-identified whereas the methods for EDB race identification have been more variable and did not always conform to the set of codes used today. Using the respondents' self-reported CAHPS data as our sample, we proceeded through the following four steps:

1. We matched the Medicare HIC numbers of Medicare beneficiaries who appeared in the CAHPS data to their corresponding records in the EDB. We then extracted and appended the EDB race variable, EDBRACE, to their CAHPS data record. Since the CAHPS self-reported race (SELFRACE) was considered the gold standard, we assessed how closely the existing EDB race/ethnicity code (EDBRACE) matched the race/ethnicity code of the CAHPS' SELFRACE. We evaluated the EDBRACE variable by examining the bivariate agreement/disagreement relationships (2 x 2 contingency tables) between race/ethnicity from the two sources, along with several measures of agreement. We found agreement between SELFRACE and EDBRACE to be fairly low for Asian/Pacific Islander (A/PIs) beneficiaries and even lower for Hispanic beneficiaries.
2. Next, we compared the CAHPS survey respondents' self-reported race/ethnicity, SELFRACE, to a new race/ethnicity variable we created using naming algorithms based on the Hispanic (Word & Perkins, 1996) and Asian/Pacific Islander (Falkenstein & Word, 2002) surname lists developed by the U.S. Census Bureau. These lists were based on the empirically established fact that certain surnames, and even certain spellings of surnames, are associated with a known probability with a person's race/ethnicity. By running the naming algorithms on the names of the CAHPS survey respondents, we were able to create a new race variable for each survey respondent based on his or her surname. We refer to this new variable as NAMERACE. It is important to note that NAMERACE was calculated independently of the survey respondent's race/ethnicity coding from the EDB and the CAHPS survey. We assessed the naming algorithms by comparing each respondent's NAMERACE code to their SELFRACE code. As in Step 1 above, 2 x 2 contingency tables and other methods of agreement assessment were used in the analysis. SELFRACE in this analysis was again the gold standard.

   We created the NAMERACE variable employing a range of empirically established probabilities of correct race/ethnicity categorization (our level of inclusion) for the names in the lists. Regardless of how strict or loose the level of inclusion, we found that starting with no race information at all, the variable created from the naming algorithm, NAMERACE, was no better overall at correctly identifying race/ethnicity for A/PI beneficiaries than the existing EDBRACE variable. For Hispanic beneficiaries, however, the variable created from the naming algorithm did result in a very modest improvement over the EDBRACE variable.

3. Upon further analysis, we found that by using the existing codes for the EDBRACE variable as a starting point, and applying the naming algorithms to them, we were able to obtain markedly improved results. These results led us to investigate how other variables found in the EDB, some simple geographic assumptions, and beneficiaries' first name could further improve the accuracy of our naming algorithms.

   Thus, using race/ethnicity information from the EDB, surname lists, geography, first name lists, and two other EDB variables, we constructed a second new race variable that we called ALGRACE. In the same manner as described above, we assessed the performance of the improved naming algorithm by comparing the agreement/disagreement between ALGRACE and SELFRACE. We found that for both Hispanic and A/PI beneficiaries, ALGRACE was considerably better at correctly identifying race/ethnicity than either the EDBRACE or NAMERACE variables.

4. The success of the ALGRACE variable for Hispanic and A/PI beneficiaries led us to the conclusion that combining the optimal Hispanic and A/PI name algorithms to construct a new "corrected" racial and ethnic variable for the EDB was the obvious next step. Following this step, we obtained the 10 segments of the unloaded EDB containing the entire enrollment of Medicare beneficiaries and the corresponding variables from the EDB used in the final step of the algorithm. Then we ran the final algorithm on the full EDB, creating a new race/ethnicity variable called NEWRACE. This variable can be added to the EDB and used in place of EDBRACE, thereby giving researchers and policy makers an improved race/ethnicity variable to work with. We discuss the detailed results of the analytic process summarized above in the next chapter.

CHAPTER 3
ASSESSMENT AND ALGORITHM RESULTS

3.1 Assessing and Improving the Accuracy of the Race/Ethnicity Coding in the EDB

3.1.1 Assessment of the EDB Race/Ethnicity Coding: Comparing Self-Reported Race/Ethnicity from the CAHPS Surveys to Race/Ethnicity in the EDB

In our assessment, we compared the self-reported race variable, SELFRACE, from the CAHPS data to the corresponding EDBRACE variable for all the survey respondents. As indicated above, the EDBRACE variable has eight different values and only allows beneficiaries one value each. Prior to making comparisons, we created the self-reported race variable, SELFRACE, from the two CAHPS survey questions related to race and ethnicity. Below are the two race/ethnicity questions and possible responses that appear in the CAHPS surveys:

1. Are you of Hispanic or Latino origin or descent?
   a. Yes, Hispanic or Latino
   b. No, not Hispanic or Latino
2. What is your race? Please mark one or more.
   a. White
   b. Black or African American
   c. Asian
   d. Native Hawaiian or other Pacific Islander
   e. American Indian or Alaskan Native

To make meaningful comparisons, the self-reported race variable, SELFRACE, created from the two survey questions above, had to be created with similar logic and the same codes as the EDBRACE variable. Thus, we devised the following rules to make the SELFRACE codes comparable to EDBRACE codes:

1. If a CAHPS survey respondent answered “Yes” to Question 1, indicating he/she was Hispanic, SELFRACE was set to Hispanic/Latino regardless of how the response to Question 2.
2. Otherwise, if the survey respondent answered “No” to Question 1 (or the response was “Missing”) and only chose one race category in Question 2, then SELFRACE was set to the value of the race that was chosen. For example, if a respondent chose “Asian,” SELFRACE was set to Asia/Pacific Islander. If a respondent selected “Native Hawaiian or other Pacific Islander,” SELFRACE was also set to A/PI.
3. If a respondent answered “No” to Question 1 (or the response was “Missing”) and he/she reported more than one race in Question 2, SELFRACE was set to a new category called “two or more.” Since the EDB did not have an equivalent category, these beneficiaries were not included in our analyses.

4. If a survey respondent’s answer was “Missing” for both Questions 1 and 2, then SELFRACE was set to the code for “Unknown.”
5. If the survey respondent answered “No” to Question 1 (or it was “Missing”), and answered “Other” to Question 2, then SELFRACE was set to “Unknown.”

Using the SELFRACE variable as the gold standard, we assessed the accuracy of EDBRACE, the EDB race/ethnicity variable or test measure. Accuracy and agreement statistics (sensitivity, specificity, positive predictive value, negative predictive value, and the Kappa coefficient) accompany 2 x 2 tables comparing the two measures for each racial/ethnic group. In Figure 1, we have lettered and labeled the cells of the 2 x 2 table as “a” (True Positive), “b” (False Negative), “c” (False Positive), and “d” (True Negative).

Sensitivity represents how good a test measure is at correctly identifying people’s actual race/ethnicity. In our case, it is the percentage of persons who self-identify in CAHPS as being in a particular racial/ethnic group (gold standard) who also are identified as being in that same group by the EDB (test measure). (In a later analysis we used this same approach to assess the accuracy of race/ethnicity codes resulting from the algorithm as the test measure.) From Figure 1, sensitivity is calculated as (a / a + b) x 100. Specificity, on the other hand, indicates how good a test measure is at correctly identifying persons who are not in the group. It is the percentage of persons not in the racial/ethnic group who are correctly identified as not being in the group by the test measure. From Figure 1, specificity is calculated as (d / c + d) x 100. Positive predictive value is the percentage of persons that the test measure identifies as being in the group who are actually in the group according to the gold standard. It is calculated from Figure 1 as (a / a + c) x 100. Negative predictive value is the percentage of persons that the test measure identifies as not being in the group who are actually not in the group according to the gold standard. It is calculated from Figure 1 as (d / b + d) x 100.

Figure 1
Measuring the association between EDBRACE and SELFRACE

		EDB Race/Ethnicity Variable (EDBRACE –Test Measure)	
		In the Group	Not in the Group
CAHPS Race/Ethnicity (SELFRACE—Gold Standard)	In the Group	a (True Positive)	b (False Negative)
	Not in the Group	c (False Positive)	d (True Negative)

While the goal is for both sensitivity and specificity to be high, there is often a tradeoff between them. In other words, to improve sensitivity it is sometimes necessary to sacrifice some measure of specificity. A similar relationship exists between positive and negative predictive value. The goal is for both to be high but when we seek to improve one it is often at the expense of the other. Our goal was to improve sensitivity by reducing the number of false negatives without drastically reducing specificity by increasing the number of false positives. As a means for deciding when to stop our manipulations, we set a pragmatic target of improving sensitivity to at least 75 percent, with negligible adverse impact on specificity.

The final measure we calculated was the Kappa coefficient (Cohen, 1960). The formula for the Kappa coefficient is:

$$\hat{\kappa} = \frac{P_o - P_e}{1 - P_e}$$

where $P_o - \sum_i p_{ii}$ and $P_e - \sum_i p_{i.}p_{.i}$. P_{ii} is the proportion for the ith row and ith column, $P_{i.}$ is the marginal proportion for the ith row, and $P_{.i}$ is the marginal proportion for the ith column.

Widely used as a measure of inter-rater reliability, Kappa can also be used to quantify the level of agreement between two measures of what are hypothesized to be the same things. The Kappa coefficient ranges from 1 (complete agreement), through 0 (no agreement), to -1 (complete disagreement). Landis and Koch (1977, p.165) suggested the following interpretations for the Kappa coefficient:

Kappa Statistic	Strength of Agreement
<0.00	Poor
0.00 – 0.20	Slight
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61– 0.80	Substantial
0.81– 1.00	Almost Perfect

Since we want to use the race/ethnicity codes for analyses at the person level, we would like the level of agreement between the improved race/ethnicity code and the SELFRACE to be almost perfect; therefore, we set achieving a Kappa coefficient of greater than 0.80 as our target.

The first section of Table 1 illustrates the agreement between the CAHPS survey-based SELFRACE variable, and the EDB-based EDBRACE variable, with respect to the classification of beneficiaries as White or non-White. Subsequent sections of Table 1 repeat the same analysis for Black, Hispanic, Asian/Pacific Island (A/PI), and American Indian/Alaska Native (AI/AN) beneficiaries. Beside the 2 x 2 table section for each racial/ethnic group are the agreement measures we calculated.

Results in Table 1 reveal some very low levels of accuracy and agreement between the EDB race/ethnicity variable (EDBRACE) and the CAHPS self-reported race/ethnicity variable (SELFRACE) in correctly identifying the race/ethnicity of Hispanic, A/PI, and AI/AN Medicare beneficiaries. For example, the third section of Table 1 indicates that there are 43,927 self-reported Hispanic beneficiaries (12,953 + 30,974) in the CAHPS data. Among those individuals, the EDB has correctly classified only 12,953 of them as Hispanic, leaving 30,974 classified as NOT Hispanic. In other words, as reflected by the sensitivity statistic, the EDB captures only 29.5 percent of Hispanic beneficiaries. There is somewhat better agreement for beneficiaries who are A/PI, with a sensitivity of 54.7 percent. As for self- identified AI/AN beneficiaries, only 35.7 percent appear as such in the EDB, and this number reflects the EDB update undertaken with the Indian Health Service mentioned earlier. The sensitivity of the EDB for Black beneficiaries, at 97.4 percent, and White beneficiaries, at 99.3 percent, are both very good.

Table 1.
Accuracy and agreement between EDBRACE and SELFRACE

Race/ethnicity		EDBRACE		Accuracy and agreement measures for EDBRACE				
SELFRACE		Yes	No	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Kappa
White	Yes	667,573	4,420	99.3%	61.7%	91.7%	95.7%	0.71
	No	60,794	97,941					
Black	Yes	57,867	1,515	97.4	98.8	86.3	99.8	0.91
	No	9,209	762,137					
Hispanic	Yes	12,953	30,974	29.5	99.9	92.7	96.2	0.43
	No	1,025	785,776					
A/PI	Yes	8,008	6,626	54.7	99.8	84.5	99.2	0.66
	No	1,469	814,625					
AI/AN	Yes	1,194	2,150	35.7	99.9	59.9	99.7	0.45
	No	799	826,585					
Other/ Unknown	Yes	478	27,158	1.7	98.8	4.9	96.7	0.01
	No	9,357	793,735					

Source: EDBRACE is from Medicare EDB from mid-2003 and SELFRACE is from Medicare CAHPS fee-for-service, managed care enrollee, and disenrollee surveys for 2000-2002.

On the other hand, the EDB does a very good job with not misclassifying non-Hispanic beneficiaries as Hispanic, non-A/PI as A/PI, non-Black as Black, and non-AI/AN as AI/AN. This is shown by the specificity reaching 98.8 percent or higher for those groups. In other words, if the EDB has a beneficiary coded as not being Hispanic, Black, A/PI, or AI/AN, then chances are very good the EDB is correct. However, while the specificity for Hispanic, A/PI, AI/AN, and Black beneficiaries is very high, it is considerably lower for those who are White. As shown by the specificity of 61.7 percent, 60,794 of the 158,735 non-Whites are mistakenly identified as White in the EDB. This finding supports the notion that there are many beneficiaries classified as White in the EDB who actually belong in one of the other race/ethnicity categories.

The overall level of agreement, reflected in the Kappa coefficients, is moderate for Hispanic and AI/AN beneficiaries—0.43 and 0.45, respectively. These Kappa coefficients reflect the historical legacy of using methods with little sensitivity for racial and ethnic differences to classify Medicare enrollees in the EDB. Much the same can be said about A/PIs despite a Kappa

(.66) that is in the substantial agreement range. We speculate that many Hispanic, A/PI, and AI/AN beneficiaries were coded as White by default because the appropriate racial/ethnic categories were not available in the EDB until relatively recently. The Kappa for White beneficiaries is also substantial (0.71), but not near perfect, undoubtedly reflecting the low specificity for this group.

3.1.2 Characteristics of the Misclassified Medicare Beneficiaries

We examined the beneficiaries who, according to the CAHPS race/ethnicity variable, SELFRACE, were misclassified in the EDB. Table 2 shows the number of beneficiaries in each racial/ethnic group who were misclassified as false negatives in the EDB race/ethnicity variable, EDBRACE, according to the SELFRACE variable for CAHPS survey respondents. The table also shows the percentage distribution of these misclassified beneficiaries according to the EDB racial/ethnic group into which they were incorrectly classified.

Table 2.
Misclassification of race/ethnicity among Medicare beneficiaries: A comparison of EDBRACE with SELFRACE

SELFRACE		Percent misclassified by EDBRACE						
Race/ ethnicity	Number misclassified in the EDB[a]	White	Black	Hispanic	AI/AN	A/PI	Other	Total
White	4,420	---	27.4	9.7	7.6	16.1	39.3	100.0
Black	1,515	72.1	---	3.8	1.5	2.1	20.5	100.0
Hispanic	30,974	89.7	4.8	---	0.2	0.6	4.8	100.0
A/PI	6,626	14.0	2.9	0.6	0.4	---	82.1	100.0
AI/AN	2,150	76.8	16.6	1.5	---	0.3	4.9	100.0
Other/ Unknown	27,158	81.6	15.3	1.7	0.3	1.2	---	100.0
2 or more	9,812	73.4	18.5	0.2	2.9	2.3	2.8	100.0

[a] Two beneficiaries in the CAHPS sample were coded as missing on EDBRACE. In addition, it should be noted that the race/ethnicity of 748,073 of the total 830,728 Medicare beneficiaries was correctly classified.

Source: EDBRACE is from Medicare EDB from mid-2003 and SELFRACE is from Medicare CAHPS fee-for-service, managed care enrollee, and disenrollee surveys for 2000-2002.

This analysis of those beneficiaries whose race/ethnicity was misclassified (the false negatives) according to the gold standard shows some striking patterns:

1. The vast majority of those misclassified beneficiaries whose race is actually Hispanic (89.7 percent), AI/AN (76.8 percent), Black (72.1 percent), and Non-Hispanic Other or Unknown (81.6 percent) were coded as White in the EDB.
2. However, the vast majority (82.1 percent) of those misclassified beneficiaries whose race is A/PI were coded as Other/Unknown in the EDB.
3. Misclassified White beneficiaries are spread across the race/ethnicity groups but they were mostly misclassified according to the EDB as Black (27.4 percent) and Other/Unknown (39.3 percent).

4. More than one-third (37.5 percent) of the 82,655 misclassified beneficiaries from the EDB were Hispanic.

3.1.3 Development of a Surname Algorithm to More Correctly Identify Race/Ethnicity: Comparison of the Algorithm's Race/Ethnicity Designation to the Self-Reported Race/Ethnicity in CAHPS

For this approach, we used two different surname lists—one for Hispanic and one for A/PI surnames—as the basis for developing a surname-based algorithm to estimate a new race/ethnicity variable, NAMERACE, for the CAHPS survey respondents. After using the surname algorithms to create the NAMERACE variable, we compared the results to the CAHPS survey respondent's self-reported race/ethnicity variable, SELFRACE. As with previous comparisons, SELFRACE was the gold standard for the comparisons.

To create the surname algorithm that produced NAMERACE we obtained a Spanish surname list (see Appendix A) based on the 1990 Census (Word and Perkins, 1996). We also obtained an A/PI surname list (see Appendix B) based on the 2000 Census (Falkenstein and Word, 2002). The Hispanic and A/PI surname lists use similar techniques that allowed us a measure of flexibility in determining whether a given surname should be classified as Hispanic or A/PI. In the Hispanic surname list, Word and Perkins assign a percentage to each name representing the proportion of times a household headed by an individual with an Hispanic surname was indeed in an Hispanic household as identified by the Census. Falkenstein and Word had similar percentages for the A/PI surname list. This feature allowed us to try different percentages as inclusion thresholds, compare the agreement statistics, and thus identify the optimal level of race/ethnicity designation for our particular needs on each list.

Using SAS and the surname lists as "data," we developed algorithms to create a race/ethnicity variable (NAMERACE) that started at a fairly liberal inclusion level of 50 percent, but then continued to get more restrictive until it reached the 90 percent inclusion level. Our analysis of the results suggested that inclusion levels below 70 percent classified too many non-Hispanic beneficiaries as Hispanic, and non-A/PI as A/PI beneficiaries. For this reason, we limited subsequent analysis to inclusion levels of 70 through 90 percent. Each surname algorithm was analyzed in this way, thereby making it possible for the algorithm for Hispanic and A/PI names to function optimally at different inclusion levels.

The Hispanic and A/PI results are presented in Tables 3 and 4, respectively. They show that we did not meet our target of a sensitivity of 75 percent and a Kappa coefficient of more than 0.80 with either surname algorithm. The best Hispanic results had Kappa coefficients between 0.69 and 0.74 and sensitivity ranged between 59.7 and 69.8 percent. Specificity and negative predictive values remained very high for all levels of the Hispanic algorithm. However, positive predictive values ranged from 82.5 to 84.4 percent.

Table 3.
Comparison of NAMERACE to SELFRACE for Medicare beneficiaries with Hispanic surnames at different inclusion levels

	Number of persons with			Accuracy and agreement measures for NAMERACE				
Census-based inclusion level[a]	SELFRACE Hispanic and NAMERACE Hispanic	SELFRACE non-Hispanic and NAMERACE Hispanic	SELFRACE Hispanic and NAMERACE non-Hispanic	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Kappa
≥ 90%	26,210	4,861	17,717	59.7%	99.4%	84.4%	97.8%	0.69
≥ 80	29,827	5,999	14,100	67.9	99.2	83.3	98.2	0.74
≥ 75	30,351	6,265	13,576	69.1	99.2	82.9	98.3	0.74
≥ 70	30,645	6,494	13,282	69.8	99.2	82.5	98.3	0.74

[a] Percent of time households headed by persons with Hispanic surnames said they were Hispanic in the 2000 Census.

Source: NAMERACE is the result of having run the surname algorithm on race/ethnicity in the Medicare EDB from mid-2003 and SELFRACE is from Medicare CAHPS fee-for-service, managed care enrollee, and disenrollee surveys for 2000-2002.

Table 4.
Comparison of NAMERACE to SELFRACE for Medicare beneficiaries with Asian/Pacific Islander surnames at different inclusion levels

	Number of persons with			Accuracy and agreement measures for NAMERACE				
Census-based inclusion level[a]	SELFRACE A/PI and NAME-RACE A/PI	SELFRACE non-A/PI and NAME-RACE A/PI	SELFRACE A/PI and NAME-RACE non-A/PI	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Kappa
≥ 90%	4,635	704	9,999	31.7%	99.9%	86.8%	98.8%	0.46
≥ 80	7,632	1,155	7,002	52.2	99.9	86.9	99.1	0.65
≥ 75	8,027	1,346	6,607	54.9	99.8	85.6	99.2	0.66
≥ 70	8,344	1,507	6,290	57.0	99.8	84.7	99.2	0.68

[a] Percent of time households headed by persons with Asian/Pacific Islander surnames said they were Asian/Pacific Islander in the 2000 Census.

Source: NAMERACE is the result of having run the surname algorithm on race/ethnicity in the Medicare EDB from mid-2003 and SELFRACE is from Medicare CAHPS fee-for-service, managed care enrollee, and disenrollee surveys for 2000-2002.

The A/PI surname algorithm results did not meet our target either. The best A/PI Kappa coefficient results ranged between 0.65 and 0.68, with measures of sensitivity falling between 52.2 percent and 57.0 percent. Similar to the Hispanic surname algorithm, the specificity and negative predictive values remained steady at around 99 percent for all levels. Positive predicted values were between 84.7 and 86.9 percent.

Based on the Kappa coefficient and sensitivity alone, we might conclude the 70 percent inclusion levels are better for both lists. However, we need also to consider how many respondents are labeled by the surname algorithm as Hispanic or A/PI but actually self-report themselves as non-Hispanic or non-A/PI. The statistic that captures this is the positive predictive value and we must be careful to control for this statistic. As Tables 3 and 4 illustrate, for the surname algorithms there is an inverse relationship between sensitivity and positive predictive value, thus we must seek to balance them.

At this point in the work, it was difficult to determine which level was best for each surname algorithm. Clearly neither of the key calculated statistics (sensitivity and Kappa) for the algorithms met our targets. For this reason, we decided to make some changes to the surname algorithms to see what further improvement we could make to enable us to use an algorithm-based measure of race/ethnicity in place of the one in the EDB. In the next section, we describe what we did to improve the surname algorithms.

3.1.4 Improving the Surname Algorithms: Using the EDB Race/Ethnicity Variable and Other EDB Variables.

Table 1 showed that when the EDB coded a beneficiary as Hispanic or A/PI, chances were high that the EDB was correct (high positive predictive values). We also observed from other analyses that beneficiaries living in areas with high concentrations of Hispanic or A/PI origins were very likely to be members of these respective racial/ethnic groups. Based on this information, we decided to explore how other variables available in the EDB could be used to elaborate our surname algorithms. This approach led us to use multiple pieces of information found in the EDB to develop the elaborated surname algorithms. In addition to the EDB variables and the surname lists, we added Hispanic/Latino and A/PI first name lists compiled from multiple Web sites.

We incorporated these pieces of information together with the previously described surname lists in a SAS program that, through an iterative process which differed slightly for Hispanic and A/PI beneficiaries, created an improved race/ethnicity variable (ALGRACE). The surname lists contributed the most in creating ALGRACE, thus we tested the logic of adding the new information at four different surname list inclusion levels (70, 75, 80, and 90 percent). The logic behind the elaborated surname algorithms for Hispanic and A/PI beneficiaries follows. For Hispanic beneficiaries, the elaborated algorithm states:

1. If the surname algorithm identifies the beneficiary as Hispanic at the designated inclusion level (70, 75, 80, and 90 percent) and the names were considered generally or heavily Hispanic by Word and Perkins, then the value of ALGRACE is set to "Hispanic." [9]
2. Otherwise, if the EDB codes the beneficiary as Hispanic, then the value of ALGRACE is set to "Hispanic."

[9] There are two exceptions in the algorithm where the inclusion level drops below 70 percent or the names were not considered generally or heavily Hispanic.

3. Otherwise, if the person is living in Puerto Rico, then the value of ALGRACE is set to “Hispanic.”
4. Otherwise, if the variable LANGCD indicates Spanish, then the value of ALGRACE is set to “Hispanic.”
5. Otherwise, if the beneficiary’s first name has Hispanic origins and the surname algorithm at the 50 percent inclusion level identifies the beneficiary as Hispanic, then ALGRACE is set to “Hispanic.”
6. Otherwise, if the beneficiary’s first name has Hispanic origins, but the surname was not considered generally or heavily Hispanic by Word and Perkins, if the surname algorithm identified the beneficiary as Hispanic at the 90 percent inclusion level, then ALGRACE is set to “Hispanic”.
7. Otherwise, the remaining beneficiaries have ALGRACE set to “Non-Hispanic.”
8. Otherwise, if the variable LANGPREF indicates English, then any previously identified “Hispanics” are changed to “Non-Hispanic.”
9. Otherwise, if the variable RACESRC indicates the EDB race code came from the 1995 survey and the EDB race code is not “Hispanic,” then any previously identified “Hispanics” are changed to “Non-Hispanic.”
10. Otherwise, if the variable RACESRC indicates the beneficiary’s EDB race code came from the Indian Health Service, then any previously identified “Hispanics” are changed to “Non-Hispanic.”

The logic for the elaborated A/PI surname algorithm follows:

1. If the surname algorithm identifies the beneficiary as A/PI at the designated inclusion level (70, 75, 80, and 90 percent), then the value of ALGRACE is set to “A/PI.”[10]
2. Otherwise, if the EDB identifies the beneficiary as A/PI, then the value of ALGRACE is set to “A/PI.”
3. Otherwise, if the beneficiary is living in Hawaii and is identified as A/PI by the surname algorithm at the 50 percent inclusion level, then the value of ALGRACE is set to “A/PI.”
4. Otherwise, if the surname algorithm at the 50 percent inclusion level identifies the beneficiary as A/PI and the beneficiary’s first name has A/PI origins, then ALGRACE is set to “A/PI.”
5. Otherwise, if the beneficiary’s first name is of Japanese origin specifically (as determined from a list of Japanese first names) regardless of surname, then ALGRACE is set to “A/PI.”
6. Otherwise, the remaining beneficiaries are set to “Non-A/PI.”
7. Otherwise, if the variable LANGPREF indicates English, then any previously identified “A/PI” are changed to “Non-A/PI”

[10] There are two exceptions in the algorithm where the inclusion level drops below 70 percent.

8. Otherwise, if the variable RACESRC indicates the EDB's race coding came from the 1995 survey and the EDB's race coding is not "A/PI," then any previously identified "A/PI" are changed to "Non-A/PI."
9. Otherwise, if the variable RACESRC indicates the beneficiary's EDB race coding came from the Indian Health Service, then any previously identified "A/PI" are changed to "Non-A/PI."

Results comparing the improved race/ethnicity variable (ALGRACE), created from the elaborated surname algorithms, to the self-reported race/ethnicity variable (SELFRACE) are presented in Tables 5 and 6. The tables demonstrate a sizeable improvement over the first effort to improve the race/ethnicity variable (NAMERACE) created from the initial surname algorithms. The elaborated Hispanic and A/PI surname algorithms show very consistent increases in almost all of the agreement statistics, with sensitivity and the Kappa coefficient demonstrating the greatest improvement.

Table 5.
Comparison of ALGRACE to SELFRACE for Medicare beneficiaries with Hispanic surnames at different inclusion levels

	Number of persons with			Accuracy and agreement measures for ALGRACE				
Census-based inclusion level[a]	SELFRACE Hispanic and ALGRACE Hispanic	SELFRACE non-Hispanic and ALGRACE Hispanic	SELFRACE Hispanic and ALGRACE non-Hispanic	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Kappa
≥ 90%	32,510	5,232	11,417	74.0%	99.3%	86.1%	98.6%	0.79
≥ 80	33,452	5,866	10,475	76.2	99.3	85.1	98.7	0.79
≥ 75	33,583	6,024	10,344	76.5	99.2	84.8	98.7	0.79
≥ 70	33,663	6,182	10,264	76.6	99.2	84.5	98.7	0.79

[a] Percent of time households headed by persons with Hispanic surnames said they were Hispanic in the 2000 Census.

Source: ALGRACE is the result of having run the elaborated surname algorithm on race/ethnicity in the Medicare EDB from mid-2003 and SELFRACE is from Medicare CAHPS fee-for-service, managed care enrollee, and disenrollee surveys for 2000-2002.

Table 6.
Comparison of ALGRACE to SELFRACE for Medicare beneficiaries with Asian/Pacific Islander surnames at different inclusion levels

	Number of persons with			Accuracy and agreement measures for ALGRACE				
Census-based inclusion level[a]	SELFRACE A/PI and ALGRACE A/PI	SELFRACE Non-A/PI and ALGRACE A/PI	SELFRACE A/PI and ALGRACE non-A/PI	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Kappa
≥ 90%	10,726	2,161	3,908	73.3%	99.7%	83.2%	99.5%	0.78
≥ 80	11,391	2,400	3,243	77.8	99.7	82.6	99.6	0.80
≥ 75	11,493	2,513	3,141	78.5	99.7	82.1	99.6	0.80
≥ 70	11,586	2,636	3,048	79.2	99.7	81.5	99.6	0.80

[a] Percent of time households headed by persons with Asian/Pacific Islander surnames said they were Asian/Pacific Islander in the 2000 Census.

Source: ALGRACE is the result of having run the elaborated surname algorithm on race/ethnicity in the Medicare EDB from mid-2003 and SELFRACE is from Medicare CAHPS fee-for-service, managed care enrollee, and disenrollee surveys for 2000-2002.

At the 70 percent inclusion level, the elaborated Hispanic surname algorithm's sensitivity was 76.6 percent compared to 69.8 percent for the initial Hispanic surname algorithm and the Kappa coefficient improved from 0.74 to 0.79. The positive and negative predictive values and specificity changed very little, being within 0.1 to 0.2 percentage points of each other.

For the A/PI elaborated surname algorithm, also at the 70 percent inclusion level, the sensitivity and Kappa coefficients increased by 22.2 percentage points and 0.12 , respectively, topping out at 79.2 percent sensitivity, with a 0.80 Kappa coefficient, and the positive predictive value decreased only three percentage points. The other agreement statistics did not change noticeably.

Table 7 compares the EDB race/ethnicity code (EDBRACE) to the race/ethnicity code created from the elaborated surname algorithms (ALGRACE) at the 70 percent inclusion level. The table shows that ALGRACE has substantially improved sensitivity and higher Kappa coefficients than EDBRACE. The sensitivity for ALGRACE, when compared to EDBRACE, for the elaborated Hispanic surname algorithm increased by 47.1 percentage points, while for the elaborated A/PI surname algorithm the sensitivity increased by 24.5 percentage points as compared to EDBRACE. The Kappa coefficients increased by 0.36 and 0.14 for the Hispanic and A/PI ALGRACE race/ethnicity variables, respectively. Specificity, positive predictive value, and negative predictive value were not noticeably different, with the exception of positive predictive value for Hispanic beneficiaries, which did decrease by 8.2 percentage points.

Table 7.
Percent improvement in Hispanic and Asian/Pacific Islander race/ethnicity coding using ALGRACE rather than EDBRACE

	Differences in accuracy and agreement measures for the 70% surname inclusion level (ALGRACE – EDBRACE)				
Race/ethnicity classification	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Kappa
Hispanic	47.1%	-0.7%	-8.2%	2.5%	0.36
A/PI	24.5%	-0.1%	-3.0%	0.4%	0.14

Source: EDBRACE is from Medicare EDB from mid-2003 and ALGRACE is the result of having run the elaborated surname algorithm on race/ethnicity in the Medicare EDB from mid-2003.

Overall, the improvement is considerable and provides evidence that the elaborated surname algorithms (creating ALGRACE) are superior to the initial surname algorithms (creating NAMERACE) and to the original EDB race/ethnicity variable (EDBRACE).

In addition to being superior to the EDB, with the multiple sources of information, the elaborated surname algorithm for Hispanic and A/PI beneficiaries exceeded our improvement target for sensitivity of 75 percent (76.6 and 79.2 percent for Hispanic and A/PI, respectively) but barely missed reaching the target of Kappa coefficients of more than 0.80 for the Hispanic (0.79) and A/PI (0.80) algorithms.

Given the success of the elaborated surname algorithms, the next obvious step was to combine the separate Hispanic and A/PI elaborated surname algorithms into a single procedure. With the combined algorithm, we intended to create a new and very much improved race/ethnicity variable (NEWRACE) and assess it against the self-reported race/ethnicity from the CAHPS surveys (SELFRACE).

3.1.5 Combining the Improved Hispanic and A/PI Algorithms

The first step in combining the improved Hispanic and A/PI surname algorithms was to decide which surname inclusion levels to use for each algorithm. The best results in terms of the highest sensitivity and Kappa coefficient for the A/PI algorithm was achieved at the 70 percent inclusion level, although it was only slightly better than the 75 percent level. For the Hispanic algorithm, the 70 through 80 percent inclusion levels had almost identical sensitivities and Kappa coefficients. For these reasons, we chose the lowest acceptable inclusion level to have the same inclusion levels for both surname algorithms – the 70 percent level.

Next, we investigated the extent of possible overlap between the Hispanic and A/PI (Filipino, in particular) surname algorithms (i.e., if the same beneficiary surname was considered Hispanic in one algorithm and Asian/Pacific Islander in the other algorithm). We used the CAHPS survey data to investigate the extent of possible surname overlap. Out of 830,728 beneficiaries, only 433 (0.05 percent) were labeled both Hispanic and A/PI. Because the overlap involved barely five one hundredths of one percent of Medicare beneficiaries, we decided that it was not large enough to cause us great concern when combining the two algorithms. Thus, we settled on a simple, straightforward approach for combining the improved Hispanic and A/PI surname algorithms. The logic of the combined surname algorithm used to create the NEWRACE variable follows:

1. If the improved Hispanic surname algorithm labels the beneficiary as Hispanic, then the NEWRACE variable is set to "Hispanic."
2. Otherwise, if the improved A/PI surname algorithm labels the beneficiary as A/PI, then the NEWRACE variable is set to "Asian/Pacific Islander."
3. Otherwise, NEWRACE is set equal to the race/ethnicity coding of the original EDB, EDBRACE.

Table 8 presents a comparison of the frequency distributions (numbers and percentages) of three race/ethnicity variables—EDBRACE, SELFRACE, and NEWRACE. As expected for Hispanic and A/PI beneficiaries, the numbers for the NEWRACE variable are much closer to the gold standard numbers of the SELFRACE variable than is true for EDBRACE. For White beneficiaries, the NEWRACE numbers also are closer to the SELFRACE numbers, probably because the EDB mislabeled a large proportion of Hispanic beneficiaries as White. As expected, the distribution of American Indian/Alaska Native and Black beneficiaries changed very little from one race/ethnicity variable to another since no effort was made to alter them.

Table 8.
Comparison of the distribution of race/ethnicity according to EDBRACE, NEWRACE, and SELFRACE

Race/ethnicity	Number (%) of persons for EDBRACE[a]		Number (%) of persons for NEWRACE		Number (%) of persons for SELFRACE	
White	728,367	(87.7)	704,185	(84.8)	671,993	(80.9)
Black	67,076	(8.1)	66,328	(8.0)	59,382	(7.2)
Hispanic	13,978	(1.7)	39,862	(4.8)	43,927	(5.9)
A/PI	9,477	(1.1)	13,812	(1.7)	14,634	(1.8)
AI/AN	1,993	(0.2)	1,977	(0.2)	3,344	(0.4)
Other	9,835	(1.2)	4,563	(0.6)	27,636	(3.3)

[a] The EDB does not allow for a "two or more" race/ethnicity; therefore the new race variable does not have this category. We dropped 9,812 persons from the comparative analysis because they identified themselves with two or more race/ethnicity codes.

Source: EDBRACE is from Medicare EDB from mid-2003; SELFRACE is from Medicare CAHPS fee-for-service, managed care enrollee, and disenrollee surveys for 2000-2002; and NEWRACE is the result of having run the combined surname algorithm on race/ethnicity in the Medicare EDB from mid-2003.

3.2 Accuracy of EDB Race/Ethnicity Coding by Specific Demographic Subgroups within Minority Populations

The purpose of this section is to examine to what extent the misclassification of Medicare enrollees based on race/ethnicity resulted in any other patterns of over- or under-representation by particular demographic subgroups within the race/ethnic groups. Based on the results we presented above in Section 3.1, we know that many Hispanic beneficiaries were incorrectly classified as “Non-Hispanic White” in the EDB, and that many A/PI beneficiaries were incorrectly classified as “Non-Hispanic Other” in the EDB.

In this section, we address to what extent the rate of misclassification by race/ethnicity demonstrates any patterns across gender and age groups. In Table 9, the first three data columns each represent one of three variables indicating the race/ethnicity of Medicare enrollees: the original EDB race code (EDBRACE), the “improved” race code (NEWRACE), and self-reported race (SELFRACE) from the CAHPS surveys. The “EDBRACE” column of the table includes only those beneficiaries whose race in the EDB matched their self-reported race on the CAHPS surveys. Likewise, the “NEWRACE” column includes only those beneficiaries whose new race (i.e., race determined by the naming algorithm) matched their self-reported race. Each of the next three columns displays ratios that, taken together, indicate the degree to which we were able to improve the accuracy of race/ethnicity coding in the EDB by using the naming algorithm.

3.2.1 Under-representation in the EDB

The first ratio indicates the proportion of beneficiaries whose EDB race matched their self-reported race from the CAHPS data. As can be seen, both Hispanic and A/PI beneficiaries were under-represented, although the latter group was better represented relative to the former. Of all the respondents in the CAHPS surveys who identified themselves as Hispanic/Latino, only about 30 percent were identified as Hispanic/Latino in the EDB. Similarly, of all respondents in the CAHPS surveys who identified themselves as A/PI, only about 55 percent were identified as A/PI in the EDB.

Table 9 also shows the level of under-representation by gender and age. For both Hispanic and A/PI beneficiaries (the only groups our algorithms seek to improve), females are less well-represented than males, although the differences are small. For each gender group within each racial/ethnic group, the ratio of EDB race to self-reported race is broken down further by age (under 65 versus 65 and older), with the 65 and older category broken down again into three groupings. As shown in the table, among the beneficiaries age 65 and older, the youngest age group (65 to 74) is the least well-represented, followed by the highest age group (85+), then the middle group (75 to 84). This pattern is true for both gender groups, and for both Hispanic and A/PI beneficiaries.

Table 9.
Comparison of EDBRACE, NEWRACE, and SELFRACE (CAHPS) distributions of race/ethnicity by gender and age

	Number of persons			Ratios		
Demographic characteristics	EDBRACE**	NEWRACE†	SELFRACE (CAHPS)*	EDBRACE/ SELFRACE	NEWRACE/ EDBRACE	NEWRACE/ SELFRACE
White	667,575	663,666	671,993	0.993	0.994	0.988
Male	287,203	286,088	289,177	0.993	0.996	0.989
Less than 65	21,008	20,914	21,387	0.982	0.996	0.978
65 and Over	266,195	265,174	267,790	0.994	0.996	0.990
65 to 74	124,295	123,771	125,110	0.993	0.996	0.989
75 to 84	111,825	111,435	112,383	0.995	0.997	0.992
85 Plus	30,075	29,968	30,297	0.993	0.996	0.989
Female	380,372	377,578	382,816	0.994	0.993	0.986
Less than 65	19,566	19,267	19,820	0.987	0.985	0.972
65 and Over	360,806	358,311	362,996	0.994	0.993	0.987
65 to 74	147,728	146,321	148,547	0.994	0.990	0.985
75 to 84	154,473	153,630	155,302	0.995	0.995	0.989
Black	57,867	57,712	59,382	0.974	0.997	0.972
Male	21,609	21,572	22,182	0.974	0.998	0.973
Less than 65	4,043	4,036	4,152	0.974	0.998	0.972
65 and Over	17,566	17,536	18,030	0.974	0.998	0.973
65 to 74	9,482	9,464	9,697	0.978	0.998	0.976
75 to 84	6,699	6,690	6,892	0.972	0.999	0.971
85 Plus	1,385	1,382	1,441	0.961	0.998	0.959
Female	36,258	36,140	37,200	0.975	0.997	0.972
Less than 65	4,789	4,762	4,915	0.974	0.994	0.969
65 and Over	31,469	31,378	32,285	0.975	0.997	0.972
65 to 74	15,109	15,055	15,460	0.977	0.996	0.974
75 to 84	12,401	12,367	12,706	0.976	0.997	0.973
85 Plus	3,959	3,956	4,119	0.961	0.999	0.960
Hispanic	12,953	33,679	43,927	0.295	2.600	0.767
Male	6,167	16,118	19,857	0.311	2.614	0.812
Less than 65	967	2,214	2,668	0.362	2.290	0.830
65 and Over	5,200	13,904	17,189	0.303	2.674	0.809
65 to 74	1,924	7,689	9,354	0.206	3.996	0.822
75 to 84	2,849	5,257	6,493	0.439	1.845	0.810
85 Plus	427	958	1,342	0.318	2.244	0.714
Female	6,786	17,561	24,070	0.282	2.588	0.730
Less than 65	710	1,667	2,210	0.321	2.348	0.754
65 and Over	6,076	15,894	21,860	0.278	2.616	0.727
65 to 74	2,115	8,284	11,294	0.187	3.917	0.733
75 to 84	3,315	6,113	8,331	0.398	1.844	0.734
85 Plus	646	1,497	2,235	0.289	2.317	0.670

(continued)

Table 9.
Comparison of EDBRACE, NEWRACE, and SELFRACE (CAHPS) distributions of race/ethnicity by gender and age (continued)

Demographic characteristics	Number of persons			Ratios		
	EDBRACE**	NEWRACE†	SELFRACE (CAHPS)*	EDBRACE/ SELFRACE	NEWRACE/ EDBRACE	NEWRACE/ SELFRACE
A/PI	8,008	11,325	14,634	0.547	1.414	0.774
Male	3,692	5,251	6,501	0.568	1.422	0.808
Less than 65	132	177	280	0.471	1.341	0.632
65 and Over	3,560	5,074	6,221	0.572	1.425	0.816
65 to 74	1,356	2,306	3,021	0.449	1.701	0.763
75 to 84	1,775	2,200	2,544	0.698	1.239	0.865
85 Plus	429	568	656	0.654	1.324	0.866
Female	4,316	6,074	8,133	0.531	1.407	0.747
Less than 65	135	161	257	0.525	1.193	0.626
65 and Over	4,181	5,913	7,876	0.531	1.414	0.751
65 to 74	1,692	2,689	3,937	0.430	1.589	0.683
75 to 84	2,001	2,531	3,127	0.640	1.265	0.809
85 Plus	488	693	812	0.601	1.420	0.853
AI/AN	1,194	1,190	3,344	0.357	0.997	0.356
Male	510	507	1,599	0.319	0.994	0.317
Less than 65	131	130	395	0.332	0.992	0.329
65 and Over	379	377	1,204	0.315	0.995	0.313
65 to 74	208	206	689	0.302	0.990	0.299
75 to 84	135	135	412	0.328	1.000	0.328
85 Plus	36	36	103	0.350	1.000	0.350
Female	684	683	1,745	0.392	0.999	0.391
Less than 65	132	132	303	0.436	1.000	0.436
65 and Over	552	551	1,442	0.383	0.998	0.382
65 to 74	279	278	684	0.408	0.996	0.406
75 to 84	217	217	567	0.383	1.000	0.383
85 Plus	56	56	191	0.293	1.000	0.293
Other	478	279	27,636	0.017	0.584	0.010
Male	204	112	11,636	0.018	0.549	0.010
Less than 65	19	11	949	0.020	0.579	0.012
65 and Over	185	101	10,687	0.017	0.546	0.009
65 to 74	92	52	4,258	0.022	0.565	0.012
75 to 84	71	38	4,665	0.015	0.535	0.008
85 Plus	22	11	1,764	0.012	0.500	0.006
Female	274	167	16,000	0.017	0.609	0.010
Less than 65	16	12	831	0.019	0.750	0.014
65 and Over	258	155	15,169	0.017	0.601	0.010
65 to 74	119	70	4,974	0.024	0.588	0.014
75 to 84	94	54	6,688	0.014	0.574	0.008
85 Plus	45	31	3,507	0.013	0.689	0.009

(continued)

Table 9.
Comparison of EDBRACE, NEWRACE, and SELFRACE (CAHPS) distributions of race/ethnicity by gender and age (continued)

Demographic characteristics	Number of persons EDBRACE**	 NEWRACE†	 SELFRACE (CAHPS)*	Ratios EDBRACE/ SELFRACE	 NEWRACE/ EDBRACE	 NEWRACE/ SELFRACE
Totals	748,075	767,851	820,916	0.911	1.026	0.935

* Note: Distribution in this column represents original self-reported race distribution from CAHPS. N = 820,916. The CAHPS data include a race category for respondents who chose more than one race (N = 9,812). The numbers in this column do not reflect that category.

** This column includes ONLY the individuals whose EDB race matched their self-reported race. Variable = EDBRACE. N = 748,973.

† This column includes ONLY the individuals whose new race matched their self-reported race. Variable = NEWRACE. N = 767,851.

Source: EDBRACE is from Medicare EDB from mid-2003; SELFRACE is from Medicare CAHPS fee-for-service, managed care enrollee, and disenrollee surveys for 2000-2002; and NEWRACE is the result of having run the combined surname algorithm on race/ethnicity in the Medicare EDB from mid-2003.

3.2.2 Improvement of the Accuracy of the EDB Race Variable

Overall, we were able to increase the accuracy of the race/ethnicity coding in the EDB for the numbers of beneficiaries by 2.6 times for Hispanic beneficiaries, and 1.4 times for those with A/PI origins. The improved EDB race variable thus accurately identifies almost 77 percent of Hispanic, and a little more than 77 percent of A/PI beneficiaries.

Tables 10 and 11 show more clearly the differences in improvement by gender and age. For both Hispanic and A/PI beneficiaries, accuracy for males and females improved by approximately the same proportion. However, given that females were slightly more under-represented than males and had a smaller percentage point increase, the resulting new level of accuracy is less for females than for males (see Table 10). Asian/Pacific Islander beneficiaries were clearly better represented in the EDB than Hispanic, but both groups achieved roughly the same new level of accuracy, with females still more under-represented than males. This gap is most likely due to the problem posed by women changing their last names when they marry and to marrying outside of their ethnic group, which highlights a limitation of using a surname algorithm to improve race/ethnicity coding.

Table 10.
Comparisons showing improvement in Hispanic and Asian/Pacific Islander coding by gender using NEWRACE and EDBRACE

	Hispanic		A/PI	
Gender	Male	Female	Male	Female
Initial level of accuracy in EDB (%)	31	28	57	53
New level of accuracy (%)	81	73	81	75
Percentage point increase in accuracy	50	45	24	22
Ratio of improvement in accuracy[a]	2.6	2.6	1.4	1.4

[a] Ratio = new level of accuracy/initial level of accuracy.

Source: EDBRACE is from Medicare EDB from mid-2003; and NEWRACE is the result of having run the combined surname algorithm on race/ethnicity in the Medicare EDB from mid-2003.

Table 11.
Comparisons showing improvement in Hispanic and Asian/Pacific Islander coding by gender and age using NEWRACE and EDBRACE

	Hispanic						A/PI					
Gender	Male			Female			Male			Female		
Age distribution for 65+	65-74	75-84	85+	65-74	75-84	85+	65-74	75-84	85+	65-74	75-84	85+
Initial level of accuracy in EDB (%)	21	44	32	19	40	29	45	70	65	43	64	60
New level of accuracy (%)	82	81	71	73	73	67	76	86	87	68	81	85
Percentage point increase in accuracy	62	37	40	55	34	38	31	17	21	25	17	25
Ratio of improvement in accuracy[a]	4.0	1.8	2.2	3.9	1.8	2.3	1.7	1.2	1.3	1.6	1.3	1.4

[a] Ratio = new level of accuracy/initial level of accuracy.

Source: EDBRACE is from Medicare EDB from mid-2003; and NEWRACE is the result of having run the combined surname algorithm on race/ethnicity in the Medicare EDB from mid-2003.

Table 11 shows an interesting pattern with regard to age. For both Hispanic and A/PI beneficiaries, EDBRACE is least accurate for the youngest group (age 65 to 74), but this group also shows the highest ratio of improvement inaccuracy. The accuracy of race for beneficiaries of Hispanic origin improved by approximately four times for males and females; improvement for A/PI beneficiaries was more modest, at around 1.7 times, but their initial level of accuracy was higher relative to the comparable Hispanic gender-age groups.

3.3 Using the Combined Naming Algorithm on the Full EDB to Provide an Improved Race/Ethnicity Variable

Upon combining the naming algorithms and verifying the combined algorithm's success on the CAHPS data, we created the NEWRACE variable for the entire EDB. The first step was to obtain from CMS all 41.7 million records of active beneficiaries in the 10 segments of the unloaded EDB. After we had uploaded the EDB records, we were able to run the combined naming algorithm on the EDB records creating NEWRACE for each living beneficiary in the EDB.

Table 12, similar to Table 8 (in Section 3.1), demonstrates the differences in the EDBRACE and NEWRACE variables for the entire population of active beneficiaries listed in the EDB. As with the results for the CAHPS data, the number and percentage of Hispanic and A/PI beneficiaries increased, while they decreased for the White and Other race categories. The number and percent of Black beneficiaries also decreased slightly.

Table 12.
Comparison of the distribution of race/ethnicity according to EDBRACE and NEWRACE for the entire EDB

	Original EDB race variable (EDBRACE)		New EDB race variable (NEWRACE)	
	Frequency	Percent	Frequency	Percent
White	35,141,623	84.2	33,424,922	80.1
Black	4,014,799	9.6	3,933,634	9.4
Hispanic	913,069	2.2	2,912,244	7.0
A/PI	593,456	1.4	854,182	2.0
AI/AN	137,989	0.3	136,498	0.3
Other	838,744	2.0	394,375	0.9
Unknown	101,095	0.2	85,254	0.2
Missing	1,631	0.0	1,297	0.0
Total	41,742,406	100.0	41,742,406	100.0

Source: EDBRACE is from Medicare EDB from mid-2003; and NEWRACE is the result of having run the combined surname algorithm on race/ethnicity in the Medicare EDB from mid-2003.

Based on our extensive evaluation of the naming algorithm (see Section 3.1), we are confident that the NEWRACE variable represents a substantially improved race/ethnicity variable for Medicare beneficiaries. We encourage CMS to incorporate this improved race/ethnicity variable into the EDB so that researchers and policy makers will have the ability to use NEWRACE in their analyses as well as the existing version of race/ethnicity in the EDB (EDBRACE).

Table 13 shows that overall, 1,998,909[11] beneficiaries listed in the EDB had their race/ethnicity recoded to Hispanic as a result of using the combined improved naming algorithm. Most of these beneficiaries were originally classified in the EDB as White (83.5 percent), followed by Other/Unknown (11.1 percent), and Black (3.8 percent). Very few beneficiaries were originally coded as A/PI (1.5 percent) or AI/NA (less than 0.05 percent). Overall, more female beneficiaries (1,068,033) than males (930,875) were recoded to Hispanic. This pattern holds true for White, Black, and Asian/Pacific Islander beneficiaries. The largest number of "new" Hispanic beneficiaries was created in the 65-to-74-year-old age group. This is true regardless of the beneficiaries' original EDB race/ethnicity code and gender. Not surprisingly, the 85-year- old-and-older age group had the fewest beneficiaries with their race/ethnicity recoded. This undoubtedly reflects the overall age distribution of Medicare beneficiaries.

[11] This excludes 266 beneficiaries who were originally coded as missing in the EDB but are now coded as Hispanics. Beneficiaries who were already coded as Hispanic in the EDB are also not included in this total.

Table 13.
Distribution of “new” Hispanic beneficiaries (NEWRACE) according to their EDBRACE, gender, and age group

EDBRACE	White		Black		Asian/Pacific Islander		American Indian/ Alaska Native		Other or unknown		Total	
Gender and age group	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	1,669,047	83.5	76,837	3.8	30,090	1.5	995	0.0	221,940	11.1	1,998,909	100.0
Male	767,952	82.5	36,070	3.9	12,499	1.3	520	0.1	113,834	12.2	930,875	100.0
Under 65	170,155	77.9	10,650	4.9	1,789	0.8	287	0.1	35,501	16.3	218,382	100.0
65-74	406,797	84.0	17,447	3.6	5,978	1.2	132	0.0	53,924	11.1	484,278	100.0
75-84	142,310	84.7	5,467	3.3	3,873	2.3	92	0.1	16,303	9.7	168,045	100.0
85 and Older	48,690	80.9	2,506	4.2	859	1.4	9	0.0	8,106	13.5	60,170	100.0
Female	901,095	84.4	40,767	3.8	17,591	1.6	475	0.0	108,105	10.1	1,068,033	100.0
Under 65	144,235	80.4	8,947	5.0	1,539	0.9	223	0.1	24,461	13.6	179,405	100.0
65-74	468,252	85.7	19,395	3.5	9,122	1.7	151	0.0	49,458	9.1	546,378	100.0
75-84	193,255	85.4	7,540	3.3	5,651	2.5	83	0.0	19,835	8.8	226,364	100.0
85 and Older	95,353	82.3	4,885	4.2	1,276	1.1	18	0.0	14,351	12.4	115,883	100.0

Source: EDBRACE is from Medicare EDB from mid-2003; and NEWRACE is the result of having run the combined surname algorithm on race/ethnicity in the Medicare EDB from mid-2003.

As can be seen from Table 14, among A/PI beneficiaries, 290,748[12] were recoded as a result of using the combined improved naming algorithm. Unlike the Hispanic beneficiaries whose race/ethnicity was most often originally coded in the EDB as White, the majority of the new A/PI beneficiaries were originally coded as Other/Unknown in the EDB. Exactly 82.0 percent of the newly coded A/PI beneficiaries were originally coded as Other/Unknown. In addition, 16.4 percent were originally coded in the EDB as White, 1.5 percent as Black, and 0.2 percent as AI/AN. Note that we did not recode any beneficiaries to A/PI who were originally coded as Hispanic in the EDB.

Table 14.
Distribution of "new" Asian/Pacific Islander beneficiaries (NEWRACE) according to their EDBRACE, gender, and age group

EDBRACE	White		Black		American Indian/ Alaska Native		Other or unknown		Total	
Gender and age group	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	47,654	16.4	4,328	1.5	496	0.2	238,270	82.0	290,748	100.0
Male	15,594	11.6	1,519	1.1	230	0.2	117,661	87.2	135,004	100.0
Under 65	2392	11.6	473	1.1	49	0.2	9809	87.2	12,723	100.0
65-74	7,858	9.0	770	0.9	114	0.1	78,366	90.0	87,108	100.0
75-84	4,157	15.6	226	0.8	60	0.2	22,241	83.3	26,684	100.0
85 and older	1,187	14.0	50	0.6	7	0.1	7,245	85.3	8,489	100.0
Female	32,060	20.6	2,809	1.8	266	0.2	120,609	77.4	155,744	100.0
Under 65	4,263	36.0	596	5.0	40	0.3	6,947	58.6	11,846	100.0
65-74	16,607	18.2	1,529	1.7	142	0.2	72,726	79.9	91,004	100.0
75-84	8,274	22.3	503	1.4	71	0.2	28,267	76.2	37,115	100.0
85 and older	2,916	18.5	181	1.1	13	0.1	12,669	80.3	15,779	100.0

Source: EDBRACE is from Medicare EDB from mid-2003; and NEWRACE is the result of having run the combined surname algorithm on race/ethnicity in the Medicare EDB from mid-2003.

With respect to gender and age, the A/PI recodes were very similar to the Hispanic recodes. Across original EDB race/ethnicity and age groups, with the exception of the A/PI group under 65 years of age, more females have been recoded to A/PI than males. Overall 155,744 females were recoded compared to 135,004 males. As with Hispanic beneficiaries, the group of A/PI beneficiaries 65 to 74 years of age were recoded most, while the group 85 and older was recoded least.

Overall, the combined improved naming algorithm recoded the race/ethnicity of 2,290,027 Medicare beneficiaries. Females and those 65 to 74 years of age were most often recoded to a new race/ethnicity when we used the combined improved naming algorithm on the full 10 segments of the unloaded EDB. For the new Hispanic beneficiaries, more were originally coded as White, compared to new A/PI beneficiaries who were most often originally coded as Other/Unknown. These results replicate the results we reported earlier in the comparison of the

[12] This excludes 68 beneficiaries who were originally coded as missing in the EDB but are now coded as A/PI. Beneficiaries who were already coded as A/PI in the EDB are also not included in this total.

EDB (EDBRACE), the improved naming algorithm (ALGRACE), and the self-reported race/ethnicity for the CAHPS sample (SELFRACE).

CHAPTER 4
ASSESSMENT OF BIAS IN UTILIZATION ESTIMATES

4.1 Identifying Bias in the Estimation of Utilization Rates by the Current EDB Race/Ethnicity Measure

As indicated earlier in this report, concern has been expressed about displaying Medicare claims data by specific race/ethnic groups other than Black and White (Arday et al., 2000). The concern was based on the fact that the Medicare enrollment database has been shown to systematically under-identify minority group beneficiaries other than Black, potentially resulting in biased estimates of treatments, payments, and outcomes for the under-identified racial/ethnic groups. Part of this project included assessing the level of bias that might exist. To do this, we compared selected estimates derived from claims and classified according to the EBD race/ethnicity variable and CAHPS self-reported race/ethnicity for White, Black, Hispanic, A/PI, and AI/AN beneficiaries.

In this chapter of the report, we compared counts and percentages of persons using a range of treatment and preventive health services and having a variety of diagnoses. We also assessed mean amounts paid by Medicare and, where applicable, mean length of stays in the hospital. All of these measures are based on data extracted from Medicare claims. These are arrayed by race/ethnicity as recorded in the EDB and as self-reported for the 221,387 respondents to the 2000 and 2001 Medicare CAHPS Fee-for-Service survey.[13] The combination of 2000 and 2001 CAHPS MFFS data will provide sufficient sample size by racial/ethnic groups to estimate the potential bias of utilization rate for a variety of services and diagnoses. Table 15 presents the frequency distribution by race/ethnicity for each year and for each race/ethnicity variable. Since the sample sizes vary for each race, the precision of the estimates will vary; this may be a particular issue for American Indian/Alaskan Native beneficiaries, because of the very small sample identified from the EDB.

Table 15.
2000 and 2001 EDB and CAHPS MFFS sample distributions by race/ethnicity

	EDBRACE		SELFRACE	
Race/ethnicity	2000	2001	2000	2001
White	92,067	105,498	87,501	98,107
Black	7,188	8,510	6,590	7,410
Hispanic	1,641	1,429	4,513	4,308
A/PI	969	1,036	1,380	1,438
AI/AN	177	197	526	596
Other	970	1,166	1,799	5,061

Source: SELFRACE is from respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys and EDBRACE is from the Medicare EDB.

[13] At the time these tabulations were made, we were limited to using only the 2000 and 2001 Medicare CAHPS Fee-for-Service surveys because claims were not yet available for later years.

Note that the focus in this chapter is not on the values of the counts, percentages, or means themselves, but rather on the extent to which these numbers differ depending on whether the race/ethnicity code came from the EDB or was self-reported in the CAHPS survey. Our objective is to indicate for each racial/ethnic group whether the distribution of services used according to the EDB race/ethnicity variable overstates or understates the number and proportion of beneficiaries using the service, the average length of stay, and the average cost to Medicare of the service relative to the measures for CAHPS self-reported race/ethnicity. For our purposes, the CAHPS race/ethnicity represents the gold standard (true race/ethnicity).

To make it obvious when there is a difference in service utilization between the two sources of race/ethnicity, we computed ratios by dividing the count, percentage, or mean for a value based on the CAHPS race/ethnicity self-report by the equivalent count, percentage, or mean value based on the EDB race/ethnicity code. When the two values are exactly the same, the computed ratio of 1.00 and values very close to 1.00 indicate that classification using the two sources of race/ethnicity give the same or a very similar resultant value for a measure. As you would expect, this rarely ever occurs for the counts, but often occurs for the percentages and mean expenditures for some utilization measures and some racial/ethnic groups (Whites and Blacks particularly). If the ratio is greater than one, then the use of the self-reported race/ethnicity from the CAHPS surveys increases the count, percentage, or mean, and using the EDB race/ethnicity variable understates it. If the ratio is less than 1.00, then the use of the self-reported race from the CAHPS survey reduces the count, percentage, or mean and using the EDB race overstates it.

We have examined the differences in utilization by the source of the race/ethnicity code (either EDB or self-reported) for the same persons' use of a variety of health care services. In particular, these include the following: (1) cancer screening services, (2) secondary preventive care services for persons with diabetes, (3) hospital or emergency department services for ambulatory care-sensitive conditions, (4) services of different types, and (5) hospital services for a variety of common chronic illness diagnoses. While we will discuss changes that occur on a racial/ethnic group basis for each of these, we will not address changes in the group identified as Other and Unreported, which result largely from missing data or multiple race codes in the CAHPS data.

Before assessing the bias resulting from the tabulation of health services utilization according to EDB race/ethnicity, we calculated a Diagnostic Cost Group Hierarchical Condition Category (DCG-HCC) risk score (Pope, Ellis, Ash, et al., 2000) for each of the 221,387 Medicare Fee-for-Service CAHPS sample respondents for 2000 and 2001. The DCG-HCC risk score is created from diagnoses associated with utilization of inpatient, outpatient, physician, and other clinically trained non-physician services during the previous 12 months along with demographic information. It is used to predict Medicare expenditures for the next 12 months. By dividing the expenditures associated with the past year's diagnosis by the average expenditure for Medicare beneficiaries, a risk score is created in which 1.00 represents the average. Higher scores represent higher expenditures (presumably due to poorer health) while scores below 1.00 represent lower than average expenditures (and presumably better health). Because it is correlated with commonly used health status measures, the DCG-HCC has been used as an indicator of health status.

We calculated the DCG-HCC risk score to investigate whether the health status of the race/ethnicity groups differ by whether they are categorized according to EDB or CAHPS self-reported race/ethnicity. The mean DCG-HCC risk scores are presented by the EDB and CAHPS self-reported race measures in Table 16. With the exception of beneficiaries of A/PI origin, the minority groups have higher risk scores than White beneficiaries, indicating that more was spent on their health in the previous year and suggesting that their health status was not as good as the White beneficiaries. However, when the same beneficiaries are distributed according to the CAHPS self-reported race/ethnicity measure, the mean risk scores of all but the Black beneficiaries decline. This gives the appearance of improved health status for White and minority group beneficiaries other than Black. We know from our earlier analysis comparing EDBRACE to SELFRACE that beneficiaries are reassigned race/ethnicity codes from being mistakenly coded as being White, Black, and Other into the Hispanic, A/PI, or AI/AN categories by using self-reported race/ethnicity. It suggests, therefore, that the beneficiaries who move from the White category are not as healthy as the White beneficiaries who remain, and that the beneficiaries added to the Hispanic, A/PI, and AI/AN categories are healthier than those who were already in that race/ethnicity category. These same conclusions are reflected in the mean ratios of the DCG-HCC means scores for the two race/ethnicity measures.

Table 16.
Mean DCG HCC Risk score (1.00 = average risk) of 2000 and 2001 Medicare CAHPS fee-for-service respondents by EDBRACE and SELFRACE

Race/ethnicity	Risk score by EDBRACE	Risk score by SELFRACE	Ratio* of risk scores
Total	0.92	0.92	1.00
White	0.92	0.91	0.99
Black	1.01	1.01	1.00
Hispanic	1.02	0.96	0.95
A/PI	0.90	0.83	0.92
AI/AN	1.06	0.99	0.93
Other/unreported	0.87	0.99	1.14

* Ratio = risk score according to SELFRACE/risk score according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

4.2 Use of Cancer Screening Services

We have prepared five tables related to cancer screening services for the previous 12 months. These tables include tabular comparisons of the distributions of screening services for several cancers based on claims separately by gender and using both the race/ethnicity coded in the EDB (EDBRACE) and as self-reported by Medicare FFS CAHPS respondents (SELFRACE). Three of the tables are specific to women and compare claims for mammograms (breast cancer screening), pap smears (cervical cancer screening), and screening for colorectal cancer. The remaining two tables are for men and they compare claims for screening for colorectal cancer and use of PSA tests for prostate cancer screening.

From Table 17, it is clear that when self-reported race rather than EDB race is used to report the number of White women receiving a mammogram during the previous year, the count drops by four percent (from 41,619 to 39,803). The number of Black women receiving a mammogram in the year drops by an even greater 11 percent (from 2,589 to 2,304). On the other hand, there are rather large increases in the number of Hispanic (from 364 to 1,199, or 229 percent), Asian/Pacific Islander (from 265 to 395, or 49 percent), and American Indian/Alaska Native (from 38 to 125, or 229 percent) women with claims indicating they received a mammogram during the year. These shifts in the numbers of female FFS Medicare beneficiaries with mammograms are reflected in the ratio of the two numbers for the two race/ethnicity counts (column 6 of the table).

Table 17.
Number, percentage, and ratio of female Medicare beneficiaries with claims for mammography in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	41,619	37.4	39,803	38.0	0.96	1.02
Black	2,589	26.9	2,304	26.8	0.89	1.00
Hispanic	364	22.1	1,199	24.6	3.29	1.12
A/PI	265	24.2	395	25.6	1.49	1.06
AI/AN	38	19.9	125	21.2	3.29	1.07
Other/unreported	284	24.9	1,333	28.0	4.69	1.12

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

We also examined changes in the proportion of women obtaining mammograms in the previous year, as represented by the percentage of women using the service in each racial/ethnic group in Table 17. Despite having fewer women with claims for mammograms, the proportion of use for White women increased slightly (by two percent) when self–reported race rather than EDB race is used to classify the women. For Black women there was virtually no difference (less than one-half of a percent) in the proportion using the service, despite a rather large decrease (11 percent) in the number of women with claims for mammograms. In addition to a rather large increase in the number of Hispanic women with claims for mammography, there was a substantial increase (12 percent) in the proportion of them using the service as well. The finding of an increased proportion of women getting mammograms was also true for women who self-reported being of A/PI and AI/AN origins (6 and seven percent higher, respectively).

Based on the data in Table 17, we have concluded that when classifying women according to their self-reported race/ethnicity rather than the EDB race/ethnicity, the number of women with claims for mammograms decreased for White and Black beneficiaries, but increased for those who are Hispanic, A/PI, and AI/AN. However, the amount of mammography use for the reclassified women moving out of the White category was not as high as the White women retained in the category, thus the proportion of White women getting mammograms increased slightly, despite the "loss" of women. On the other hand, the Black women who moved out of the category must have had an approximately similar proportion obtaining mammography as those who remained in the Black category, and thus there was no change in the proportion of Black beneficiaries receiving mammograms. Among the Hispanic, A/PI, and AI/AN beneficiaries, however, the proportions getting mammograms were higher among the women moving into those groups than they were among the women already in the groups, thus there was an increase in proportion getting mammograms for those categories.

The situation is not dissimilar in Table 18 with respect to women for whom Medicare claims indicated receipt of a pap smear during the year. The number of White and Black women with claims for pap smears declined with the switch from an EDB-based race code to a self-reported race classification. On the other hand, the number of Hispanic, A/PI, and AI/AN women receiving a pap smear increased considerably. Despite the loss of women receiving pap smears who were incorrectly coded as White, the proportion of White women getting a pap smear actually increased slightly. The Black category also lost women who were incorrectly classified but the proportion having pap smears did not change for Black women. When Hispanic, A/PI, and AI/AN women were categorized by self-reported race, the proportion obtaining pap smears increased substantially.

Table 18.
Number, percentage, and ratio of female Medicare beneficiaries with claims for pap smears in the previous 12 months by EDBRACE and SELFRACE

	EDRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	38,009	34.1	36,355	34.7	0.96	1.02
Black	2,472	25.7	2,205	25.6	0.89	1.00
Hispanic	364	22.1	1,129	23.2	3.10	1.05
A/PI	261	23.9	387	25.1	1.48	1.05
AI/AN	34	17.8	125	21.2	3.68	1.19
Other/unreported	278	24.3	1,217	25.6	4.38	1.05

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Similar to mammograms and pap smears, Table 19 shows that the number of White and Black women with claims for colorectal cancer screening during the year decreased when self-reported race/ethnicity codes were used in place of the EDB race/ethnicity codes. The opposite occurred for Hispanic, A/PI, and AI/AN women. The number of beneficiaries with claims for colorectal cancer screening increased. Similar to the situation for mammograms and pap smears, the proportion of White, Hispanic, A/PI, and AI/AN women having claims for colorectal screening increased. However, unlike the use of services in the preceding tables, the proportion of Black women actually decreased.

Table 19.
Number, percentage, and ratio of female Medicare beneficiaries with claims for colorectal cancer screening in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	18,166	16.3	17,446	16.7	0.96	1.02
Black	1,026	10.7	902	10.5	0.88	0.98
Hispanic	127	7.7	455	9.4	3.58	1.22
A/PI	152	13.9	222	14.4	1.46	1.04
AI/AN	8	4.2	39	6.6	4.88	1.58
Other/unreported	134	11.8	549	11.6	4.10	0.98

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Tables 20 and 21 compare screening for colorectal cancer[14] and PSA testing for men, respectively. The number of beneficiaries with claims for these screening procedures across the race/ethnicity codes for men followed the same general pattern as shown for women. The number of White and Black beneficiaries with claims decreased when self-reported race/ ethnicity was used in place of the EDB race/ethnicity, while the number of Hispanic, A/PI, and AI/AN beneficiaries with these claims increased. The proportion of White, Black, and AI/AN men stayed about the same for both colorectal cancer screening and PSA tests. However, the proportion of Hispanic men actually having the test decreased, while for A/PI men the proportion was relatively unchanged.

Table 20.
Number, percentage, and ratio of male Medicare beneficiaries with claims for colorectal cancer screening in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	14,136	16.3	13,551	16.7	0.96	1.02
Black	562	9.2	499	9.2	0.89	1.00
Hispanic	128	9.0	351	8.8	2.74	0.98
A/PI	118	12.9	163	12.7	1.38	0.99
AI/AN	8	4.4	33	6.1	4.13	1.40
Other/unreported	115	11.6	470	12.7	4.09	1.09

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

[14] Colon cancer screening procedures in the comparison include: fecal occult blood test (FOBT) or fecal immunochemical test (FIT); flexible sigmoidoscopy; double-contrast barium enema; and colonoscopy.

Table 21.
Number, percentage, and ratio of male Medicare beneficiaries with claims for a PSA test in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	33,476	38.6	31,882	39.2	0.95	1.01
Black	1,462	23.9	1,308	24.1	0.89	1.01
Hispanic	420	29.5	1,111	28.0	2.65	0.95
A/PI	237	25.9	336	26.1	1.42	1.01
AI/AN	20	10.9	98	18.2	4.90	1.67
Other/unreported	238	23.7	1,118	30.0	4.70	1.26

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

The ratios for the number of beneficiaries with claims for these cancer detection procedures and the proportion of beneficiaries with such claims, respectively, across the five previous tables are summarized in Tables 22 and 23. The ratios for the five different service use measures are listed along with the mean of the five ratios in the last column. Across the board, the number of White and Black beneficiaries (women and men) obtaining cancer screening procedures decreased on average by four and 11 percent, respectively, when self-reported race/ethnicity was used instead of EDB race/ethnicity. The opposite occurred for Hispanic, A/PI, and AI/AN beneficiaries, and the numbers increased on average by 207, 45, and 318 percent, respectively. This is not surprising because, as we have demonstrated earlier in this report, proportionally speaking, Hispanic, A/PI, and AI/AN beneficiaries are more often misidentified in the EDB race/ethnicity code. We would expect that as more minority beneficiaries are correctly identified and coded, the number with claims for these cancer screening services could increase as well.

Table 22.
Ratios of number of Medicare beneficiaries with selected cancer screening claims in the previous 12 months by race/ethnicity

Race/ethnicity	Mammogram	Pap smear	Colorectal screening (female)	Colorectal screening (male)	PSA	Mean ratio*
White	0.96	0.96	0.96	0.96	0.95	0.96
Black	0.89	0.89	0.88	0.89	0.89	0.89
Hispanic	3.29	3.10	3.58	2.74	2.65	3.07
A/PI	1.49	1.48	1.46	1.38	1.42	1.45
AI/AN	3.29	3.68	4.88	4.13	4.90	4.18
Other/unreported	4.69	4.38	4.10	4.09	4.70	4.39

* Ratio = number of persons according to SELFRACE/number of persons according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table 23.
Ratios of percentage of Medicare beneficiaries with selected cancer screening claims in the previous 12 months by race/ethnicity

Race/ethnicity	Mammogram	Pap smear	Colorectal screening (female)	Colorectal screening (male)	PSA	Mean ratio*
White	1.02	1.02	1.02	1.02	1.01	1.02
Black	1.00	1.00	0.98	1.00	1.01	1.00
Hispanic	1.12	1.05	1.22	0.98	0.95	1.06
A/PI	1.06	1.05	1.04	0.99	1.01	1.03
AI/AN	1.07	1.19	1.58	1.40	1.67	1.38
Other/unreported	1.12	1.05	0.98	1.09	1.26	1.10

* Ratio = percentage of persons according to SELFRACE/percentage of persons according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

To fully understand the effects of using self-reported race/ethnicity, however, we have to consider how the proportion of beneficiaries using services change as well. With few exceptions, the proportion of White, Hispanic, A/PI, and AI/AN beneficiaries with claims for these screening services increased —on average by two, six, three, and 38 percent, respectively, while the proportion of Black beneficiaries with such claims remained unchanged.

4.3 Secondary Prevention Services Use and Hospitalization for Diabetes

The second area of health service utilization in which we have compared differences in claims-based Medicare utilization measures by EDB and CAHPS survey self-reported racial/ethnic group codes is for diabetes care. The comparisons we made are of services used in the prior 12 months for secondary prevention of complications from diabetes mellitus by persons identified as having diabetes[15]. These services include foot care, eye examination, blood and urine tests, and self-care education. In addition, we have compared differences in the number and proportion of beneficiaries with diabetes hospitalized with a principle diagnosis of diabetes, mean payment for the hospital stay, and mean length of stay in the hospital.

Table 24 presents the number of Medicare fee-for-service beneficiaries identified through their claims for the previous 12 months as having diabetes. The overall proportion of the sample of 221,387 with diabetes is 16.17 percent or 35,797 beneficiaries. As the table illustrates, the number of White and Black beneficiaries is greater, and the number of Hispanic, A/PI, and AI/AN beneficiaries is smaller depending on whether we use the EDB or CAHPS self-reported race/ethnicity variable to classify them. Using the CAHPS self-report of race/ethnicity for the same sample of beneficiaries reduced the number of White and Black beneficiaries with diabetes, and increased the numbers of Hispanic, A/PI, and AI/AN. The number of White beneficiaries

[15] Identification of persons with diabetes was based on a Medicare inpatient claim with a diagnosis of diabetes, or an outpatient or physician claim with a diagnosis of diabetes plus at least one acute diabetes-related procedure or two non-acute diabetes-related procedures more than seven days apart. Exact specification of procedure and diagnostic codes for this and the preventive services we examined are contained in Appendix G of the Part 2 of the Final Report for this project.

with diabetes was eight percent lower using the CAHPS self-reported race/ethnicity rather than the EDB race/ethnicity, and it was 10 percent lower for Black beneficiaries. But for Hispanic, A/PI, and AI/AN beneficiaries, there were 170, 38, and 155 percent more, respectively, who had diabetes. However, this is not surprising given that the overall number of White and Black beneficiaries declined while the number of Hispanic, A/PI, and AI/AN increased.

Table 24.
Number, percentage, and ratio of Medicare beneficiaries with diabetes diagnosis by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	30,300	15.3	27,939	15.0	0.92	0.98
Black	3,869	24.6	3,463	24.7	0.90	1.00
Hispanic	835	27.2	2,254	25.5	2.70	0.94
A/PI	316	15.7	437	15.5	1.38	0.98
AI/AN	103	27.5	263	23.3	2.55	0.85
Other/unreported	374	17.5	1,441	17.0	3.85	0.97

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Despite the sizeable increases in the number of Hispanic, A/PI, and AI/AN beneficiaries identified as having diabetes, there were reductions in the proportion of these groups identified as having diabetes, especially for AI/AN beneficiaries where the proportion was 15 percent lower. The reduction in the proportion for Hispanic and A/PI beneficiaries were much smaller (six and two percent, respectively) and there was even a two percent drop in the White proportion, but there was no change in the proportion with diabetes among Black beneficiaries. It should be noted that the proportion of White and A/PI beneficiaries with diabetes were very similar (15.30 and 15.71 percent versus 15.02 and 15.47 percent), regardless of the variable used to categorize the race/ethnicity of the beneficiary sample. For the remaining tables in this section on diabetes, the proportions presented are based on a denominator that includes only persons identified as having diabetes. In other words, the proportions reported are of beneficiaries with diabetes who had a claim for the selected service.

Table 25 presents the distributions of beneficiaries with diabetes who received foot care (claims for a podiatry visit or therapeutic shoes for diabetics) during the previous 12 months according to the EDB and CAHPS self-reported race/ethnicity. As with the cancer screening tables, the self-reported race/ethnicity lowered the number of White and Black beneficiaries with diabetes who received foot care services by eight and one percent, respectively, and increased the number of Hispanic, A/PI, and AI/AN who did by 127, 17, and 189 percent, respectively. When we used the self-reported race/ethnicity variable, for every group except AI/AN, the proportion receiving foot care declined. It declined slightly for White and Black (one percent), and considerably for Hispanic and A/PI (16 percent) beneficiaries, but the proportion of use rose by 13 percent for AI/AN.

Table 25.
Number, percentage, and ratio of Medicare beneficiaries with diabetes who had foot care in previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	3,107	10.25	2,848	10.19	0.92	0.99
Black	509	13.16	453	13.08	0.89	0.99
Hispanic	130	15.57	295	13.09	2.27	0.84
A/PI	12	3.80	14	3.20	1.17	0.84
AI/AN	9	8.74	26	9.89	2.89	1.13
Other/unreported	29	7.75	160	11.10	5.52	1.43

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

We looked at the number and proportion of diabetics having an eye exam in the past 12 months in Table 26. The pattern is very much the same as with diabetics' receipt of foot care services. The number of White and Black beneficiaries having an eye exam declined by seven and 10 percent, respectively, and the number of Hispanic, A/PI, and AI/AN having an eye exam increased by 153, 39, and 191 percent, respectively, when we shifted from the EDB to the CAHPS self-report of race/ethnicity variable. The proportion having an eye exam increased for all groups but the Hispanic. The percentage of Hispanic beneficiaries receiving an eye exam dropped by six percent when the self-reported rather than the EDB race/ethnicity variable was used. While the proportion of White, Black, and A/PI beneficiaries receiving an eye exam increased only slightly (one percent), the increase in the proportion of AI/AN beneficiaries receiving an eye exam was fairly large (14 percent).

Table 26.
Number, percentage, and ratio of Medicare beneficiaries with diabetes who had an eye exam in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	17,768	58.6	16,533	59.2	0.93	1.01
Black	1, 964	50.8	1,776	51.3	0.90	1.01
Hispanic	437	52.3	1,108	49.2	2.53	0.94
A/PI	177	56.0	247	56.5	1.39	1.01
AI/AN	33	32.0	96	36.5	2.91	1.14
Other/unreported	184	49.2	803	55.7	4.36	1.13

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

A third service we examined was receipt in the past 12 months of any of the following tests that we refer to as physiological measures in Table 27: an HbA1c blood test (glycosolated hemoglobin) to monitor diabetes control; a lipid profile or three individual blood tests to measure total cholesterol, high-density lipoproteins, and triglycerides; or measurement of microalbumin in the urine. These were the services most often received by diabetics, regardless of race/ethnicity. As with the other diabetes services, the number of White and Black beneficiaries with diabetes who had claims for these services declined (by seven and 11 percent, respectively), while the number of Hispanic, A/PI, and AI/AN beneficiaries getting these services increased (by 169, 40, and 242 percent, respectively), when we shifted from EDB-based to CAHPS self-reported race/ethnicity. Changes in the proportion using these services were small (one percent or less), however, with the exception of AI/AN beneficiaries for whom there was a 34 percent increase in the proportion using these tests.

Table 27.
Number, percentage, and ratio of Medicare beneficiaries with diabetes who had selected physiological measures taken in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	24,934	82.3	23,158	82.9	0.93	1.01
Black	2,844	73.5	2,540	73.4	0.89	1.00
Hispanic	598	71.6	1,607	71.3	2.69	1.00
A/PI	255	80.7	356	81.5	1.40	1.01
AI/AN	43	41.8	147	55.6	3.42	1.34
Other/unreported	276	73.8	1,142	79.3	4.14	1.07

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

The final secondary preventive service whose use we examined in Table 28 was receipt of self-care services or supplies (glucose testing or supplies or monitor for glucose testing) or diabetes education. Consistent with the other diabetes services, the change in the source of the race/ethnicity code caused the number of White and Black beneficiaries receiving the service to decline (by seven and nine percent, respectively) but the number of Hispanic, A/PI, and AI/AN beneficiaries getting the service to increase (by 161, 39, and 328 percent, respectively). The changes in the proportions using the services were fairly small (one to three percent) with the exception of AI/AN beneficiaries whose utilization of these services increased by 68 percent.

Table 28.
Number, percentage, and ratio of Medicare beneficiaries with diabetes who had self-care training or diabetes education in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	12,550	41.4	11,646	41.7	0.93	1.01
Black	1,671	43.2	1,515	43.8	0.91	1.01
Hispanic	310	37.1	599	35.9	2.61	0.97
A/PI	93	29.4	129	29.5	1.39	1.00
AI/AN	18	17.5	77	29.3	4.28	1.68
Other/unreported	116	31.0	583	40.5	5.03	1.30

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Tables 29 and 30 summarize the ratios for the number and proportion of beneficiaries with claims for diabetic services, respectively. Ratios for the four different services are listed with the mean of the ratios in the last column. As Table 29 shows, similar to beneficiaries using cancer screening services, the number of White and Black beneficiaries with diabetes having claims for diabetes services decreased on average by seven and 10 percent, respectively, when self-reported race/ethnicity codes were used instead of EDB-based race/ethnicity codes. On the other hand, the number for Hispanic, A/PI, and AI/AN beneficiaries using those services increased, on average by 153, 34, and 238 percent, respectively.

Table 29.
Ratios of number of Medicare beneficiaries with diabetes who used selected diabetic services by race/ethnicity

Race/ethnicity	Foot care	Eye exam	Physiological measures	Self-care and education	Mean ratio*
White	0.92	0.93	0.93	0.93	0.93
Black	0.89	0.90	0.89	0.91	0.90
Hispanic	2.27	2.53	2.69	2.61	2.53
A/PI	1.17	1.39	1.40	1.39	1.34
AI/AN	2.89	2.91	3.42	4.28	3.38
Other/unreported	5.52	4.36	4.14	5.03	4.76

* Ratio = number of persons according to SELFRACE/number of persons according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table 30.
Ratios of percentage of Medicare beneficiaries with diabetes who used selected diabetic services in the previous 12 months by race/ethnicity

Race/ethnicity	Foot care	Eye exam	Physiological measures	Self-care and education	Mean ratio*
White	0.99	1.01	1.01	1.01	1.01
Black	0.99	1.01	1.00	1.01	1.00
Hispanic	0.84	0.94	1.00	0.97	0.94
A/PI	0.84	1.01	1.01	1.00	0.97
AI/AN	1.13	1.14	1.34	1.68	1.32
Other/unreported	1.43	1.13	1.07	1.30	1.23

* Ratio = proportion of persons according to SELFRACE/proportion of persons according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

As can be seen in Table 30, the proportion of White and Black beneficiaries with diabetes having used such services, however, changed only one percent or less when comparing the EDB race/ethnicity and self-reported race/ethnicity. The proportion of Hispanic beneficiaries using these services decreased on average by six percent and the proportion of persons of A/PI origin who used them fell by three percent. AI/AN beneficiaries are the only minority group in which the proportion having used diabetes services increased, by 32 percent on average.

In addition to the use of preventive services by beneficiaries with diabetes, we examined the number, percentage, mean payment, and mean length of stay for diabetic Medicare beneficiaries hospitalized with a discharge diagnosis of diabetes during the year. The number and proportion data on beneficiaries with diabetes who were hospitalized with a diabetes discharge diagnosis are presented in Table 31. We suggest caution in interpreting the numbers because there are so few minority beneficiaries with hospitalizations having a discharge diagnosis of diabetes. Nonetheless, the numbers of beneficiaries seemed to follow the same pattern as with the preventive services when we changed from the EDB to the CAHPS self-reported race/ethnicity measure. The number of White and Black beneficiaries with diabetes hospitalized with a diabetes diagnosis declined by eight and 11 percent, respectively. However, the number of Hispanic and AI/AN beneficiaries increased by 125 and 60 percent, respectively, while the number of A/PI with a hospitalization with a discharge diagnosis of diabetes remained unchanged. The proportion of White and Black beneficiaries with diabetes who were hospitalized with a diagnosis of diabetes remained about the same, but it decreased considerably for Hispanic, A/PI, and AI/AN beneficiaries—by 17, 28, and 37 percent, respectively.

Table 31.
Number, percentage, and ratio of Medicare beneficiaries with diabetes who had a hospital discharge with a principle diagnosis of diabetes in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	454	1.5	417	1.5	0.92	1.00
Black	125	3.2	111	3.2	0.89	0.99
Hispanic	20	2.4	45	2.0	2.25	0.83
A/PI	7	2.2	7	1.6	1.00	0.72
AI/AN	5	4.9	8	3.0	1.60	0.63
Other/unreported	6	1.6	29	2.0	4.83	1.25

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table 32 shows that the mean payment amount in dollars and mean length of stay in days for hospitalizations with discharge diagnoses of diabetes both increased slightly for White and Black beneficiaries (one or two percent) and by five percent for the A/PI category when the CAHPS self-reported race/ethnicity measure was used. On the other hand, the mean payment and mean length of stay for hospitalized AI/AN beneficiaries with diabetes dropped by three and 26 percent, respectively. Curiously, the pattern was broken by Hispanic beneficiaries with diabetes for whom the mean payment decreased by 19 percent when switching from EDB to CAHPS self-reported race/ethnicity, while the mean length of stay increased by 19 percent.

Table 32.
Mean payment per discharge, mean length of stay in days, and ratio of Medicare beneficiaries with diabetes who had a hospital discharge with a principle diagnosis of diabetes in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Payment per discharge	Length of stay in days	Payment per discharge	Length of stay in days	Payments per discharge	Lengths of stay in days
White	$7,395.98	15.79	$7,529.26	16.17	1.02	1.02
Black	7,709.70	8.90	7,765.87	8.97	1.01	1.01
Hispanic	8,638.80	13.25	7,016.04	15.80	0.81	1.19
A/PI	7,760.57	5.43	8,129.71	5.71	1.05	1.05
AI/AN	8,766.40	24.00	8,470.75	17.88	0.97	0.74
Other/unreported	16,240.00	18.83	8,543.10	6.41	0.53	0.34

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

4.4 Hospital and Emergency Room Admissions for Selected Ambulatory Care-Sensitive Conditions (ACSCs)

We also compared the number and percent of beneficiaries who were admitted to a hospital or observed in an emergency room for a set of 15 ambulatory care-sensitive conditions (ACSCs) by EDB and self-reported race/ethnicity. ACSCs are often seen as reflecting either poor access to or quality of primary medical care (Bindman, Grumbach, Osmond, et al., 1995). If treated appropriately on an outpatient basis (i.e., on a timely basis with effective interventions), it has been asserted that most beneficiaries with these conditions can successfully avoid or reduce the need to be hospitalized. The 15 ACSCs we examined included five chronic conditions (chronic lung disease [asthma and chronic obstructive pulmonary disease combined]; congestive heart failure, seizures, diabetes mellitus, and hypertension); eight acute conditions (cellulitis, dehydration, bacterial pneumonia, urinary tract infection; gastric or duodenal ulcer, hypoglycemia, hypokalemia, and ear, nose and throat infections); and two preventable conditions (influenza and malnutrition) (McCall, Harlow and Dayhoff, 2001).

Because of the small frequencies associated with the ACSCs in some of the racial/ethnic groups, we have reported on the numbers and proportions of beneficiaries with these conditions grouped into logical categories: whether there were any ACSCs, any chronic ACSCs, any acute ACSCs, any preventable ACSCs, and any ACSCs for which beneficiaries were held for observation in an emergency room but not hospitalized. Tables presenting combined hospital and emergency room admissions for each of the 15 individual ACSCs are presented in Appendix C.

The distribution of the number and percentage of beneficiaries with hospital or emergency room admissions having a diagnosis of any ACSC according to EDB and CAHPS self-reported race/ethnicity are found in Table 33. The number of beneficiaries with an ACSC when EDB race/ethnicity is compared to the self-reported race/ethnicity decreased for White and Black beneficiaries by seven and nine percent, respectively. In contrast, the number of Hispanic, A/PI, and AI/AN beneficiaries with ACSCs increased by 165, 25, and 214 percent, respectively.

Table 33.
Number, percentage, and ratio of Medicare beneficiaries with hospital or emergency room admission for a diagnosis of an ambulatory care-sensitive condition in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	14,139	7.1	13,181	7.0	0.93	0.99
Black	1,684	10.7	1,581	10.9	0.91	1.02
Hispanic	279	9.1	738	8.4	2.65	0.92
A/PI	87	4.3	109	3.9	1.25	0.89
AI/AN	36	9.6	113	10.0	3.14	1.04
Other/unreported	130	6.1	683	8.0	5.25	1.32

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Although the number of beneficiaries with an ACSC changed dramatically, the proportion with an ACSC remained fairly stable for White, Black, and AI/AN beneficiaries, dropping or rising by one to four percent. The proportion of Hispanic and A/PI beneficiaries with an ACSC, however, declined considerably, by eight and 11 percent, respectively.

Table 34 presents the distributions for beneficiaries with hospital or emergency room admissions for the five chronic disease ACSC diagnoses combined by race/ethnicity. The comparisons between EDB and self-reported race/ethnicity are very similar to those for any ACSC presented in Table 33 and discussed above. The number of beneficiaries admitted for chronic disease ACSCs, when self-reported race/ethnicity was used instead of EDB race, decreased for Black and White beneficiaries, by 10 and seven percent, respectively, and increased for Hispanic, A/PI, and AI/AN beneficiaries, by 186, 35, and 215 percent, respectively.

Table 34.
Number, percentage, and ratio of Medicare beneficiaries with hospital or emergency room admission for a diagnosis of a chronic ambulatory care-sensitive condition in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	7,025	3.6	6,501	3.5	0.93	0.99
Black	960	6.1	868	6.2	0.90	1.01
Hispanic	139	4.5	397	4.5	2.86	0.99
A/PI	40	2.0	54	1.9	1.35	0.96
AI/AN	20	5.4	63	5.6	3.15	1.05
Other/unreported	69	3.2	370	4.4	5.36	1.35

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

The proportion of White, Black, and Hispanic Medicare beneficiaries with a chronic disease ACSC, when we changed the race/ethnicity measure from EDB to CAHPS self-report, was barely affected. The proportion of White and Hispanic beneficiaries dropped by one percent, while the proportion of Black beneficiaries with an admission for a chronic disease ACSC increased by one percent. However, the proportion with a chronic disease ACSC decreased by six percent among A/PI beneficiaries, but increased by five percent for those who were AI/AN.

Distributions for the eight acute-disease ambulatory care-sensitive conditions combined are presented in Table 35 according to the two race/ethnicity measures. The number of Whites and Black beneficiaries dropped by six and nine percent, respectively, when self-reported race/ethnicity was used instead of EDB race. However, the number of beneficiaries who were Hispanic, A/PI, and AI/AN increased by 146, 15, and 181 percent, respectively.

Table 35.
Number, percentage, and ratio of Medicare beneficiaries with hospital or emergency room admission for a diagnosis of an acute ambulatory care-sensitive condition in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	7,119	3.6	6,673	3.6	0.94	1.00
Black	663	4.2	604	4.3	0.91	1.02
Hispanic	133	4.3	327	3.7	2.46	0.85
A/PI	47	2.3	54	1.9	1.15	0.82
AI/AN	21	5.6	59	5.2	2.81	0.93
Other/unreported	57	2.7	323	3.8	5.67	1.43

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to 2000 and 2001 Medicare fee-for-service CAHPS survey.

There was no difference in the proportion of beneficiaries with an acute-disease ASCS for White beneficiaries, and the proportion of Black with an acute-disease ACSC rose only two percent. The proportion of Hispanic, A/PI, and AI/AN beneficiaries with an acute-disease ACSC, however were considerably lower, by 15, 18, and seven percent, respectively.

Table 36 presents the numbers and percents for beneficiaries with a hospital or emergency room stay with a diagnosis of either or both of the two preventable ACSCs (influenza and malnutrition). The analysis of these ACSCs for the minorities is based on such small frequencies that they do not allow us to draw any reliable conclusions.

Table 36.
Number, percentage, and ratio of Medicare beneficiaries with hospital or emergency room admission for a diagnosis of a preventable ambulatory care-sensitive condition in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	151	0.1	139	0.1	0.92	0.98
Black	24	0.2	23	0.2	0.96	1.08
Hispanic	2	0.1	6	0.1	3.00	1.04
A/PI	1	0.1	4	0.1	4.00	2.85
AI/AN	0	0.0	2	0.2	.	.
Other/unreported	4	0.2	8	0.1	2.00	0.50

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to 2000 and 2001 Medicare fee-for-service CAHPS survey.

The patterns of change in the number and proportion for chronic and acute ACSCs, when we switched from using the EDB race/ethnicity measure to the CAHPS self-reported race/ethnicity measure were somewhat different. The numbers went down for White and Black beneficiaries, but up for those who were Hispanic, A/PI, and AI/AN. For the proportions with chronic and acute ACSCs, however, the pattern of changes was more complex. The proportion for White and Black beneficiaries did not change very much for chronic- or acute-disease ACSCs. The proportion of those who were Hispanic with chronic ACSCs decreased only slightly, but the proportion with acute ACSCs dropped considerably. For A/PI beneficiaries, the proportion with admissions for ACSCs fell quite a bit for both, but more for acute than for chronic ACSCs. The situation for AI/AN beneficiaries was mixed in that the proportion with chronic ACSCs increased considerably while the proportion with acute ACSCs decreased considerably.

4.5 Use of Different Types of Health Services

We also compared the combined and individual distributions of six different types of Medicare services for the 2000 and 2001 Medicare CAHPS Fee-for-Service respondents by race/ethnicity. We examined differences in the number, proportion, and mean payments on Medicare claims for beneficiaries categorized by the EDB and CAHPS self-reported race/ethnicity measures. As before, we also created ratios of the amount for SELFRACE divided by the amount for EDBRACE to quantitatively report on the differences between the two measures of race/ethnicity. The six types of health services we included are: overnight hospital stays, physician office and outpatient visits, nursing home stays, home health services, durable medical equipment, and emergency department visits.

In Table 37, we present the distribution of the number and proportion of Medicare beneficiaries using any of the six Medicare services and the mean dollars paid for these services, by both measures of race/ethnicity. In addition, we present the ratios for the number and proportion of beneficiaries using, and the mean dollars paid. Using the CAHPS self-reported race/ethnicity rather than the EDB measure reduced the number of White beneficiaries using any service by six percent and the number of Black by 11 percent. It also increased the number of

Hispanic, A/PI, and AI/AN beneficiaries using any of these six types of services by 186, 43, and 212 percent, respectively.

Table 37.
Number, percentage, mean payment in dollars, and ratio of Medicare beneficiaries for the sum of selected services billed to Medicare in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE			SELFRACE			Ratio*		
Race/ethnicity	Number	Percent	Mean payment	Number	Percent	Mean payment	Numbers	Percents	Mean payments
White	155,904	78.72	$3,248.64	147,264	79.14	$3,234.16	0.94	1.01	1.00
Black	11,146	70.83	4,427.69	9,953	70.94	4,416.11	0.89	1.00	1.00
Hispanic	2,125	69.15	3,962.14	6,078	68.76	3,560.22	2.86	0.99	0.90
A/PI	1,109	55.15	3,487.20	1,587	56.20	2,733.96	1.43	1.02	0.78
AI/AN	257	68.72	5,076.20	802	71.16	4,725.24	3.12	1.04	0.93
Other/unreported	1,328	62.11	3,266.36	6,185	72.84	3,841.62	4.66	1.17	1.18

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

While there were major shifts in the number of minority group beneficiaries using the services, the proportion of each race using any of the six services changed far less when using the CAHPS self-reported race/ethnicity rather than EDB race/ethnicity. There was no change for Black beneficiaries, but White and A/PI beneficiaries increased use by one and two percent, respectively. The proportion of beneficiaries of AI/AN origin using any of the services increased by four percent, while the proportion of Hispanic beneficiaries using these services declined slightly, by one percent.

The mean amount paid for services used by White and Black beneficiaries did not change with the race/ethnicity measures. However, there were large shifts for the other groups. The amount paid declined by 10, 22, and seven percent for Hispanic, A/PI and AI/AN beneficiaries, respectively.

Shifts in the distribution of overnight hospital stays by the two measures of race/ethnicity are presented in Table 38. The number of White and Black beneficiaries declined by six and 11 percent, respectively, but there was an increase of 174 percent in Hispanic, 17 percent in A/PI, and 195 percent in AI/AN beneficiaries. There was no difference in the proportion with a hospital stay for White and Black beneficiaries, but there was a five percent drop for Hispanic, a two percent drop for AI/AN, and a 16 percent decrease for A/PI beneficiaries. The mean amount paid did not change for White, Black, and AI/AN beneficiaries. The remaining minorities had larger decreases in the average amount that was paid for their care. The average amount paid for Hispanic beneficiaries dropped by five percent and A/PI by nine percent.

Table 38.
Number, percentage, mean payment in dollars per discharge, and ratio of Medicare beneficiaries for overnight hospital stays in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE			SELFRACE			Ratio*		
Race/ethnicity	Number	Percent	Mean payment	Number	Percent	Mean payment	Numbers	Percents	Mean payments
White	31,836	16.07	$9,492.98	29,941	16.09	$9,510.63	0.94	1.00	1.00
Black	2,694	17.12	$9,856.21	2,410	17.18	$9,810.37	0.89	1.00	1.00
Hispanic	483	15.72	$9,617.34	1,324	14.98	$9,107.85	2.74	0.95	0.95
A/PI	208	10.34	$11,114.64	244	8.64	$10,125.25	1.17	0.84	0.91
AI/AN	74	19.79	$9,798.12	218	19.34	$9,755.60	2.95	0.98	1.00
Other/unreported	252	11.79	$9,435.98	1,410	16.61	$9,769.13	5.60	1.41	1.04

* Ratio = number (percent or mean) according to SELFRACE/number (percent or mean) according to EDBRACE.

Source: Medicare claims for respondents to 2000 and 2001 Medicare fee-for-service CAHPS survey.

Table 39 presents the comparison of the two race/ethnicity variables for office and outpatient physician visits. As in the earlier tables, the number of White and Black beneficiaries with a physician visit decreased by five and 11 percent, respectively, and the number of persons with Hispanic, A/PI, and AI/AN origins with physician visits increased by 191, 47, and 264 percent, respectively. However, the proportion of each racial/ethnic group with physician visits did not change for Black beneficiaries, and increased by one percent for White and Hispanic beneficiaries. For A/PI and AI/AN beneficiaries, it increased more—by five and 21 percent. The mean payment for these services did not change for White beneficiaries, and decreased by one percent for Black. However, for Hispanic and A/PI beneficiaries, the mean amount paid for these services declined by six percent, and for AI/AN it dropped by eight percent.

Table 39.
Number, percentage, mean payment in dollars, and ratio of Medicare beneficiaries for physician visits in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE			SELFRACE			Ratio*		
Race/ethnicity	Number	Percent	Mean payment	Number	Percent	Mean payment	Numbers	Percents	Mean payments
White	145,058	73.24	$272.37	137,283	73.78	$271.39	0.95	1.01	1.00
Black	9,803	62.30	259.24	8,758	62.42	255.59	0.89	1.00	0.99
Hispanic	1,867	60.75	333.25	5,425	61.37	312.53	2.91	1.01	0.94
A/PI	1,005	49.98	326.35	1,477	52.30	306.26	1.47	1.05	0.94
AI/AN	162	43.32	241.35	589	52.26	223.03	3.64	1.21	0.92
Other/unreported	1,191	55.71	276.22	5,554	65.41	287.04	4.66	1.17	1.04

* Ratio = number (percent or mean) according to SELFRACE/number (percent or mean) according to EDBRACE.

Source: Medicare claims for respondents to 2000 and 2001 Medicare fee-for-service CAHPS survey.

Services provided to beneficiaries in a nursing home are shown in Table 40 comparing the EDB and CAHPS self-reported race/ethnicity variables. Consistent with previous services, the number of White and Black beneficiaries using nursing home services were six and 10 percent less when using self-reported race/ethnicity. The number of Hispanic, A/PI, and AI/AN beneficiaries using nursing home services, on the other hand, increased by 156, seven, and 180 percent, respectively. While two of these are large increases, the numbers involved are small and conclusions from them may be unreliable. There was also some change in the proportion of beneficiaries using nursing home services among minorities. There was no difference for White beneficiaries, and the proportion of Black using increased by one percent. The proportion of Hispanic beneficiaries using nursing home care dropped by 11 percent, A/PI by 24 percent, and AI/AN by seven percent. The mean payment for nursing home stays for White beneficiaries fell by one percent and for Black by six, but it remained the same for Hispanic. It decreased for A/PI AI/AN beneficiaries by 11 and 14 percent, respectively.

Table 40.
Number, percentage, mean payment in dollars, and ratio of Medicare beneficiaries for services provided during nursing home stays in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE			SELFRACE			Ratio*		
Race/ethnicity	Number	Percent	Mean payment	Number	Percent	Mean payment	Numbers	Percents	Mean payments
White	6,340	3.20	$4,877.54	5,963	3.20	$4,852.18	0.94	1.00	0.99
Black	386	2.45	$5,599.66	346	2.47	$5,262.20	0.90	1.01	0.94
Hispanic	64	2.08	$6,150.93	164	1.86	$6,155.54	2.56	0.89	1.00
A/PI	29	1.44	$5,663.75	31	1.10	$5,035.43	1.07	0.76	0.89
AI/AN	10	2.67	$5,112.26	28	2.48	$4,390.31	2.80	0.93	0.86
Other/unreported	46	2.15	$4,043.24	343	4.04	$5,356.47	7.46	1.88	1.32

* Ratio = number (percent or mean) according to SELFRACE/number (percent or mean) according to EDBRACE.

Source: Medicare claims for respondents to 2000 and 2001 Medicare fee-for-service CAHPS survey.

A comparison of the receipt of home health services by Medicare beneficiaries categorized by EDB and CAHPS self-reported race/ethnicity is shown in Table 41. Paralleling the other tables, the number of White and Black beneficiaries using home health services declined by six and 11 per cent when using self-reported race/ethnicity, but there was an increase in the number of Hispanic, API, and AI/AN beneficiaries, this time by 191, eight, and 514 percent. The proportion of each group using home health services did not change for White or Black beneficiaries when using self-reported race/ethnicity, and only increased by one percent for Hispanic. However, it declined by 23 percent for A/PI and increased by 104 percent for AI/AN beneficiaries. The mean payment for White beneficiaries did not change, it declined by two percent for Black, and it increased by two percent for AI/AN. Hispanic and A/PI beneficiaries both decreased, by seven and 23 percent, respectively.

Table 41.
Number, percentage, mean payment in dollars, and ratio of Medicare beneficiaries for home health services in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE			SELFRACE			Ratio*		
			Mean			Mean			Mean
Race/ethnicity	Number	Percent	payment	Number	Percent	payment	Numbers	Percents	payments
White	9,023	4.56	$2,622.55	8,451	4.54	$2,630.51	0.94	1.00	1.00
Black	892	5.67	3,420.53	798	5.69	3,335.49	0.89	1.00	0.98
Hispanic	128	4.17	3,135.06	373	4.22	2,909.06	2.91	1.01	0.93
A/PI	39	1.94	2,575.66	42	1.49	1,977.01	1.08	0.77	0.77
AI/AN	7	1.87	4,109.27	43	3.82	4,197.28	6.14	2.04	1.02
Other/unreported	66	3.09	3,443.23	448	5.28	2,748.50	6.79	1.71	0.80

*Ratio = number (percent or mean) according to SELFRACE/number (percent or mean) according to EDBRACE.

Source: Medicare claims for respondents to 2000 and 2001 Medicare fee-for-service CAHPS survey.

Table 42 contains the distribution of the use of the Medicare durable medical equipment (DME) benefit according to the EDB and CAHPS self-reported race/ethnicity. The number of White and Black beneficiaries using this benefit declined by six and 11 percent when arrayed according to self-reported race. The number of Hispanic, A/PI, and AI/AN beneficiaries who received this benefit increased by 169, 24, and 232 percent, respectively. The proportion of White and Black beneficiaries receiving the service was not affected by the race/ethnicity measure used. The proportion of persons of Hispanic and A/PI origins using the DME benefit declined by six and 11 percent, respectively, but the proportion of AI/AN increased by 10 percent when the self-reported race/ethnicity measure was used. The mean payment for DME services declined slightly for White (one percent) and Black (two percent) beneficiaries when we classified beneficiaries by their self-reported rather than the EDB race/ethnicity variable. It declined further for Hispanic (13 percent) and A/PI beneficiaries (18 percent). Only for AI/AN beneficiaries did it increase—by 100 percent.

Table 42.
Number, percentage, mean payment in dollars, and ratio of Medicare beneficiaries for durable medical equipment in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE			SELFRACE			Ratio*		
			Mean			Mean			Mean
Race/ethnicity	Number	Percent	payment	Number	Percent	payment	Numbers	Percents	payments
White	32,352	16.33	$615.09	30,393	16.33	$606.87	0.94	1.00	0.99
Black	2,577	16.38	766.30	2,298	16.38	754.49	0.89	1.00	0.98
Hispanic	540	17.57	937.52	1,455	16.46	819.22	2.69	0.94	0.87
A/PI	160	7.96	547.39	199	7.05	450.83	1.24	0.89	0.82
AI/AN	53	14.17	592.86	176	15.62	1,187.76	3.32	1.10	2.00
Other/unreported	218	10.20	608.45	1,379	16.24	698.24	6.33	1.59	1.15

*Ratio = number (percent or mean) according to SELFRACE/number (percent or mean) according to EDBRACE.

Source: Medicare claims for respondents to 2000 and 2001 Medicare fee-for-service CAHPS survey.

The final type of service examined is emergency department (ED) use. The distribution of ED use by the two race measures is reported in Table 43. The number of White and Black beneficiaries using the ED was six percent and 10 percent smaller, respectively, when categorized by the CAHPS self-reported race/ethnicity variable. As in the other tables, the number of Hispanic, A/PI, and AI/AN beneficiaries using the ED increased using self-reported race/ethnicity, by 169, 19, and 221 percent, respectively. The proportion of White and Black beneficiaries using the ED is the same for both race/ethnicity measures, but not for the other minority groups. The proportion of Hispanic and A/PI beneficiaries using the ED declined by seven and 15 percent when tabulated according to the CAHPS self-reported race/ethnicity, while the proportion of AI/AN increased by six percent. Mean payments for ED services do not differ for White beneficiaries regardless of the race/ethnicity measure used, however, they decreased for Hispanic and A/PI beneficiaries by six and nine percent, respectively, and increased for Black and AI/AN beneficiaries by two and seven percent, respectively, when using the self-reported race/ethnicity variable.

Table 43.
Number, percentage, mean payment in dollars, and ratio of Medicare beneficiaries for emergency department use in the previous 12 months by EDBRACE and SELFRACE

	EDBRACE			SELFRACE			Ratio*		
Race/ethnicity	Number	Percent	Mean payment	Number	Percent	Mean payment	Numbers	Percents	Mean payments
White	37,244	18.80	$296.01	34,851	18.73	$296.03	0.94	1.00	1.00
Black	3,653	23.21	322.31	3,270	23.31	327.78	0.90	1.00	1.02
Hispanic	647	21.05	300.13	1740	19.68	281.49	2.69	0.93	0.94
A/PI	210	10.44	317.50	250	8.85	288.95	1.19	0.85	0.91
AI/AN	77	20.59	309.72	247	21.92	331.45	3.21	1.06	1.07
Other/unreported	259	12.11	277.17	1,732	20.40	303.66	6.69	1.68	1.10

*Ratio = number (percent or mean) according to SELFRACE/number (percent or mean) according to EDBRACE.

Source: Medicare claims for respondents to 2000 and 2001 Medicare fee-for-service CAHPS survey.

4.6 Hospital Services Use for Selected Chronic and Acute Disease Diagnoses

Our analysis of the difference in health services utilization between racial/ethnic groups when categorized according to self-reported and EDB race/ethnicity continues with a review of hospital care provided for selected chronic and acute conditions—heart disease, cerebrovascular disease (stroke), pneumonia, malignant neoplasms (cancers), and fractures[16]. As we have done with analyses of other health services in this chapter, we have limited our discussion to a summary of the results of our analysis. The tables that show the actual numbers, proportions, mean payments, and mean lengths of stay for both race measures for each of the conditions mentioned above are contained in Appendix D.

Table 44 summarizes differences in health services use with a set of ratios calculated for each racial/ethnic group category by dividing the number of beneficiaries hospitalized for each condition according to their self-report of race/ethnicity by the number hospitalized for that

[16] ICD 9 diagnostic codes used to define these conditions are listed in Appendix G of Part 2 of the Final Report.

condition according to their EDB race/ethnicity code. It also presents a mean ratio across all five conditions.

Table 44.
Ratio of number of Medicare beneficiaries hospitalized with selected chronic and acute diagnoses in the previous 12 months by race/ethnicity

Race/ethnicity	Heart disease	Cerebro-vascular disease	Pneumonia	Malignant neoplasms	Fractures	Mean ratio*
White	0.94	0.94	0.94	0.95	0.94	0.94
Black	0.90	0.88	0.93	0.93	0.89	0.91
Hispanic	2.56	3.19	2.87	3.11	2.48	2.84
A/PI	1.26	0.86	1.00	1.07	1.38	1.11
AI/AN	3.67	4.00	1.90	7.00	3.50	4.01
Other/unreported	6.47	6.56	4.50	4.92	7.89	6.07

* Ratio = number of persons according to SELFRACE/number of persons according to EDBRACE.

Source: Medicare claims for respondents to 2000 and 2001 Medicare fee-for-service CAHPS survey.

Caution should be used in interpreting the ratios across the five conditions for Hispanic, A/PI, and AI/AN beneficiaries because the small number of persons who were hospitalized for these conditions according to the EDB race/ethnicity variable results in some extreme ratios for relatively rare conditions and for some smaller groups. However, the ratios are still indicative of meaningful differences for the more widespread conditions and larger groups.

The average ratio for the number of White beneficiaries hospitalized declined about six percent when the self-reported race/ethnicity was used compared to use of the EDB measure. This number varied little across the five conditions. For Black beneficiaries, using self-reported race/ethnicity resulted in a 9 percent decline in number of beneficiaries hospitalized across the conditions, although there was some variation across the conditions with two of them slightly higher than that, two slightly lower, and one almost equal to the mean.

Among Hispanic beneficiaries, the average number hospitalized for the five selected conditions was 184 percent higher using the self-reported race/ethnicity than the EDB measure. There was, however, considerable variation in the ratios. Two were above the average ratio, two below it, and one almost exactly equal to it. The situation for A/PI beneficiaries was different in that the average ratio across the five conditions using the self-reported race/ethnicity was only 11 percent higher than with the EDB measure. There was again some variation across the conditions, but it was much more limited, with the ratios for three of the five conditions above one, only two below the mean. AI/AN beneficiaries had on average 301 percent more beneficiaries with hospital stays for the five conditions using the self-reported race/ethnicity variable than the EDB measure. The ratios for all five conditions were well above a ratio of one, but again there was considerable variation in the ratios across the conditions, ranging from 90 to 600 percent.

There are much smaller differences by race/ethnicity in the ratios based on the proportions of beneficiaries hospitalized for the five selected conditions presented in Table 45.

The same proportion of White beneficiaries had a hospital stay for all of the conditions regardless of the race/ethnicity measure used. The same was true for the mean ratio of Black beneficiaries, but there was some variation by condition, so looking only at the average ratio can be deceptive. The ratios for Black beneficiaries were higher than one for two conditions, lower for one, and two had ratios that were close to the mean. For Hispanic beneficiaries the variation was considerably greater, with two ratios well above one, two well below, and one equal to one and very close to the mean. The situation with respect to the ratios for persons of A/PI origins was also quite inconsistent across the conditions. The mean ratio was 21 percent lower across the conditions using the self-reported race/ethnicity. For four of the conditions the ratio was very much lower than one, while for the last it was barely below one. Despite an average ratio that was 30 percent higher using the self-reported race/ethnicity measure for AI/AN beneficiaries, there was one condition for which the ratio was considerably higher, one for which it was considerably lower, two that were lower and one that equaled the mean..

Table 45.
Ratio of percentage of Medicare beneficiaries hospitalized with selected chronic and acute diagnoses in the previous 12 months by race/ethnicity

Race/ethnicity	Heart disease	Cerebro-vascular disease	Pneumonia	Malignant neoplasms	Fractures	Mean ratio*
White	1.01	1.00	1.00	1.01	1.00	1.00
Black	1.01	0.99	1.05	1.04	1.00	1.02
Hispanic	0.89	1.11	1.00	1.08	0.86	0.99
A/PI	0.89	0.61	0.71	0.76	0.98	0.79
AI/AN	1.22	1.33	0.63	2.32	1.16	1.33
Other/unreported	1.63	1.65	1.13	1.24	1.99	1.53

* Ratio = proportion of persons according to SELFRACE/proportion of persons according to EDBRACE.

Source: Medicare claims for respondents to 2000 and 2001 Medicare fee-for-service CAHPS survey.

Table 46 contains the ratios by race/ethnicity of the mean Medicare payment in dollars for beneficiaries hospitalized for the five selected conditions. The mean payments for White beneficiaries did not differ across conditions according to how they are coded for race/ethnicity. For Black beneficiaries the differences were small and the mean ration was only one percent higher using self-reported race/ethnicity. The mean payment across conditions for Hispanic beneficiaries was four percent higher using the self-reported race/ethnicity measure, but there was considerable variation by condition, with two much higher than the average, one much lower, and the remaining two equal to or close to one. The average ratio for A/PI beneficiaries was exactly one, but for two of the conditions the ratio was higher than the overall average, for two it was considerably lower, and the fifth condition was very close to one. The situation for AI/AN beneficiaries was greatly distorted by a ratio for one condition that was greatly out of line with all of the others. For the remaining four conditions, the average ratio was 17 percent lower using the self-reported rather than the EDB race/ethnicity variable, with the ratios of two of the conditions higher and two lower.

Table 46.
Ratio of mean payment in dollars for Medicare beneficiaries hospitalized with selected chronic and acute diagnoses in the previous 12 months by race/ethnicity

Race/ethnicity	Heart disease	Cerebro-vascular disease	Pneumonia	Malignant neoplasms	Fractures	Mean ratio*
White	1.00	1.00	1.00	0.99	1.00	1.00
Black	0.99	1.02	1.02	1.00	1.00	1.01
Hispanic	1.12	0.90	1.01	1.16	1.00	1.04
A/PI	0.87	1.01	1.05	0.96	1.10	1.00
AI/AN	1.22	0.88	1.47	(56.40**)	0.56	0.83
Other/unreported	0.93	1.15	0.61	1.42	0.80	0.98

* Ratio = mean payment of persons according to SELFRACE/mean payment of persons according to EDBRACE.

** This extreme value was not included in the average ratio. It occurred because of the single AI/AN beneficiary with the diagnosis according to EDBRACE code who had an extremely low mean payment.

Source: Medicare claims for respondents to 2000 and 2001 Medicare fee-for-service CAHPS survey.

Ratios of the average length of hospital stay in days by condition are presented in Table 47. The average length of stay among White beneficiaries was about the same regardless of the race/ethnicity measure used. The average ratio for Black beneficiaries was one percent higher when the self-reported race/ethnicity measure was used and there was little variation across the conditions. There was more variation among the ratios for the other minority groups on this measure. Hispanic beneficiaries had an average ratio that was four percent higher when using the self-reported race/ethnicity variable. There were two conditions, however, whose ratios were inflating the overall Hispanic average, despite a ratio well below one of the other three conditions. The overall mean ratio for A/PI beneficiaries was 15 percent lower using the self-reported race/ethnicity variable but there was variation across the conditions. The ratios for two of the conditions were considerably lower and one was higher than the mean. The length of stay ratios were most mixed for beneficiaries who are AI/AN, likely because of their smaller number when categorized by the EDB race/ethnicity measure. The overall average length of stay was 85 percent higher when the self-reported race/ethnicity measure was used, but the ratios were considerably higher than that for two conditions and considerably lower than that for one of the others.

Table 47.
Ratio of mean length of stay in days of Medicare beneficiaries hospitalized with selected chronic and acute diagnoses in the previous 12 months by race/ethnicity

Race/ethnicity	Heart disease	Cerebro-vascular disease	Pneumonia	Malignant neoplasms	Fractures	Mean ratio*
White	1.00	0.99	1.00	0.99	1.00	1.00
Black	0.99	1.04	1.00	1.01	1.00	1.01
Hispanic	0.91	0.85	0.87	1.46	0.97	1.01
A/PI	0.80	0.88	0.86	0.79	0.93	0.85
AI/AN	1.29	2.92	1.71	2.50	0.83	1.85
Other/unreported	1.05	1.41	0.80	1.15	1.13	1.11

* Ratio = number of persons according to SELFRACE/number of persons according to EDBRACE.

Source: Medicare claims for respondents to 2000 and 2001 Medicare fee-for-service CAHPS survey.

Our conclusions from the analysis of bias in the number of Medicare beneficiaries with claims for hospitalizations during a one-year period for these five conditions is that for White and Black beneficiaries the numbers with the conditions were overstated or upwardly biased when using the EDB race/ethnicity measure, by six and nine percent, respectively. Further, while there is some variation depending on the condition in question, the numbers of Hispanic, A/PI, and AI/AN beneficiaries with claims for hospitalizations for these same five conditions were understated or downwardly biased. The bias was by only 11 percent for A/PI, but nearly 200 percent for Hispanic, and close to 300 percent for AI/AN beneficiaries.

The amount of bias was much less for all race/ethnicity categories for the proportion of beneficiaries with a hospitalization across the five conditions. There was virtually no bias for White beneficiaries, and for Black there was essentially none on average. There was much more variation among the proportion of Hispanic beneficiaries with the conditions, although there was virtually no bias on average. There was a substantial (21 percent) upward bias (overstatement) on average in the proportion with conditions for A/PI beneficiaries based on using the EDB race/ethnicity. The opposite was true for the proportion of AI/AN beneficiaries with a hospitalization for one of these conditions—a 33 percent downward bias (understatement) on average using the EDB race/ethnicity variable.

The average amount Medicare spent on beneficiaries with a hospital stay for any one of these conditions was not on average biased across the five conditions for White and Black beneficiaries, but it was biased downward by an average of four percent for Hispanic beneficiaries when using the EDB race/ethnicity measure. The payments made by Medicare for A/PI beneficiaries with hospitalizations for these conditions were unbiased on average, but exhibited considerable variation by condition. The average Medicare payment for AI/AN beneficiaries with a hospital stay for one of these conditions was on average biased upwardly by 24 percent on average but because of small numbers the estimates are unreliable.

Conclusions about the effect on average length of hospital stay for every group of beneficiaries but White were less clear and more variable. For White beneficiaries, there was practically no bias in this average when using the EDB race/ethnicity, while for Black and

Hispanic, there was upward and downward bias depending on the conditions, but on average it was relatively unbiased. There was clearly an upward bias with respect to the average length of stay in the hospital using the EDB race/ethnicity code for A/PI beneficiaries. It was the opposite for AI/AN; the average length of stay was typically understated using the EDB race/ethnicity measure by 85 percent on average, but the amount differed considerably by condition.

CHAPTER 5
ADDING GEOGRAPHIC-BASED CENSUS MEASURES OF SOCIO-ECONOMIC STATUS (SES) TO THE EDB

5.1 Introduction

This chapter of the report describes the work performed on a task that was added to this project after the project had begun. It was described as a data processing modification to the contract, the purpose of which was to obtain socioeconomic status (SES) indicators for Medicare beneficiaries' residential areas. No SES measures at the person level are currently available as part of the Medicare enrollment database (EDB). Despite the obvious limitations and errors inherent in using residential area rather than person-level measures of SES, it was the only real option available to us on this project for obtaining SES measures. Having such measures as covariates is critical to analyses of racial/ethnic disparities in health care utilization to separate the impact on access and use of socioeconomic status considerations from those effects expected to be associated primarily with race/ethnicity. The objective of this task, therefore, was to identify socioeconomic indicators available from the 2000 U.S. Census that could be linked to the residential addresses of Medicare beneficiaries listed in the mid-2003 EDB so these data could be used as covariates to control on the effects of socioeconomic status in analyses of racial/ethnic disparities, alongside the person-level variables available in the EDB.

5.2 Development of an Approach to Geocode Beneficiary Addresses to Link SES Data from the Census to the Medicare Beneficiaries in the EDB

Geocoding refers to the process of assigning a code number to each Medicare beneficiary's address that allows it to be linked to the U.S. Census data that describes characteristics of the beneficiary's place of residence. The primary reason to geocode the addresses of Medicare beneficiaries in the EDB is to enable the association of geographic-based U.S. Census measures of socioeconomic status (SES) with the beneficiaries. While U.S. Census SES measures are not individual-level measures, they can be aggregated to specified geographic units, such as the census block, block group, tract, county, or state, which are associated with every beneficiary. For example, a block group-level file containing a variable for median household income would have one record for each block group, and would contain the following fields:

- A "key" variable serving as the unique identifier for each record. This key would consist of a string of federal information processing standards (FIPS) codes identifying the state, county, census tract, and block group of each record.

- An income variable indicating the median household income (in dollars) for each block group.

The details of Census geography and related data elements are described more fully further in this chapter. Much more detailed information on Census geography can be found in the Geographic Area Reference Manual http://www.census.gov/geo/www/garm.html .

In the remainder of this chapter, we will discuss the following topics:

- Address preparation
- The GeoCode program process
- Final data file creation

5.2.1 Address Cleaning

In order to link the beneficiaries in the EDB to the Census information available for the beneficiaries' residential area, there must be something in common on both records. The U.S. Census data is identified by a federal information processing standard (FIPS) code that can identify values for areas as small as blocks and block groups for the SES data in which were interested. The beneficiary's residential area on the other hand is identified by an address. We needed some mechanism for efficiently translating the addresses in the EDB to FIPS codes that corresponded to those in the Census. We obtained a computer database product from GeoLytics Incorporated of East Brunswick, New Jersey – GeoCode program 2003 Version 1.02 – that was promoted by the manufacturer as being able to correctly assign FIPS codes to the level of Census blocks to addresses that were read into it.

Address information on Medicare beneficiaries is stored in the EDB in six address fields, each with a length of 22 characters. These address fields are generic, and labeled ADDRESS1, ADDRESS2, etc., and thus there is the potential for great variation in the type and order of information contained within the address fields. Upon examination, it appeared that the six fields were simply filled from left to right with whatever information had been collected about the beneficiary's address. The one exception was the beneficiary's zip code, which was always stored in the RESZIP field. However, the GeoLytics GeoCode program product requires that the beneficiaries' address input files be formatted in the following way:

STREET, CITY, STATE ZIP

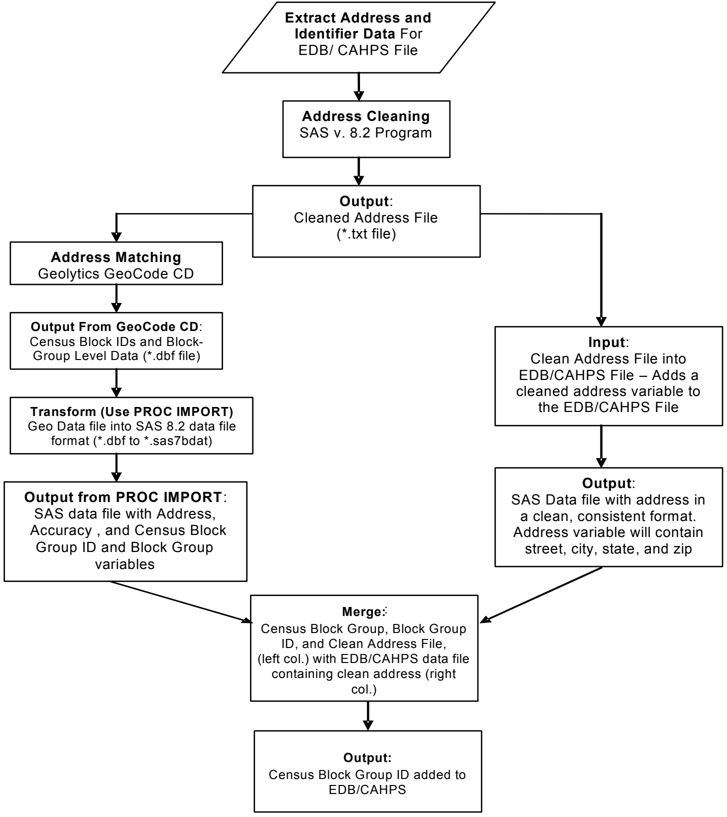
The GeoCode program requires that STREET contains the street number and street name, separated by a space, with street name followed by a comma; then city followed by a comma, and then the two-letter state postal abbreviation code, a space, and the five digit zip code. It was a challenge and extremely time-consuming to extract, validate, and format these four pieces of information from the EDB address fields so they could be used as input for the GeoCode program. To meet this challenge, we developed the following procedures to apply to the EDB records:

1. Identify, for each beneficiary, what information is contained in each EDB address field
2. Extract the necessary information from the address fields, and create separate street, city, state, and zip code variables.
3. Verify that street, city, and state variables contain the information they are supposed to, check that the information is in the correct format, and, if not, put it in the correct format.

4. Output a text file (an ASCII text file, *.txt) in the proper format required as input for the GeoCode program.
5. Run the GeoCode program
    a. Input the address text file
    b. Output
        i. a text file summarizing the results of the address matching program
        ii. a database file (*.dbf) containing block IDs, error and accuracy codes, and other information related to the matched addresses.
6. Import the database file (*.dbf) into SAS, which transforms the *.dbf file to a *.sas7bdat file.
7. Merge the full transformed address file back onto the EDB records. This step adds a US Census-based geographic identifier (a string of FIPS codes) to each person-level beneficiary record.

A summary of these steps is graphically represented below in Figure 2. This process, with these same steps, was used to Geocode the CAHPS sample test file initially and then subsequently to Geocode the 10 separate segments of the unloaded EDB. The final step in the process (not shown in the figure) allows the EDB/CAHPS files to be linked to Census data files using the block group FIPS code that is common to both.

Figure 2. Graphic Representation of the Process of Geocoding Addresses from the Medicare EDB to Enable Linking Beneficiary Records to Census Area Data


Extract Address and Identifier Data For EDB/ CAHPS File
Address Cleaning SAS v. 8.2 Program
Output: Cleaned Address File (*.txt file)
Address Matching Geolytics GeoCode CD
Output From GeoCode CD: Census Block IDs and Block-Group Level Data (*.dbf file)
Transform (Use PROC IMPORT) Geo Data file into SAS 8.2 data file format (*.dbf to *.sas7bdat)
Output from PROC IMPORT: SAS data file with Address, Accuracy , and Census Block Group ID and Block Group variables
Input: Clean Address File into EDB/CAHPS File – Adds a cleaned address variable to the EDB/CAHPS File
Output: SAS Data file with address in a clean, consistent format. Address variable will contain street, city, state, and zip
Merge: Census Block Group, Block Group ID, and Clean Address File, (left col.) with EDB/CAHPS data file containing clean address (right col.)
Output: Census Block Group ID added to EDB/CAHPS

We could not perform all of the necessary address preparation and verification activities manually on all 41 million-plus beneficiaries in the EDB because the sheer number of beneficiaries. Instead, we determined that we would use a random sample of addresses to identify patterns present in the beneficiaries' addresses in the EDB. Thus, we took a smaller batch of EDB records, specifically those EDB records corresponding to the 830,728 beneficiaries who responded to the CAHPS surveys we used earlier (to develop the algorithm to improve on the EDB race/ethnicity coding) to identify the various data patterns exhibited in the EDB address fields. We developed SAS programs to extract, format, and validate the address information we needed, and then tested the performance of the GeoCode program. The following are the steps we performed to get the addresses from the EDB in good enough shape to run through the GeoCode program.

Identify and extract the information in each address field. EDB address fields could potentially follow many different patterns, and some did contain a good deal of superfluous or invalid information. Fortunately, the majority of records did follow a standard pattern:

- ADDRESS1 contained the beneficiary's street address – both the street number and the street name. In some cases, this field also contained a direction (e.g., "East 1st Street," or "E 1st Street," or "1st Street E"), and/or an apartment number. [17]

- ADDRESS2 contained either:

    - the beneficiary's city and state of residence, or

    - the beneficiary's apartment number

- ADDRESS3, in cases where the ADDRESS2 field contained the apartment number or the like, contained the beneficiary's city and state of residence.

- The last field with non-missing data typically contained the city and state of residence. So, in most cases, address fields 4, 5, and 6 were blank; a lesser number of cases had a blank for address field 3 as well.

The SAS program we wrote set the variable STREET equal to the EDB address field that should contain the street address (typically ADDRESS1). It also extracted separate CITY and STATE variables from the EDB address field that contained the city and state.

The RESZIP field in the EDB data contains the 9-digit Zip code. The SAS program dropped the last four digits of the EDB RESZIP variable, and created a new variable with the 5-digit Zip code (ZIP).

Verify the values and formats of STREET, CITY, and STATE. The first part of this step is completed prior to running addresses through the GeoCode program search engine. To

[17] There are also several analogues to apartment number that appear in address fields, including suite number, lot number (in the case of mobile home parks), unit number, etc.

verify that STREET and STATE contain the correct data, the SAS program checked for two things:

1. That the string of characters contained in the new variable, STREET, actually started with a number. This does not provide 100 percent verification, as it is possible for the string of characters contained in the variable STREET to start with a number, but not be an actual street address. However, this step does help ensure that STREET contains a street address.
2. That the string we identified as the state of residence (the new variable, STATE) was a valid two letter state postal abbreviation.

At this point, the STATE and ZIP variables were considered finalized. The remainder of the SAS algorithm focused on cleaning the STREET variable and ensuring that it was in the proper format. Before cleaning STREET, we dropped any cases where the GeoCode program would be unable to make a match, and for which we could obtain a match simply by reformatting the data. Dropped were addresses where:

- The street address was missing
- The beneficiary's state was invalid (as indicated by an invalid two letter state postal abbreviation which was often a foreign country), or they lived in Puerto Rico[18]
- If the beneficiary's address was a rural route, an RFD, a P.O. Box, or Box number

For the remaining cases, CITY appeared to be relatively clean, and we did not attempt to reformat or validate that particular variable subsequent to dropping the cases listed above. Approximately 12.5 percent of the EDB records were dropped by this point, leaving us with about 87.5 percent of the records to which we applied further cleaning algorithms.

At this point, we began an iterative process of running small samples of the Medicare CAHPS survey addresses through the GeoCode address-matching process, identifying format-related problems in the street address field, and developing SAS code to repair the problems. Based on this testing process, we developed a series of six[19] "fixes," all of which were targeted to reformat specific anomalies that occurred regularly in the street address field. These fixes made repairs related to three basic elements of a street address that caused the address matching program to fail to find a valid match for what is a valid address:

1. Street address fields sometimes contained apartment, suite, lot, or unit numbers. While these are valid for mailing, the GeoCode program will return an error (i.e., "street not found") on an address containing one of these numbers. The first "fix" applied to the EDB address removed the apartment number (or analogue) out of the

[18] The GeoCode program does not match addresses in Puerto Rico.

[19] The "fixes" were numbered according to the order in which they were developed. However, the order in which they were applied in the SAS programs does not follow this numbering. Some fixes developed later (Fix 5, for example) had to be applied before earlier fixes.

STREET field. This fix cleared the path for the subsequent five fixes that were applied to the STREET field.

2. In cases where the street NAME was actually a number (e.g., 25th Street, 1st Avenue, etc.), the Geocode program failed to find a valid match for the street if the suffix was missing from the numbered street. The suffix was almost always missing in the EDB address fields. We tested the suffix problem manually, and found that the simple addition of a suffix could, in many cases, turn a null match into an exact match. Numerical street names appear in a variety of patterns in the STREET variable, and four out of the five remaining fixes were designed to detect these patterns, and make the appropriate changes.
3. In some records, the street address contained what appeared to be a double street number – one 2- or 3-digit number, followed by a space, then another 2- or 3-digit number. We discovered that in some places, particularly Queens, NY, the space needs to be replaced by a dash. In other places, however, it is unclear if the double number with a space is valid, or if the space should be deleted. In those cases, the double number was left as is.

For each fix, the SAS program outputs a text file listing, for each "fixed" record, the Medicare beneficiary's HIC number, the observation number, the address in it's original, "pre-fixed" format, the pattern of the new format, and the actual "fixed" address. This allowed us to check that the fix actually did what we expected it to, and it provides a record of the difference between the old addresses and the new addresses.

Output corrected addresses. The SAS program uses the PUT statement in conjunction with the FILE statement to output a single ASCII text file (*.txt) of addresses in the STREET, CITY, STATE ZIP format. This file contains all of the addresses that have been cleaned (100 percent of the records that were run through the fixes, or about 87.5 percent of the total number of beneficiary records). During testing we started with a CAHPS-matched EDB file with 830,728 records, which was reduced to 760,961 after the first stage of the SAS program was run.

5.2.2 Running the GeoCode program

In testing the GeoCode program, we discovered that the program had a tendency for erratic performance. The help staff at GeoLytics seemed unable to explain the variations in performance. The primary problem was due to a lookup error—"failure to open data member" (eFOM). Between two and six percent of addresses we tested returned this error. Upon examination, we could not find any syntax errors that prevented these records from being successfully coded, and the technical support people at GeoLytics could not explain why these errors were occurring. However, we found that when we ran the addresses receiving the eFOM error code back through the GeoCode program a second time by themselves, they were matched at a 100 percent success rate.

The GeoLytics GeoCode program product allows the user to choose a variety of options that alter the balance between completeness of address coverage and speed of processing. In order to obtain maximum coverage, and thereby match the most addresses possible, we ran the GeoCode program with the following options turned on:

- Allow phonetic match of state name
  - The geocoder phonetically matches the full state name in an address (but not an abbreviation).
- Allow place-based ZIP code match
  - If a street is not found in a ZIP, the geocoder scans other ZIP codes associated with the place (typically a city or a town) for a match.
- Allow phonetic match of street name
  - The geocoder uses a phonetic match for street names (e.g., an input address with the street name "Maine St." is considered a match with Main St. in the database).
- Disregard parity for address match
  - Normally, the geocoder matches even/odd addresses with even/odd address ranges. This option disregards this practice.
- Allow closest address match
  - The geocoder finds the closest address range to match the house number (rather than an exact one)
- Allow fuzzy street type match
  - The geocoder will match addresses with the same street name, even if the street types are different (e.g., Greenwood Drive is considered a match with Greenwood Road)
- Geocode no matter what
  - If it cannot find an exact match, the geocoder will assign to the address the census coordinates associated with the center of a ZIP code (ZIP centroid[20]), or the center of a state (state centroid).

The GeoCode program outputs two files as it runs – a text file (*.txt) summarizing the geocoder performance, the accuracy codes, and the error codes; and a database file (*.dbf) containing the fields selected by the user. For each database file, we selected the following fields[21]:

[20] The centroid of a 5-digit ZIP code area is the balance point of the polygon formed by its boundaries. The centroid is calculated based on the coordinate extremes of the polygon.

[21] One field we did not include, the MATCH field, contained the full address that the GeoCode search engine determined to be the closest match to the input address. We had intended to include this field, but during the

SEQNO	Sequential Number
ADDRESS	Input Address
ACCURACY	Accuracy and Error Codes
BLOCK	Matched Block Code
PLACE	Place FIPS Code
MCD	MCD (Minor Civil Division) Code
STATE	State FIPS Code
ZIP	ZIP Code for 2003
PLACENAME	Matched Place Name
AreaKey	Block Group Code

The sequential number field contains a number between 1 and *n*, where *n* is the total number of records processed by the program. The input address is the address in the STREET, CITY, STATE ZIP format constructed and output by the address cleaning SAS program. Accuracy and error codes are explained below. The matched block code is a string of fifteen digits that indicates, respectively, an individual's state (2 digit FIPS code), county (3 digit FIPS code), census tract (6 digit FIPS code), and block (4 digit FIPS code, the first digit in the 4-digit string indicates the block group). The full string constitutes a unique, block-level identifier. Any persons living within the same block will have the same matched block code. Place indicates the city or town FIPS code, and MCD indicates the Minor Civil Division code. The area key is basically a substring of the matched block code that contains the first twelve, rather than the full fifteen digits, and constitutes a unique block group-level identifier.

5.2.3 Summary of GeoCode program accuracy codes

Failure details. The geocoding process can fail for a number of reasons, including setup or programmatic errors, a missing database entry, or an invalid input address. Failures fall under two general categories: syntax/lookup errors and programmatic/setup errors. Failed GeoCode results are indicated by error codes, which are summarized in Tables 48 and 49.

testing phase, we discovered problems with the MATCH field that led to major problems when trying to transform the *.dbf files into SAS files.

Table 48.
GeoCode program syntax and lookup errors

Error Code	Error Message
eIHN	Missing or invalid house number*
eISt	Missing or invalid street name*
eITy	Missing or invalid street type
eINa	Missing or invalid city name
eISN	Missing or invalid state name/abbrev*
eIZI	Missing or invalid ZIP code*
eIAd	Incomplete or malformed address*
eUAF	Unknown address format
eMiA	Missing address
eNZI	Failed to lookup ZIP code
eANF	Address not found
eSNF	Street not found

*Errors encountered while geocoding EDB addresses.

Source: GeoLytics Incorporated of East Brunswick, New Jersey – GeoCode CD program 2003, Version 1.02.

Table 49.
GeoCode program programmatic and setup errors

Error Code	Error Message
eGNO	GeoCode has not been opened
eFOD	Failed to open database
eFOF	Failed to open data file NAME
eFOM	Failed to open data member NAME*
eMiF	Missing file NAME
eGOF	General open failure, file NAME
eFA1	Failed to allocate memory
eNAS	No address data for state NAME*
eNSZ	No data for state-zip NAME
eSSO	String size overflow
eOKI	Output file kind invalid NAME
eOF1	Output failure NAME
eOLI	Output field list invalid NAME

*Errors encountered while geocoding EDB addresses.

Source: GeoLytics Incorporated of East Brunswick, New Jersey – GeoCode CD program 2003, Version 1.02.

Success details. The GeoCode program also indicates how successful it has been in matching addresses to FIPS codes. In addition to indicating accurate or exact matches, it indicates what kinds of "adjustments" it made to successfully match the address to a place with a FIPS code. Successful match details are presented in Table 50. Some successful results will generate accuracy codes indicating that the geocoder could only code the address by using some of the fallback matching options described above. Its worth noting that GeoCode may employ more than one of these fallback matching options to find a match for a particular address.

Table 50.
GeoCode program accuracy codes and messages

Accuracy Code	Accuracy Message
aNP1	Place not found*
aNPa	Address match with no parity*
aCAd	Closest address match*
aFTy	Fuzzy street type match*
aPhM	Phonetic match*
aNMa	No match found
aNMP	No match performed
aPBZ	Place-based ZIP match*
aSpC	Spelling corrected*
aStC	State centroid used*
aSEn	Street end used*
aZIC	ZIP centroid used*
aInD	Inaccurate direction*

*Accuracy options encountered while geocoding EDB addresses.

Source: GeoLytics Incorporated of East Brunswick, New Jersey – GeoCode CD program 2003, Version 1.02

Test results using the GeoCode program on the CAHPS sample addresses. Table 51 below summarizes the error and accuracy results from the CAHPS sample test file. It indicates that 8.4 percent of the 830,728 CAHPS sample addresses taken from the EDB were dropped because they were uncodeable by the GeoCode program for some reason, very often for having a box number instead of a street address. It also shows that of the remaining 760,961 addresses (91.6 percent of the original total), all but four-tenths of a percent (0.4 percent) were successfully geocoded. The process we followed in this test yielded an overall total successful match of 91.2 percent of the EDB addresses to Census block group level FIPS codes.

Table 51.
Summary of GeoCode error and accuracy results for the CAHPS test file

	CAHPS/EDB Test File	
	Number	Percent
Original number of records	830,728	100.0
Number of records dropped (uncodeable)	69,767	8.4
Addresses processed	760,961	91.6
...Successfully geocoded (first iteration)	719,220	94.5
...Successfully geocoded eFOM records (second iteration)	38,322	5.0
...Total failed	3,419	0.4
GeoCode success rate	757,542	99.6
Percent total test file records matched		91.2
Success details*		
Accurate Match	477,746	62.8
Place Not Found	77,273	10.2
Address match with no parity	5,931	0.8
Closest address match	37,984	5.0
Fuzzy street type match	86,701	11.4
Phonetic match	37,847	5.0
Place-based ZIP match	16,519	2.2
Spelling corrected	0	0.0
State centroid used	905	0.1
Street end used	3,871	0.5
ZIP centroid used	63,031	8.3
Inaccurate direction	20,525	2.7
Failure details		
Failed due to syntax error	3,418	0.4
…Missing or invalid house number	3,367	0.4
…Missing or invalid state name/abbreviation	0	0.0
…Missing or invalid ZIP code	47	0.0
…Incomplete or malformed address	4	0.0
Failed due to lookup error	38,323	5.0
…Failed to open data member (eFOM)	38,322	5.0
…No address data for state	1	0.0

*Note: Success detail categories reflect distribution of accuracy codes. These codes are NOT mutually exclusive. Some addresses can have up to four accuracy codes associated with them.

Source: Result of running GeoCode CD program 2003 Version 1.02 on addresses from Medicare EDB from mid-2003 for respondents to the Medicare CAHPS fee-for-service, managed care enrollee, and disenrollee surveys for 2000-2002.

5.3 Application of the GeoCode Program Processing to the Full EDB

We obtained the 10 segments of the full unloaded EDB from CMS in mid-2003. Because each segment of the EDB contained more than four million beneficiary records, we processed each segment separately, first extracting the addresses and other necessary identification variables from the EDB, correcting the addresses using the SAS programs we developed, and finally running them through the GeoCode program. Each segment of the EDB was run through the GeoCode program separately. The program took from 16 to 36 hours to process and match the more than four million records contained in each segment. As indicated above in the description of the test results on the CAHPS sample addresses, it was necessary to rerun the addresses with an eFOM error that failed to match on the first iteration, and virtually all of them were successfully matched on the second iteration through the GeoCode program.

Run EDB segments through the GeoCode program. The results of the GeoCode program processing are summarized in Table 52 for all 10 segments of the unloaded EDB combined. The results were extremely similar for each of the 10 segments. However, a separate summary has been prepared for each segment and included in Appendix F. Overall, 86.8 percent of the 41,742,407 addresses of Medicare beneficiaries were processed through the Geocode program. Ninety-nine and two tenths percent of the addresses that were processed (or 36,223,053) were successfully matched to a FIPS code that included the block group. As Table 52 shows, 61 percent of the matches made were exact with the addresses that were input.

Import Geocode output files and merge with EDB records. We used PROC IMPORT in SAS 8.2 to transform the database (*.dbf) files produced by the GeoCode program into SAS data files (*.sas7bdat). Using the ADDRESS field we prepared as input from the EDB to the GeoCode program as the common key (common to the EDB and the GeoCode output), we merged the output files (containing Census-based geographic identifiers including the AreaKey number string that identifies block groups) onto the EDB records.

Identifying and extracting socioeconomic status indicators from the 2000 U.S. Census. Rather than be limited in the number and type of socioeconomic status indicators available to CMS from this effort, we extracted a rather extensive list of block group level measures from the 2000 U.S. Census. Our thinking on taking all of these was that that some of these could be could be used alone or in combinations to describe the SES of the block group in which the Medicare beneficiary resided. For a list of the variables we extracted and the values for which they are reported, see Appendix F. Included in the measures we extracted were:

- median family income in 1999
- median household income in 1999
- per capita income in 1999
- median rent asked

Table 52.
Summary of GeoCode error and accuracy codes for the 10 segments of the EDB combined

	Sums	Percent
Original number of records	41,742,407	100.0
Number of records excluded (uncodeable)	5,223,766	12.5
Addresses processed	36,518,641	87.5
...Successfully geocoded (First Iteration)	35,108,329	96.1
...Successfully geocoded eFOM records (second iteration)	1,114,724	3.1
...Total failed	295,588	0.8
Geocoding success rate	36,223,053	99.2
Percent total EDB records matched		86.8
Success details*		
Accurate match	20,028,633	61.0
Place not found	3,216,868	9.8
Address match with no parity	281,554	0.9
Closest address match	1,821,893	5.5
Fuzzy street type match	3,919,792	11.9
Phonetic match	1,752,858	5.3
Place-based ZIP match	799,836	2.4
Spelling corrected	10	0.0
State centroid used	47,252	0.1
Street end used	181,270	0.6
ZIP centroid used	2,972,274	9.0
Inaccurate direction	1,027,377	3.1
Failure details		
Failed due to syntax error	262,176	0.8
…Missing or invalid house number	175,561	0.5
…Missing or invalid state name/abbr	4	0.0
…Missing or invalid ZIP code	86,335	0.3
…Incomplete or malformed address	276	0.0
Failed due to lookup error	1,022,267	3.4
…Failed to open data member (eFOM)	1,018,483	3.4
…No address data for state	3,784	0.0

*Note: Success detail categories reflect distribution of accuracy codes. These codes are NOT mutually exclusive. Some addresses can have up to four accuracy codes associated with them.

Source: Result of running GeoCode CD program 2003, Version 1.02 on addresses from Medicare EDB from mid-2003.

- median value of owner occupied housing units
- proportion of persons 25 and older completing different levels of education by gender
- proportion of persons 16 and older according to their employment status by gender
- proportion of civilian employed persons 16 and older according to their industry by gender

- proportion of civilian employed persons 16 and older according to their occupation by gender
- proportion of families according to their income level in 1999
- proportion of households according to their income level in 1999
- proportion of families according to poverty level in 1999 by age of head
- proportion of families according to their income level in 1999 divided by the poverty level in 1999
- median household income in 1999 by race of householder
- median household income in 1999 by age of householder
- proportion of households with income below the poverty level in 1999 by race and age of householder

These variables were extracted for all block groups in the nation along with their Block group FIPS codes and saved in a file. This file can readily be used to link to any particular beneficiary in the EDB and be used to supply the value (percent, median, per capita amount) of any block group level measure chosen from this file for his/her place of residence because both files have the block group FIPS code (AreaKey) on them.

CHAPTER 6
ASSESSING HOW REPRESENTATIVE THE MEDICARE CURRENT BENEFICIARY SURVEY'S (MCBS) SAMPLE SITES ARE OF NATIONAL ORIGIN SUBGROUPS FOR HISPANICS AND ASIANS/PACIFIC ISLANDERS

6.1 Introduction

The objective of the analysis reported in this chapter is to assess whether the primary sampling units (PSUs) used by the Medicare Current Beneficiary Survey (MCBS) appropriately represent Hispanic and Asian/Pacific Islander beneficiaries in the Medicare program. "Appropriately" in this context means that the areas from which the MCBS sample is selected are composed of the same mixture of Hispanic and Asian/Pacific Islander subgroups as the nation as a whole. This would allow one to reasonably expect that the samples of persons selected in the MCBS could represent Hispanic and Asian/Pacific Islander (A/PI) Medicare beneficiaries with the same mix of national origins as the nation as a whole.

Since the focus was on the nation as a whole, we used the 2000 U.S. Census counts of persons by race/ethnicity and national origins as the baseline of our assessment. However, the Medicare program includes both persons under 65 years of age who are disabled or have been certified as having end stage renal disease, as well as persons 65 years of age and older. There are no Census data that report on the population's level of disability by race/ethnicity according to national origins but there are data on age by race/ethnicity according to national origins. For this reason, we have focused solely on the segment of the population in these two diverse race/ethnic groups who were 65 years of age and older at the time of the Census and, therefore, are very likely to be eligible for Medicare.

6.2 Methodology

To assess the similarity of the nation and the MCBS PSUs with respect to representation of racial/ethnic subgroups, we summed the 2000 U.S. Census counts for the nation as a whole for persons of Hispanic and Asian/Pacific Islander origins who were 65 years of age and older by national origin subgroup and in total, separately for Hispanic and Asian/Pacific Islander persons. Next, we obtained the list of MCBS counties (the PSUs are counties and groups of counties). Then, we summed the 2000 U.S. Census counts for Hispanic and Asian/Pacific Islander persons 65 years of age and older by national origin subgroup and in total just for the counties included in the 107 MCBS PSUs. These are presented in Table 53. From this table, it is clear that the MCBS PSU's have included a large proportion of the nation's elderly Hispanics (1,086,909 out of 1,733,591, or 62.7 percent) and an even larger proportion of the nation's elderly Asians/Pacific Islanders (546,351 out of 821,616, or 66.5 percent).

It is also apparent from this table that the Hispanic population 65 years of age and older constitutes 4.91 percent of the Hispanic population in the nation but is a slightly smaller proportion (4.81 percent) of the Hispanic population included in the MCBS PSUs. The same situation exists with respect to the elderly Asian/Pacific Islander population. They represent 7.72 percent of the Asian/Pacific Islander population nationally, but only 7.53 percent of the

Table 53.
Hispanic and Asian/Pacific Islander subgroups as a percent of elderly (age 65 +): National totals vs. MCBS PSUs

	National totals			MCBS PSU totals			
Race or ethnic group	Total population	Age 65 +	Age 65+ as percent of total	Total population	Age 65 +	Age 65+ as percent of total	Ratio of percents
Total population	281,421,906	34,991,753	12.43	138,833,074	16,328,861	11.76	1.06
Hispanic or Latino	35,305,818	1,733,591	4.91	22,610,423	1,086,909	4.81	1.34
Mexican alone	20,640,711	809,842	3.92	12,408,405	414,193	3.34	1.10
Puerto Rican alone	3,406,178	191,295	5.62	2,334,187	140,879	6.04	1.58
Cuban alone	1,241,685	228,677	18.42	1,042,746	202,436	19.41	1.90
Other Hispanic or Latino alone	10,017,244	503,777	5.03	6,792,346	327,507	4.82	1.39
...Dominican alone	764,945	36,648	4.79	648,637	32,292	4.98	1.89
...Central American alone	1,686,937	54,151	3.21	1,344,220	44,895	3.34	1.78
...South American alone	1,353,562	76,791	5.67	1,051,283	62,215	5.92	1.74
...Spaniard alone	100,135	13,209	13.19	62,738	8,904	14.19	1.44
…All other Hispanic or Latino alone	6,111,665	322,978	5.28	3,685,468	179,201	4.86	1.19
Asian/Pacific Islander Total*	10,641,833	821,616	7.72	7,251,023	546,351	7.53	1.42
Asian	10,242,998	800,795	7.82	7,080,445	538,637	7.61	1.44
Asian Indian alone	1,678,765	66,834	3.98	1,195,073	48,060	4.02	1.54
Chinese alone	2,432,585	235,995	9.70	1,891,307	190,453	10.07	1.73
Filipino alone	1,850,314	164,768	8.90	1,209,101	106,685	8.82	1.39
Japanese alone	796,700	161,288	20.24	407,884	69,622	17.07	0.93
Korean alone	1,076,872	68,505	6.36	755,017	51,396	6.81	1.61
Vietnamese alone	1,122,528	58,241	5.19	745,525	39,627	5.32	1.46
Other specified Asian alone**	914,776	30,470	3.33	576,029	19,698	3.42	1.39
Pacific Islander †	398,835	20,821	5.22	170,578	7,714	4.52	0.79

*Note: A/PI sub groups, as provided on the Census SF2, are not exhaustive. A/PI Total is equal to sum of Asian and Pacific Islander.

**Includes Bangledeshi, Cambodian, Hmong, Indonesian, Laotian, Malaysian, Pakistani, Sri Lankan, and Thai.

† Includes Native Hawaiian, Polynesian, Micronesian, Melanesian, and other specified Pacific Islanders.

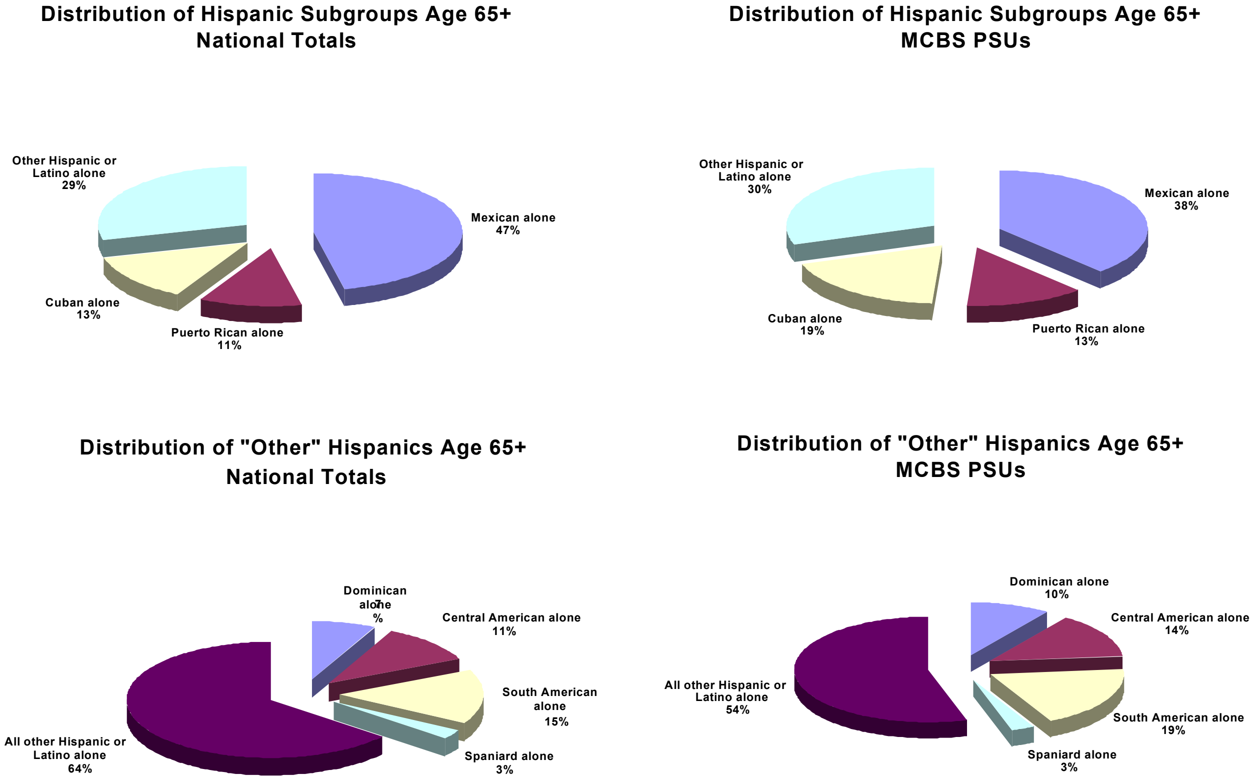
Source: 2000 U.S. Census, Summary File 3.

Asian/Pacific Islander population in the MCBS PSUs. It is also worth noting that the Hispanic population, while larger than that of the Asian/Pacific Islander, consists of a smaller proportion of persons 65 years of age or older.

Next, we calculated the percentage of the total national count of Hispanic persons 65 years of age and older represented by each of the Hispanic subgroups separately. This is presented in the upper portion of Table 54 and graphically for the Hispanic groups in Figure 3.

Table 54 demonstrates that nearly half of the nation's elderly Hispanics are of Mexican national heritage (46.7 percent), and slightly more than one-tenth each are Puerto Rican (11.0 percent) and Cuban (13.2 percent). All "Other" Hispanic origins combined constitute slightly less than one third (29.1 percent) of the total elderly Hispanic population.

Figure 3.
National and MCBS PSU distribution of Hispanic national origin subgroups in 2000



Distribution of Hispanic Subgroups Age 65+ National Totals

Distribution of Hispanic Subgroups Age 65+ MCBS PSUs

Distribution of "Other" Hispanics Age 65+ National Totals

Distribution of "Other" Hispanics Age 65+ MCBS PSUs

Of the "Other" Hispanic subgroups, fewer than one in ten (7.3 percent) are of Dominican heritage, approximately one in ten are of Central American national heritage (10.7 percent), slightly more (15.2 percent) are of South American national heritage, and only 2.6 percent are Spaniards. The remaining "Other" Hispanic persons are classified as "All other" Hispanics and account for nearly two-thirds (64.1 percent) of the "Other" Hispanic group.

We calculated the same percentage for each of the national origin subgroups in the MCBS PSUs. It is important to note that with two exceptions – the "Mexican" and the much smaller "All other Hispanic" subgroups – the proportion of the subgroup populations in the MCBS areas is larger than for the entire nation. Thus, the Mexican subgroup, has 46.7 percent of the nation's elderly Hispanic persons identified as being of Mexican national origin, but only 38.1 percent of the population in the MCBS PSU's are identified as being of Mexican heritage.

We made similar calculations for the nation's Asian and Pacific Islander population 65 years of age and older. These are presented in the lower portion of Table 54 and are graphically presented in Figure 4. Elderly persons of Pacific Island origin (including Native Hawaiians) represent only 2.5 percent of the national total, while elderly persons of Asian origins represent

97.5 percent. The largest elderly Asian subgroup is the Chinese (29.5 percent of Asians), followed by Filipinos (20.6 percent) and the Japanese (20.1 percent). Koreans constitute 8.6 percent of elderly Asians followed by Asian Indians (8.3 percent), and the Vietnamese (7.3 percent). Other Asians represent only 3.8 percent of the national total Asians and include persons of Bangladeshi, Cambodian, Hmong, Indonesian, Laotian, Malaysian, Pakistani, Sri Lankan, and Thai national origins.

Table 54.
Subgroup composition of Hispanic and Asian/Pacific Islander elderly (age 65+): National totals vs. MCBS PSUs

	National totals		MCBS PSUs		
Race or ethnic group	Age 65 +	Subgroup as % of total	Age 65 +	Subgroup as % of total	Ratio of MCBS to nation percent
Hispanic or Latino	1,733,591	100.0%	1,086,909	100.0%	1.00
Mexican alone	809,842	46.7%	414,193	38.1%	0.82
Puerto Rican alone	191,295	11.0%	140,879	13.0%	1.17
Cuban alone	228,677	13.2%	202,436	18.6%	1.41
Other Hispanic or Latino alone	503,777	29.1%	327,507	30.1%	1.04
...Dominican alone	36,648	7.3%	32,292	9.9%	1.36
...Central American alone	54,151	10.7%	44,895	13.7%	1.28
...South American alone	76,791	15.2%	62,215	19.0%	1.25
...Spaniard alone	13,209	2.6%	8,904	2.7%	1.04
…All other Hispanic or Latino alone	322,978	64.1%	179,201	54.7%	0.85
A/PI total*	821,616	100.0%	546,351	100.0%	1.00
Asian	800,795	97.5%	538,637	98.6%	1.01
Asian Indian alone	66,834	8.3%	48,060	8.9%	1.07
Chinese alone	235,995	29.5%	190,453	35.4%	1.20
Filipino alone	164,768	20.6%	106,685	19.8%	0.96
Japanese alone	161,288	20.1%	69,622	12.9%	0.64
Korean alone	68,505	8.6%	51,396	9.5%	1.12
Vietnamese alone	58,241	7.3%	39,627	7.4%	1.01
Other specified Asian alone**	30,470	3.8%	19,698	3.7%	0.96
Native Hawaiian/Other Pacific Islander (NHPI)†	20,821	2.53%	7,714	1.41%	0.56

*Note: A/PI sub groups, as provided on the Census SF2, are not exhaustive. A/PI Total is equal to sum of Asian and NHPI.

**Includes Bangledeshi, Cambodian, Hmong, Indonesian, Laotian, Malaysian, Pakistani, Sri Lankan, and Thai.

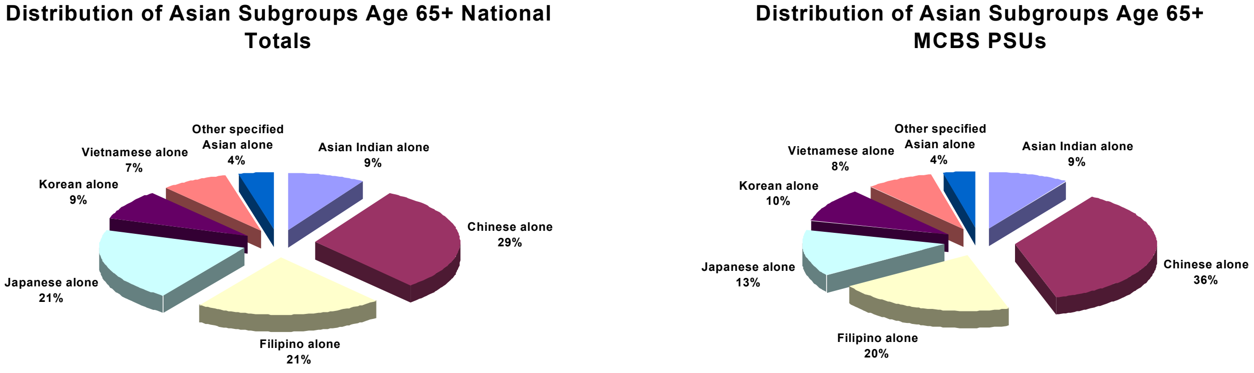
† Includes Polynesian, Micronesian, Melanesian, and Other specified Pacific Islanders.

Source: 2000 U.S. Census, Summary File 3.

As with the Hispanic elderly population, we also calculated the percentage of Asian/Pacific Islander elderly in the MCBS PSUs for each of the national origin subgroups. Noteworthy here is that 29.5 percent of the nation's Asian/Pacific Islander elderly population is

Chinese and 20.1 percent are Japanese. However, in the MCBS PSUs, 35.4 percent of the elderly Asian/Pacific Islander population is Chinese and only 12.9 percent is Japanese.

Figure 4.
National and MCBS PSU distribution of Asian/Pacific Islander national origin subgroups in 2000



Distribution of Asian Subgroups Age 65+ National Totals

Distribution of Asian Subgroups Age 65+ MCBS PSUs

To judge whether the MCBS PSUs adequately represented the national distribution of elderly persons of Hispanic and Asian/Pacific Island national heritage, we have calculated a ratio. The ratio is calculated as an indicator of how closely the proportional representation of the elderly in the subgroup in the MCBS PSUs comes to being the same as the proportional representation of the elderly in the subgroup nationally. The ratio is calculated for each subgroup by dividing the proportional representation of the elderly subgroup in the MCBS's total Hispanic or Asian/Pacific Islander elderly population by the proportional representation of the same elderly subgroup in the nation. Ratios of (or close to) 1.00 indicate that the proportional representation of the elderly subgroup in the MCBS sample area is the same (or almost the same) as the elderly subgroup's national representation. Ratios that are below 1.00 indicate that the subgroup is underrepresented in the MCBS sample PSUs, while ratios above 1.00 indicate overrepresentation of the subgroup in the MCBS sample PSUs.

6.3 Results

Examination of the ratios of Hispanic subgroups in the last column of Table 54 suggests that elderly persons of Mexican heritage are underrepresented in the MCBS PSUs by 18 percent (1.00 – 0.82), and that those of Puerto Rican and Cuban origin are overrepresented by 41 and 17 percent, respectively. The pool of Other Hispanics is represented at about the right level overall, although within the pool of Other Hispanics, persons from the Dominican Republic, Central America, and South America are overrepresented by from 25 to 36 percent; Spaniards are approximately correctly represented; but the remaining subgroup of Other Hispanics are underrepresented by about 15 percent.

The situation in the table with respect to elderly person of Asian/Pacific Islander origins is slightly better insofar as elderly Japanese are the only subgroup greatly underrepresented (by 36 percent), and only elderly Chinese are greatly overrepresented (by 20 percent). The remaining Asian subgroups – Filipino, Korean, Asian Indian, Vietnamese, and the pool of Other Asians –

are either just slightly overrepresented or slightly underrepresented with ratios ranging from 0.96 to 1.12.

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Appendix A
Spanish Surnames List Documentation

Appendix A
Spanish Surnames

TECHNICAL WORKING PAPER NO. 13
March 1996

Building a Spanish Surname List for the 1990's— A New Approach to an Old Problem

by
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Washington D.C.

The data and results appearing in this working paper were originally introduced at the Annual Meeting of the Population Association of America (PAA) Miami, Florida May 1994.

The views expressed in this paper are solely attributable to the two authors and do not necessarily reflect the position of the United States Bureau of the Census.

ABSTRACT

The United States Census Bureau produced and released Spanish surname products for 1950, 1960, 1970 and 1980. This 1990 version is another way station in an ongoing research journey. This paper, “Building a Spanish Surname List for the 1990’s—A New Approach to an Old Problem,” differs from its predecessors in two significant respects.

(1) Until 1990, name has never been part of a permanent Census electronic record. Following the 1990 Census, the Census Bureau appended name to 7 million Census records for the purposes of determining undercount. The “List” is constructed by tabulating the responses (surname by surname) to the Spanish origin question for persons in that sample. Well over 90 percent of male householders with the surnames: GARCIA, MARTINEZ, RODRIGUEZ, and LOPEZ responded affirmatively to the Spanish origin question while less than 1.0 percent of male householders named SMITH, JOHNSON, and BROWN provided a positive response to the Spanish origin question.

(2) In the past, a name was either on the list (e.g., Garcia) and was taken to be Spanish or it did not appear on the list. The assumption was that any name not on the list was not Spanish. Since neither BROWN nor SILVA appeared on the 1980 Spanish Surname list, one would naturally assume that neither name was Spanish. In the electronic version of the 1990 “List” we append auxiliary data for 25,000 surnames including both SILVA and BROWN that allow users to form their own lists. Almost 60 percent of the SILVA’s in our 1990 Census sample responded that they were Hispanic while less than 1 percent of BROWN’s claimed to be Hispanic. Moreover, another auxiliary item suggests that the letters S I L V A form a potentially Spanish word. That same statement cannot be made for B R O W N. From this data, some users might include SILVA on their own personal Spanish surname list, while others would justifiably arrive at an opposite conclusion.

We must emphasize that this product does not violate the confidentiality of Census responses. On average, each captured surname represents about 40 householders. Moreover, we provide no subnational geographic data nor is there any indication of first name or age of respondent. Given these conditions, we are confident that this file does not provide information that could identify any individual enumerated in the 1990 Census.

ACKNOWLEDGEMENTS

This paper could not have been written without the help of our colleagues at the Census Bureau. Six of our co-workers provided so much assistance that they are singled out for special thanks.

1. Randy Klear single-handedly built the data base used in the surname extraction operation. He wrote the programs to normalize names (JOHN SMITH JR is normalized to JOHN SMITH) as well as creating the algorithms for inverting names (JOHNSON CYNTHIA is inverted to CYNTHIA JOHNSON) when appropriate.

2. Sam Davis designed the programs to delineate infrequently occurring surnames into various Hispanic categories.

3. Marie Pees created the electronic diskettes that are an important supplement to the paper. For persons needing specific information on individual surnames, the statistical material located on the diskette is crucial.

4. Signe Wetrogan gave the authors a great deal of her time, enthusiasm and expertise in their early efforts at organizing and writing this paper. Many of her suggestions on points of emphasis have been included in this document.

5. Gregg Robinson painstakingly read and re-read several versions of this paper. His sense for where to expand and where to modify the authors’ original phrasing were almost always right on the money.

6. Finally, we want to commend Rheta Pemberton on her word processing skills and her patience in producing “just one more final draft”. The typographical errors which have crept into this paper are the sole responsibility of the authors.

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Building a Spanish Surname List for the 1990's—A New Approach to An Old Problem

by

David L. Word and R. Colby Perkins Jr.

This paper describes a direct and reproducible method for creating an inventory of surnames characteristic of the Hispanic origin population in the United States. The individual surnames included in this inventory are created by combining distinct surnames into groups and then analyzing group responses to the 1990 Hispanic origin question. Persons wishing to purchase an electronic file need to be specific as to whether they want the long list (Section 10.1.2) or the short list (Section 10.1.3).

Both electronic versions are available through the Population Division's Statistical Information Office (301-457-2422). If you would like or need additional insight into the contents of this paper, David Word (301-457-2103) dword@census.gov and Colby Perkins (301-457-2428) rperkins@census.gov will welcome your comments.

1.0 INTRODUCTION

In 1980 the Census Bureau published a list of 12,497 different "Spanish" surnames. The central premise for including a surname on that list was the "similarity" of that name's geographic distribution to the geographic distribution of the Hispanic origin population within the United States. The 12,497 surnames appearing on the 1980 Spanish surname list were culled from a data base of 85 million taxpayers filing individual federal tax returns for 1977.

Each of the 1.4 million distinct names appearing on the 1977 IRS file was subjected to a complex mathematical function incorporating Bayes' theorem to determine the "odds" that any particular surname was Spanish (Word, et al 1978). When the arithmetic value of the function exceeded a predetermined standard, that surname became a potential candidate for inclusion on the 1980 Spanish surname list. If the numerical value of the multinomial function failed to reach that criterion, the surname being tested was immediately discarded. This procedure works remarkably well for commonly occurring surnames, but a great amount of "hands on" effort was required to dispose of infrequently occurring surnames that surfaced as "Spanish" on the initial selection pass.

In this paper, Perkins and Word discard that **indirect** Bayesian approach in favor of a **direct** method to reach the same ends. Here, instead of attempting to "classify" surnames through geographic distribution, we actually link ethnicity and name. The ideal data source for classifying surnames by proportion Hispanic origin would be the 1990 Census in its entirety. Because of disclosure concerns, name has never been part of the computerized permanent record even though the Decennial Census routinely requests name for followup purposes.

Nevertheless, a very large sample data set is available that does link name (first and last) to individual 1990 Census records. This individual record file, hereafter called the SOR—(Spanish Origin)—file contains 7,154,390 person records[1] and was originally created for the purpose of estimating undercount in the 1990 Census. Since slightly over 1.5 million of those records lack name and/or Hispanic origin information, we limited ourselves to the 5,609,592 records that include both a valid surname and a response to the Hispanic origin question.

[1] Following the 1990 Census, the Census Bureau instituted a large scale post-enumerative survey (PES) to measure undercount in the 1990 census (Hogan, 1993; 1992). The formal PES sample was limited to 377,000 persons residing in 171,000 households in 5300 preselected blocks. The much larger SOR sample includes those PES blocks AND surrounding ring blocks. The SOR sample file used in this analysis is nearly 20 times as large as the formal PES sample.

Most people within a household have the same surname and the same ethnicity, implying that 5,609,592 person records do not produce 5,609,592 independent observations. To mitigate the effect of clustering, we limit our universe to the 1,868,781 Householder[2] records that include valid responses to both surname and Hispanic origin. This "householder" data set contains 268,783 distinct surnames—167,765 occurring exactly one time. In fairness, a large portion of surnames occurring one time appear to be errors in keying or errors in interpreting handwriting. GOUZALEZ, GOMEZS, and RODRIGUF are the surnames of three householders appearing in the SOR file who designated themselves as Hispanic.

For reasons sited in footnote 2, all future discussions of frequency/appearances/observations for individual surnames in the SOR file, will be taken as householders not persons.

2.0 BACKGROUND

If it were possible to develop a Spanish surname list that identifies all Hispanics, and does not include any non-Hispanics, we could represent that condition by Table 1.

TABLE 1—TABULAR ENTRIES IN AN IDEAL SITUATION

	Hispanic Origin	Non-Hispanic Origin	All Origins
Spanish Surname	**X**	ZERO	**X**
Non-Spanish Surname	ZERO	**Y**	**Y**
All Names	**X**	**Y**	**Z**

In Table 1, each of the **X** persons denoting themselves as Hispanic possesses a Spanish surname, and no person of Hispanic origin has a non- Spanish surname. Moreover, not one single person among the **Y** non-Hispanics possess a Spanish surname. This pattern does not hold in the real world. Hispanic persons may possess surnames that are not "Spanish", and non-Hispanics,—especially married women—can have Spanish Surnames. Table 2 illustrates this "real world" situation.

TABLE 2—TABULAR ENTRIES IN A NORMAL SITUATION

	Hispanic Origin	Non-Hispanic Origin	All Origins
Spanish Surname	**X**	**p**	**S**
Non-Spanish Surname	**q**	**Y**	**T**
All Names	**H**	**U**	**Z**

If the surname list under consideration behaves normally, the entries "**p**" and "**q**" are small relative to the values of **X** and **Y**. Displaying the data in this form clarifies the two relationships which are crucial in **evaluating** any Spanish surname list.

[2] The term "householder" used in the context of this paper is limited to male or never married female householders plus any other male or never married female in the household not related to the householder. We expressly exclude ever married women from the calculations because our interest in the relationship of surname to ethnicity lies in the potential of a given surname to identify persons of Hispanic origin. As would be suspected, the existing 1980 Spanish surname list is less effective in identifying the ethnicity of ever married females than any other demographic group (Perkins, 1993).

1. The entry “**p**” represents the number of persons possessing any “Spanish surname” appearing on an existing Spanish surname list who do not identify themselves as Hispanic. We define **Error of Commission** to be the ratio of **p** to **S**. That is, of the **S** persons who have Spanish surnames, “**p**” **are not** Hispanic. As a rule of thumb, fewer than 10 percent of the persons with generally accepted “Spanish” surnames fail to identify themselves as Hispanic. Ambiguous surnames, such as SANTOS and SILVA, should be **excluded** from any Spanish Surname list if a user’s goal is to minimize Error of Commission.

2. The entry “**q**” represents persons who identify themselves as Hispanic, but whose surname is not found on a given Spanish surname list. **Error of Omission** is analogous to Error of Commission and is the ratio of **q** to **H**. However, Error of Omission is not strictly a rate. It is the proportion of the Hispanic origin population whose last name does not appear on a particular Spanish surname list. Although fewer than 1 percent of persons with non-Spanish surnames identify themselves as Hispanic, non-Hispanics outnumber Hispanics by 10 to 1 in the United States. For that reason, it is virtually impossible for Error of Omission to dip much below 10 percent, regardless of “fringe” surnames that are added to an existing surname list. If one desires to lower the Error of Omission at the expense of Error of Commission, indefinite surnames such as SANTOS and SILVA need to be **included** on a Spanish surname list.

3.0 PURPOSE OF CONSTRUCTING A SPANISH SURNAME LIST

The existing 1980 Spanish surname list was originally created to code persons of Spanish surname in the five Southwestern States at the time of the 1980 Census (Passel and Word, 1980). But that surname list has had a far wider range of uses and users since its release. Five practical applications involving the use of Spanish surnames follow:

3.1 **Mortality Studies.** Until very recently (late 1960’s) there was no attempt to identify the Latin American community with a single unifying term. As a result, Mexicans, Germans, Iraqis and Peruvians were terms for persons of four distinct ethnic groups. By the late 1970’s, the term Spanish origin came into vogue and Mexicans, Peruvians, Puerto Ricans, etc. were combined under a single generic designation—Spanish origin population. (The term Spanish origin has gradually been replaced or used interchangeably with the term Hispanic origin.) At the same time (1980) the Social Security Administration (SSA) revised their application form to request ethnic (”Hispanic”) information for Social Security applicants. But neither Social Security nor its sister agency, Health Care Financing Administration (HCFA/Medicare), felt that it was necessary to obtain direct information on Hispanic origin for persons who had applied for and received Social Security numbers prior to 1980.

In order to obtain information on mortality of the elderly Hispanic population, HCFA is contemplating a large scale mortality study of the Hispanic origin population enrolled in Medicare. For a large proportion of that population, “Hispanic origin” will be defined and assigned on the basis of surnames contained on either the existing 1980 or the new 1990 Spanish surname list.

3.2 **Population Estimates.** The Census Bureau’s initial effort at producing local area population estimates for the Hispanic population (Word, 1989) relied on the premise that the domestic migration rate of the Hispanic origin population could be approximated from the migration of the Spanish surnamed population as defined in 1980.

3.3 **Customer Base.** A utility company knows its customer base (by surname) at time t_0 and time t_1. The ratio of Spanish surnamed customers at the end point relative to the starting point provides an excellent basis for estimating change in the Hispanic origin population from the beginning to the end of the time period.

3.4 **Marketing.** In the first three applications, it was more important to limit errors of commission than errors of omission. But for marketing purposes it is generally useful to approach persons who are tangential to the group being studied. Suppose that a publisher wishes to launch a magazine written in Spanish about items of interest to persons of Hispanic origin. In order to get the largest subscriber base, it would be worthwhile to contact persons with borderline Spanish surnames on the chance that they are Hispanic.

3.5 **Census Use.** The Census Bureau is continually faced with the problem of "estimating" data when the respondent does not supply data on a census form. This estimation process is called "editing" or "imputation". Given that name will be captured on the year 2000 census record, a possible option to be considered is to use name to improve editing the Hispanic origin question when a direct response is not available.

4.0 ONE DOZEN COMMON SPANISH SURNAMES

The paper contains many abridged tables illustrating the authors' logic in generating Spanish surnames. For frequently occurring surnames, the qualification standards are self evident—we need only to know the ratio of successes (persons with a particular name identifying as Hispanic) to failures (persons with that same surname identifying as non-Hispanic). For rarely occurring names, the procedures for deciding whether a surname is or is not Spanish require more innovation.

As a starting point, we tabulated for each surname (SMITH as well as GARCIA) the proportion of persons who indicate that they are Hispanic. Using this construct, the criteria for establishing numerical limits on what constitutes a Spanish surname can be left to the individual data user. In practice, 95 percent of male householders with frequently occurring surnames (e.g., GOMEZ, GONZALEZ, GARCIA, RUIZ, etc.,) said they were Hispanic while less than 1 percent of males with common Anglo-Saxon surnames report themselves to be Hispanic. There are a few surnames (e.g., SILVA and SANTOS) for which the proportion of Hispanics is close to one-half, but these difficult to classify surnames are quite rare.

Approximately 20 percent of the Spanish surnamed population in the United States is concentrated in an even dozen names. The relative positioning of those 12 Spanish surnames in 1977 and 1990 appear in Table 3.

TABLE 3—RANKING SPANISH SURNAMES BY HOUSEHOLDER

(Source: 1977 (IRS); 1990 (Census SOR file))

	1977			**1990**	
Rank	Name	Percent	Rank	Name	Percent
1.	Garcia	2.97	1.	Garcia	2.90
2.	Martinez	2.69	2.	Martinez	2.73
3.	Rodriguez	2.51	3.	Rodriguez	2.55
4.	Lopez	1.99	4.	Lopez	2.23
5.	Hernandez	1.89	5.	Hernandez	2.16
6.	Gonzalez	1.65	6.	Gonzalez	1.87
7.	Perez	1.57	7.	Perez	1.73
8.	Sanchez	1.41	8.	Sanchez	1.50
9.	Gonzales	1.18	9.	Rivera	1.24
10.	Ramirez	1.13	10.	Ramirez	1.20
11.	Torres	1.03	11.	Torres	1.15
12.	Rivera	0.98	12.	Gonzales	1.06
	TOTAL	**21.00**		**TOTAL**	**22.31**

The term “householder” in Table 3 is used for convenience and does not follow a precise census definition. For the 1977 entries, a more exact descriptor would be “primary taxpayers on 1977 IRS returns”. The 1990 SOR source includes male householders but excludes all female householders currently or previously married.

Table 3 focuses upon the stability of surname positional rankings. Even though the Hispanic origin population in the United States increased by 70 percent over the 13 year period (1977 to 1990), the relative positioning of the 12 most frequently occurring Spanish surnames are invariant in both data sources. Were it not for the inversion of RIVERA and GONZALES, the individual positional rankings among the first 12 Spanish surnames would be identical.

We are now prepared to address the following question: “Just how effective are Spanish surnames in identifying the Hispanic origin population?” Table 4 attempts to answer that question by presenting surname data from the SOR research file for both “householders” (H.H.) and all persons (POP). Note how the inclusion of ever married females in the POP column depresses the effectiveness of both Spanish and non-Spanish surnames as classifiers of ethnic populations.

TABLE 4—PERCENT OF HOUSEHOLDERS AND PERSONS SELF-IDENTIFIED AS HISPANIC

(Source 1990 Census-SOR)

	Spanish Surnames				**Non-Spanish Surnames**		
Rank	Surname	H. H.	Pop.	Rank	Surname	H. H.	Pop.
1.	Garcia	94.5	91.0	1.	Smith	0.7	1.2
2.	Martinez	95.9	93.2	2.	Johnson	0.6	1.1
3.	Rodriguez	96.9	94.2	3.	Williams	0.8	1.1
4.	Lopez	94.6	91.8	4.	Brown	0.9	1.3
5.	Hernandez	97.0	94.2	5.	Jones	0.5	0.9
6.	Gonzalez	98.0	95.5	6.	Davis	0.7	1.1
7.	Perez	95.8	92.6	7.	Miller	0.6	1.3
8.	Sanchez	96.4	93.4	8.	Wilson	1.0	1.5
9.	Rivera	96.1	92.3	9.	Anderson	0.7	1.4
10.	Ramirez	96.7	94.3	10.	Moore	0.5	1.1
11.	Torres	95.3	92.9	11.	Taylor	0.7	1.1
12.	Gonzales	92.1	89.8	12.	Thomas	0.8	1.2
30.	Silva	57.3	60.0	13.	Martin	2.5	3.2
47.	Santos	60.3	61.5	209.	Oliver	3.1	3.0

Table 4 demonstrates just how effectively the top 12 Spanish and Anglo surnames classify the total population as to Hispanic or non-Hispanic origin. About 93 percent of the population and 96 percent of the householders with the 12 most common Spanish surnames identified themselves as Hispanic in the 1990 Census. On the other hand, only 1.2 percent of the population and 0.7 percent of the householders with the 12 most frequently occurring Anglo names answered the Hispanic origin question affirmatively.

Note that MARTIN and OLIVER are substantially more Hispanic than the other 12 Anglo surnames. The reason for this is that the pronunciation of MARTIN and OLIVER can be altered from English to Spanish by accenting the last syllable rather than the next to the last syllable. We do not doubt that persons pronouncing their surnames as MAR TEEN or O LEE VAIR are generally Hispanic. Given that a name’s pronunciation cannot be guessed from its spelling, the surnames MARTIN and OLIVER should not be classified as Spanish in the United States. Only 3 percent of persons with names spelled M-A-R-T-I-N or O-L-I-V-E-R responded positively to the Hispanic origin question on the 1990 Census.

5.1 STATISTICAL PROPERTIES FOR FREQUENTLY OCCURRING SURNAMES

The primary goal of this research is to supply statistical data on surnames where a sizeable proportion of persons with these surnames self-identify as Hispanic. Approximately 95 percent of householders possessing the 12 most frequently occurring Spanish surnames (Table 4) identify as Hispanic, and that pattern holds for the majority of Spanish surnames on the existing 1980 list. To avoid the awkward construction "**x** percent of persons with surname **s** are Hispanic", we will employ the arbitrary, but easily understandable usage of "Heavily Hispanic", "Generally Hispanic", "Moderately Hispanic", "Occasionally Hispanic" and "Rarely Hispanic" for surname classification purposes. Table 5 defines these terms.

TABLE 5—CRITERIA FOR SPANISH SURNAME CLASSIFICATION

Spanish Surname Classification	Proportion of Householders Who are Hispanic
1. Heavily Hispanic	Over 75 Percent
2. Generally Hispanic	50 Percent < x ≤ 75 Percent
3. Moderately Hispanic	25 Percent < x ≤ 50 Percent
4. Occasionally Hispanic	5 Percent < x ≤ 25 Percent
5. Rarely Hispanic	Less than or equal to 5 percent
6. Indeterminant	Name not on file

Within the SOR file, there were 8,614 distinct "householder" surnames which appear 25 or more times. Based on an extrapolation of Social Security data (Social Security Administration, 1984), persons with those 8,614 surnames account for 70 percent of the American population. 715 of these 8,614 surnames matched entries appearing on the 1980 Spanish surname list. Unpublished data from Passel and Word's earlier work suggest that these 715 "Spanish" surnames represent 83 percent of the Spanish surname population.

Tables 6A, 6B, and 7 provide "householder" data on proportion Hispanic for those 8,614 surnames.

TABLE 6A—CATEGORIZING FREQUENTLY OCCURRING SPANISH SURNAMES (1980 LIST) BY PROPORTION HISPANIC

Total Surnames = 715		
Heavily Hispanic (over 75 percent)	93.1	
More than 95 percent		43.4
More than 90 percent		73.1
Generally Hispanic (50 to 75 percent)	6.0	
Moderately Hispanic (25 to 50 percent)	0.7	
Occasionally Hispanic (5 to 25 percent)	0.1	
Rarely Hispanic (less than 5 percent)	0.0	

From the information appearing in Table 6A and Table 7, it is evident that the Bayesian approach used to create the 1980 Spanish Surname List was quite successful. The vast majority (93.1 percent) of these 715 names fell into the Heavily Hispanic category, and nearly three-fourths of those surnames (73.1 percent) were Hispanic 90 percent of the time.

In our 1990 SOR File, we found only 5 instances where a "frequently" occurring 1980 "Spanish" surname fell into the Moderate classification (FELIX, PASCUAL, MIGUEL, JUAN, and TOLENTINO). And there is only a single instance (DECASTRO) where a surname appearing on the 1980

Spanish list would be classified as Occasionally Hispanic based on data in the SOR file. No surname appearing on the 1980 Spanish surname list occurring 25 or more times falls into the Rarely Hispanic category.

We now turn to the 7,899 surnames occurring at least 25 times in the SOR file that do not appear on the 1980 Spanish surname list.

TABLE 6B—CATEGORIZING FREQUENTLY OCCURRING NON-SPANISH SURNAMES (1980 LIST) BY PROPORTION HISPANIC

(Total Surnames = 7,899)

Rarely Hispanic (less than 5 percent)	96.3	
Less than 2 percent		84.3
Occasionally Hispanic (5 to 25 percent)	3.0	
Moderately Hispanic (25 to 50 percent)	0.5	
Generally Hispanic (50 to 75 percent)	0.3	
Heavily Hispanic (over 75 percent)	0.0	

Based on results from the SOR sample, not one of the 7,899 most frequently occurring "non-Spanish surnames" would now be assigned to the Heavily Hispanic category. There are, however, 20 surnames categorized as Generally Hispanic based on the SOR sample. They are, in order of Hispanic occurrence: (1) SILVA, (2) ROMAN, (3) MACHADO, (4) VENTURA, (5) PIMENTEL, (6) PALMA, (7) AQUINO, (8) BELLO, (9) ARAUJO, (10) CHAVES, (11) LEMOS, (12) VALERIO, (13) MANZO, (14) MATTA, (15) SALVADOR, (16) MACEDO, (17) VICTORIA, (18) BARBOZA, (19) REAL, and (20) LOMAS

Table 7 provides a numerical assessment of the Hispanic classification for the 8,614 surnames which appear 25 or more times in the SOR file. When Passel and Word created their 1980 Spanish surname list, they did not have the luxury of using the General or Moderate classification where most of the inconsistencies lie. As might be expected many of the surnames falling into those two categories were considered "close calls" by Word and Passel when they developed the 1980 Spanish surname list.

TABLE 7—HISPANIC CLASSIFICATION FOR SURNAMES OCCURRING 25 OR MORE TIMES ON THE SOR FILE

(On List: surname classified as Spanish in 1980)

	On List	Not on List
Heavily Hispanic (75% and over)	666	0
Generally Hispanic (50-75%)	43	20
Moderately Hispanic (25-50%)	5	42
Occasionally Hispanic (5-25%)	1	234
Rarely Hispanic (less than 5%)	0	7603
TOTAL	715	7899

Summary: The most frequent 8,614 surnames (715 + 7899) in the SOR file are exceedingly efficient for differentiating the Hispanic and Non-Hispanic populations. All of the 666 names which are over 75 percent Hispanic in the SOR file were identified as Spanish surnames in 1980. There are 7,603 surnames, none previously categorized as “Spanish”, where fewer than 5 percent of respondents indicated that they are Hispanic. Note the paucity of surnames falling into the General and Moderate categories.

5.2 STATISTICAL PROPERTIES FOR INFREQUENTLY OCCURRING SURNAMES

Even though the 8,614 most frequently occurring surnames in the SOR file contain 70 percent of the total population and 83 percent of the Spanish surname population, they represent a very small proportion of all surnames or all surnames designated as “Spanish”. The information appearing in Table 8 demonstrates that the correspondence between surnames classified as Spanish in 1980 and 1990 becomes somewhat weaker as the SOR sample thins. Nevertheless, the correspondence between surname and ethnicity for surnames occurring as few as 5 to 9 times in the SOR “householder” sample is still strong.

TABLE 8—CLASSIFYING SURNAMES ON THE 1980 SPANISH SURNAME LIST ACCORDING TO NUMBER OF OBSERVATIONS ON THE SOR FILE (householder only)

Group I,	25 or More Observations	n = 715
Group II,	10 to 24 Observation	n = 605
Group III,	5 to 9 Observations	n = 776

	Group I	Group II	Group III
	n = 715	n = 605	n = 776
Heavily Hispanic	93.1	84.3	78.4
Generally Hispanic	6.0	10.4	11.1
Moderately Hispanic	0.7	3.3	6.1
Occasionally Hispanic	0.1	1.6	2.6
Rarely Hispanic	0.0	0.3	1.9

Again referring to Passel and Word’s unpublished data, the most frequent 1320 (those occurring 10 or more times) Spanish surnames on their 1980 list cover 90.6 percent of the Spanish surnamed population. When we extend the universe to the most frequent 2096 Spanish surnames (those occurring 5 or more times in the SOR sample), we reach 93.6 percent of the 1980 Spanish surnamed population.

Table 9, following, is similar to Table 7 but is confined to surnames appearing 5 to 24 times in the SOR file.

TABLE 9—1990 HISPANIC CLASSIFICATION OF SURNAMES OCCURRING 5 TO 24 TIMES IN THE SOR FILE BASED ON HISPANIC CLASSIFICATION IN 1980

	10 to 24 Observations		5 to 9 Observations	
1990 Hispanic Classification	On 1980 List	Not On 1980 List	On 1980 List	Not On 1980 List
Heavily Hispanic	510	9	600	58
Generally Hispanic	63	22	94	53
Moderately Hispanic	20	79	50	151
Occasionally Hispanic	10	893	17	1005
Rarely Hispanic	2	9033	15	15345
TOTAL	605	10036	776	16612

As before, the terms “On” and “Not On” refer to whether the surname does or does not appear on the 1980 Spanish surname list. There are 1381 (605+776) different surnames on the 1980 Spanish surname list which appear 5 to 24 times in the SOR sample file. Only 44 (10 + 2 + 17 + 15) of those surnames will be reclassified as either Occasionally or Rarely Hispanic based on the 1990 analysis.

Again referring to Table 9, we find that there are 26,648 (10,036 + 16,612) different surnames occurring 5 to 24 times on the SOR file that do not appear on the 1980 Spanish surname list. Only 67 (9+58) of those names are now classified as Heavily Hispanic. An additional 75 names (22+53) fall into the Generally Hispanic category.

Summary: Of the 605 Spanish names on the 1980 list occurring 10 to 24 times, 95 percent fall into the Heavy or General classifications, and only 2 names fall into the Rarely Hispanic group. For 776 names that occurred 5 to 9 times, almost 90 percent continue to be classified as Heavily or Generally Spanish. Fifteen surnames previously classified as Hispanic are now Rarely Hispanic.

6.0 LIMITATIONS

The data presented in Tables 3 through 9 are derived from a sample—albeit a very large one. The 5,609,592 matchable SOR records contain 597,533 individuals who reported themselves to be Hispanic in the 1990 Census. The proportion Hispanic (10.7 percent) within the SOR sample is higher than the Hispanic proportion (9.0 percent) enumerated in the 1990 Census. This finding is not unexpected as there was a conscious effort to oversample Hispanics in the PES. If we were using unweighted responses to estimate the total proportion of population with Spanish surnames, we would certainly overstate that ratio. But this analysis does not attempt to estimate population totals; rather, our goal is to estimate (on a name by name basis) the proportion of persons who are Hispanic. With this goal in mind there is no inherent reason against using unweighted observations.

Another limitation is response variance. We must accept the individuals census designation as to his or her origin. For most census question such as sex and age, a respondent will provide answers that are consistent over time. Based on the 1990 Decennial Census Content Reinterview Survey (McKenney et al, 1993), about 7 percent of persons saying that they were Hispanic origin in the 1990 Census decided that they were non-Spanish at the later date. And 11 percent of persons saying that they were Hispanic origin in the reinterview, indicated that they were non-Spanish on their 1990 Census forms. This recent finding on lack of consistency for Hispanic origin response reinforce previous findings from reinterview surveys.

Finally, we have errors in measurement due to random sampling. When 90 persons out of 100 with a particular name in the SOR sample answer the Spanish origin question affirmatively, we say that 90 percent of persons with that surname are Hispanic. But, there is an error associated with that estimate. Using the normal approximation to the binomial, the standard error of that estimate is approximately $\sqrt{p * (1 - p)/(n -}$. Here p = 0.9 and n = 100. Table 10 below displays values of sampling errors associated with two choices of "p" and three values of "n".

TABLE 10—STANDARD ERRORS IN PROPORTION HISPANIC ARISING FROM A SAMPLE

N	X	P	S_p
300	270	90.0	1.7
100	90	90.0	3.0
30	27	90.0	5.5*
300	210	70.0	2.6
100	70	70.0	4.6
30	21	70.0	8.4

In Table 10, N = observations;
X = Hispanics;
P = Proportion Hispanic (x/n)
S_p = Standard error of p in percent

* When x or (n-x) drops below 5, the values of the normal distribution are no longer appropriate. For this row, the two sigma upper and lower limits are 97.5 and 73.7 percent.

7.0 RARELY OCCURRING SURNAMES: OR WHEN DO STATISTICS END AND WHEN DOES COMMON SENSE TAKE OVER?

To this point we have confined our comments to surnames appearing 5 or more times in our data set. Those 34,000 surnames encompass 85 percent of the householder population in the SOR file but less than 15 percent of the **number** of different surnames appearing in that file. Our goal is to classify every surname appearing on the SOR file; but for names appearing less than five times the proportion Hispanic should not and will not be the sole criterion for classification. In this section, we outline the thought process used in classifying infrequently occurring surnames. The exact details are found in Appendix Section 10.2 on page 21.

The 7.2 million record SOR file is a reasonably representative national sample (almost 3 percent) of persons enumerated in the 1990 Census. In general terms, it is quite possible to designate a surname as being Heavily Hispanic or Rarely Hispanic from samples of three or possibly even two surnames; but samples of this size are inappropriate for separating Generally Hispanic from Moderately Hispanic or Moderately Hispanic from Occasionally Hispanic. Table 11 presents data demonstrating why it is difficult to badly misclassify the ethnicity of a surname when 5 independent observations of that surname exist.

Assume that we are trying to categorize three separate surnames, and that five independent observations exist for each name. We also happen to know that among **all** Americans, surname "H" (Heavily) is 90 percent Hispanic; surname "M" (Midway) is 50 percent Hispanic and surname "R" (Rarely) is 2 percent Hispanic. Table 11 provides binomial probabilities (in percent) of getting 0, 1, 2, 3, 4, and 5 persons identifying as Hispanic for each of these three surnames.

TABLE 11—PROBABILITY OF FINDING “X” HISPANICS FROM 5 INDEPENDENT OBSERVATIONS

(Numbers in percent)

X	Name “H” (90%)	Name “M” (50%)	Name “R” (2%)
0	0.0	3.1	90.4
1	0.1	15.6	9.2
2	0.8	31.3	0.4
3	7.3	31.3	0.0
4	32.8	15.6	0.0
5	59.1	3.1	0.0

Armed with this knowledge, it is evident that for Heavily Hispanic (”H”) or Rarely Hispanic (”R”) surnames there is little chance of misclassifying a surname that occurs 5 times. If our five observation sample were to yield three Hispanics, we might be tempted to classify the surname as “H” when it should have been “M” or vice versa, but there is little chance that a type “R” name could provide 3 Hispanics in a sample of 5 independent observations.

7.1.1 Classification of 1980 Spanish Surnames Occurring 4 or Fewer Times on the SOR Sample. Table 12 presents data on the number of “householders” with Spanish surnames (1980 definition) whose surname surfaced four or fewer times on the SOR file.

TABLE 12—SURNAMES INCLUDED ON THE 1980 SPANISH SURNAME LIST WHICH APPEAR 4 OR FEWER TIMES ON THE SOR FILE

		Number of Hispanics				
Distinct Surnames	Appearances	4	3	2	1	0
424	4	**273**	91	30	14	16
594	3		**401**	100	53	40
1143	2			**790**	229	124
2358	1				**1784**	574
5882	0					

To aid in interpreting Table 12, the 1143 different surnames appearing exactly 2 times on the SOR sample represent 2286 (2 x 1143) householders. In 790 instances both householders having those particular surnames identified as Hispanic; in 229 cases one householder with the surname was Hispanic and one was not; in 124 cases neither householder with that surname said they were Hispanic. Overall, 74.8 percent of Spanish surnamed (1980 list) householders with names appearing exactly two times on the SOR file self-identified as Hispanic in the 1990 file.

It is especially enlightening to note that nearly one-half (5882) of the 12,497 surnames on the 1980 Spanish surname list did not even occur in the SOR file. For those 5882 names we **can not** make any judgement as to whether those names are associated with persons who are Hispanic origin. There are two reasons why the SOR file did not capture those 5,882 surnames: (1) Many of these 1980 names may have themselves been the result of miskeying (e.g., RODRIGUF); (2) The data base used in assembling the 1980 list consisted of 80 million observations; this sample uses only 1.8 million records. In any case, the length (number of names) of a surname list has little correlation on its effectiveness.

Table 13 presents data on the “householders” whose surname occurs 4 or fewer times on the SOR file and that surname **did not appear** on the 1980 Spanish surname list.

TABLE 13—SURNAMES THAT ARE NOT INCLUDED ON THE 1980 SPANISH SURNAME LIST AND APPEAR 4 OR FEWER TIMES ON THE SOR FILE

		Hispanic Responses				
Distinct Surnames	Appearances	4	3	2	1	0
9,056	4	48	34	57	362	8,555
16,115	3		180	142	543	15,250
37,073	2			740	1,146	35,187
165,407	1				9,849	155,558

Since none of the entries appearing in Table 13 was previously (1980 surname list) classified as Hispanic, we would never consider reclassifying surnames included in the far right column of Table 13 into any positive Hispanic category. The names appearing in the remaining cells in Table 13 will be categorized by more subjective measures described in the Appendix. One possible yardstick for classifying surnames might have been to extend the binomial expansion appearing in Table 11 to lesser numbers of sample observations. For example, the probability that 4 independent readings on a truly Spanish surname (90 percent successful in identifying Hispanics) would yield 1 or 0 Hispanics is 0.3 and 0.0 percent respectively. But we decided against employing the binomial because we have additional data at our disposal for classifying ethnicity of surnames.

There is a natural predilection to retain any surname appearing on the existing 1980 Spanish surname list unless the evidence for removal is strong. And we don’t want to add additional surnames to the 1990 list unless there is overriding evidence for doing so. For surnames occurring often, we feel that the probability of misclassification is minimal, but the chance of misclassifying ethnicity based only on probabilities rises sharply as the sample shrinks. To aid us in our classification of surnames we turn to:

7.1.2 Orthographic Structure of Surname and Hispanic Status of Surname in 1980. For names occurring 4, 3, or even 2 times the entries on the binomial expansion can be of some guidance. But for surnames with single observations, the binomial expansion is useless. For that reason, we have assembled two additional items of information to guide us on the classification of surnames. They are (1) orthographic structure of surnames and (2) whether that surname appeared among the 12,497 surnames on the 1980 Spanish surname list.

7.1.3 Orthographic Structure of Surnames. Linguists, particularly the late Robert W. Buechley (Buechley, 1961, 1967, 1971, 1976), have observed that certain letter combinations are common amongst Spanish surnames. The two letter ending EZ as in MARTINEZ, RODRIGUEZ and LOPEZ is almost always indicative of a Spanish surname. But of even greater importance for Spanish surname classification is the fact that certain letter formations never or almost never occur among Spanish surnames.

We initially parsed all surnames appearing 5 or more times in the SOR file by the Hispanic classifications described previously. We discovered (not surprisingly) that no surname falling into Heavily, Generally, or Moderately category contained either a K or a W. Based on that finding, it would be logical to assume that any surname containing the letter K or W should not be classified Hispanic regardless of its performance in the SOR sample.

In addition to checking for the appearance of a K and/or W anywhere in the surname we also analyzed opening three letter and closing three letter combinations. The letters SMI as in SMITH and

JOH as in JOHNSON never initiated surnames falling into the first 3 Hispanic categories and ITH is not a Hispanic ending among frequently occurring SOR names. Buechley had previously determined that there are 1465 valid 3 letter starts and 1114 valid 3 letter endings among Spanish surnames. (More information on starts and endings appear in the technical Appendix.)

A third orthographic finding is that double letters excepting R and L just don't occur. The notable exceptions are S **AA** VEDRA, JA **SS** O, DELO **SS** ANTOS, and CO **TT** O. Thus a surname containing a double letter excepting RR and LL should not be classified as Spanish regardless of the proportion of householders with that surname who are Hispanic in the SOR file.

7.1.4 Hispanic Status of Surname in 1980. A second and final auxiliary item of information used in determining Hispanic classification for low occurrence surnames in the SOR was the 1980 status. We felt that the previous research was sound and the knowledge of whether a surname was or was not Spanish on the previous list was a piece of information to be used in categorizing surnames.

Summary—For frequently occurring surnames (e.g., 5 or more times in the SOR file), we believe that proportion Hispanic should be the sole means for classifying a surname. For rarely occurring surnames, there are three indicators used in classifying. They are, listed in importance: (1) proportion Hispanic, (2) orthographic structure, and (3) appearance on 1980 surnames list. See Section 10.2 in the Appendix for additional details on how these three criteria fit into a point value system.

8.0 CONCLUSION

The authors hope that the evidence presented here convinces the reader that a well constructed Spanish surname list is a useful alternative for identifying persons of Hispanic origin when Hispanic origin is not known. In some instances (estimating rate of change in the Hispanic origin population) defining Spanish origin solely through the use of surname may be preferable to self-designated Hispanic origin because surname provides a "consistent" response.

With very few exceptions every frequently occurring surname is either Heavily Hispanic or Rarely Hispanic and there is no middle ground. This finding is the determining factor why Spanish surname is such an excellent proxy for identifying Hispanics within the United States. Based on the analysis of the SOR file, fewer than 1000 surnames are sufficient for capturing 80 percent of the Hispanic population in the United States. Moreover, householders with those surnames are Hispanic 95 percent of the time.

The Census Bureau has released Spanish surnames following the Censuses of 1950, 1960, 1970, and 1980. This 1990 edition is only another station on an ongoing research journey, but this 1990 product does differ significantly from its predecessors. Each of the 25,277 individual surnames appearing on the electronic file that supplements this report contain auxiliary information allowing prospective users the flexibility to construct their own Spanish surname list if necessary. For example, we provide data on the surnames **SMITH, JONES,** and **ROBINSON** as well as **GARCIA, GOMEZ,** and **SILVA**. Granted, it is unlikely that any one would use this auxiliary information to conclude that **SMITH** is a Spanish surname. In theory, we are not providing a Spanish surname "list". Rather, we provide auxiliary data for each surname that can be sorted into a continuum allowing the prospective user to determine his or her own criteria as to what is or is not a Spanish surname.

If the SOR sample universe was doubled or even tripled (we had 1.9 million households in the SOR sample), we might have a better measure for classifying surnames that now appear 3 to 5 times. But a larger sample would also double or triple the number of persons named **SMITH** and **GARCIA** where the current sample size is already sufficient for classifying Hispanic status. Moreover, surnames that do not occur in this sample might appear 1 or 2 times in the larger sample and the problems with infrequently occurring surnames would still remain; only the infrequent surnames would be different.

9.0 REFERENCES

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10.0 APPENDIX

A significant portion of the Appendix is written for persons requiring electronic access to individual surname data. Consequently, persons with only a casual interest in Spanish surnames can be adequately served by reading section 10.3 and browsing the contents of Appendix Table A.

10.1 SERVING OUR CUSTOMERS

From talking to prospective customers of Spanish surname data, we conclude that we are serving two or perhaps even three classes of customers. The three classes include:

10.1.1 Persons who are satisfied with a minimal number of surnames (preferably on a piece of paper) that adequately cover a large proportion of the Hispanic origin/surnamed population within the United States. For these persons, we provide 639 Heavily Hispanic Spanish surnames arranged in alphabetic order in Appendix Table A. Persons with those surnames represent more than two-thirds of the Hispanic origin population and approximately 80 percent of the Spanish surnamed population (see Section 5.1 of the main text). The 639 surnames share two characteristics:

(1) For each surname appearing in Appendix Table A, at least 25 SOR "householders" provided positive responses to the Spanish origin question on their 1990 Census forms.

(2) Each of the 639 surnames listed in Appendix Table A qualify as heavily (75 percent) Hispanic. Overall, 94 percent of the householders in the United States with those surnames answered the 1990 Hispanic origin question affirmatively.

Note that these criteria do not precisely produce the tabulations appearing in Table 6A. There, we tabulated responses from 715 surnames that **both** occurred 25 or more times in the SOR file **and** appeared on the 1980 Spanish surname list. None of those 715 surnames were subjected to a minimum standard for percent Hispanic. In fact, one of those 715 surnames (DECASTRO) is now classified as occasional Hispanic.

For a surname to appear in Appendix Table A, we require 25 positive responses in the SOR file and a minimum Hispanic "hit rate" of 75 percent. Thus a 1980 Spanish surname that appeared 27 times in the SOR file with 24 positive Hispanic entries would be an entry in Table 6A but not in Appendix Table A.

For many purposes, this abridged 639 surname list is sufficient for making a reasonably accurate assessment on the number or proportion Hispanic within a group. Consider an organization of 100 persons. Twenty of the organization's members have surnames that match the abbreviated 639 entry surname list. Armed with this information one can reasonably conclude that between 20 and 30 members are Hispanic. The number 30 is derived by dividing matched members (20) by 2/3—the proportion of the Hispanic population with these 639 surnames. For many/most uses an approximation with this level of accuracy suffices as a "ball park" estimator.

10.1.2 Persons who need surname data in electronic form and want the flexibility of customizing their own Spanish surname lists. The authors have arbitrarily categorized a surname to be Heavily Hispanic if more than 75 percent of householders with that name are Hispanic. Some users of Spanish surname data might wish to construct a surname base of Heavily Hispanic names where the criteria for Heavily is 90 percent, or 60 percent or some intermediate value. These customers will receive a flat file of 25,276 surnames arranged in nine data fields.

For purposes of illustration, we provide the contents for four individual names.

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9
0225	SILVA	0	2	710	499	407	344	0.441
0105	FEBUS	0	-2	8	5	7	5	1.875
0325	FELIX	1	2	187	132	88	78	-0.160
5500	BROOKS	0	-6	1714	587	5	4	-2.987

SILVA's category—0225—indicates that the surname is Generally Hispanic with more than 25 positive occurrences. The name did not appear on the 1980 list, but it does pass the Buechley test. The surname is much more likely (344/499) to be Hispanic in Hispanic states than non-Hispanic states (63/211).

FEBUS's, 0105 classification signifies that the surname is Heavily Hispanic with between 5 and 9 positive occurrences. The surname was not on the 1980 Spanish surname list. The final three letters in the surname (BUS) do not match the Buechley "Ends". Of the 8 householders with the name FEBUS, 7 are Hispanic. All 5 householders living in "Spanish States" are Hispanic.

FELIX is similar to SILVA except that the surname FELIX did appear on the 1980 Spanish surname list. It's category 0325 indicates that the surname is classified as Moderately Hispanic and there are more than 25 positive replies to the Hispanic question in the SOR sample.

BROOKS appears on the electronic file because it had at least one (actually 5) positive responses on the SOR file. The category 5500 indicates that the surname is Rarely Hispanic and that there are at least 500 negative responses for that surname. BROOKS (as expected) was not on the 1980 Spanish surname list. The score of -6 for Buechley occurs because of the existence of the letter K, the ending (OKS), and the double OO in the middle of the name.

Field 1 A numeric descriptor (located in positions 1-4) that provides both a Hispanic classification and a frequency grouping. Each of the 25,276 surnames appearing in these files falls into one and only one of 28 mutually exclusive categories. Appendix Table B (Spanish Surname Categories) define these 28 groupings.

Field 2 The surname itself—limited to 13 characters and appearing in positions 6 through 18.

Field 3 A "1" or a "0" appearing in column 20. A "1" signifies that this particular surname appears on the 1980 Spanish surname list; a "0" indicates that it did not.

Field 4 A positive "2" in column 24 or a negative even number appearing in columns 22 through 24. A "2" in column 24 signifies that the particular surname passes all the Buechley criteria. (See section 7.1.3 in main text for reference to Robert A. Buechley) A negative 2, 4, 6, 8, or 10 indicates whether the surname violates 1, 2, 3, 4, or even 5 Buechley rules.

Buechley Rule 1 — the letter K anywhere in name
Buechley Rule 2 — the letter W anywhere in name
Buechley Rule 3 — starts (initial 3 letters)
Buechley Rule 4 — ends (final 3 letters)
Buechley Rule 5 — double letters (excepting rr and $$)

Field 5 Total number of householders in the SOR File possessing the surname appearing in Field 2. Columns 25 through 30.

Field 6 Number of householders in the SOR file residing in one of the 11 states with large numbers of Hispanics. Columns 31 through 35.

We define the following 11 states to contain a large number of Hispanics: 1. Arizona, 2. California, 3. Colorado, 4. Connecticut, 5. Florida, 6. Illinois, 7. New Jersey, 8. New Mexico, 9. New York, 10. Pennsylvania, and 11. Texas.

Field 7 Total householders (national) with this surname who provide a positive response to the Spanish origin question. Columns 36 through 40. The ratio of the entry in Field 7 to the entry in Field 5 generates national Hispanic proportions for that particular surname.

Field 8 Hispanic householders in 11 States with large numbers of Hispanics. Columns 41 through 45. The ratio of the entry in Field 8 to the entry in Field 6 yields the Hispanic proportion for those 11 States.

Field 9 "Point Value of Surname" An integer (possibly preceded by a negative sign), decimal point, followed by three digits appears in columns 47 through 52. Although each and every one of the 25,276 surnames appearing in the electronic file is assigned a point value, that point value is only germane for classifying surnames when the number of positive and negative responses is fewer than 5.

10.1.3 Customers who want surname data in electronic form, but are willing to accept census "Hispanic" classifications. For those customers, we provide a file of surnames arranged in strict alphabetic order with the same 9 data fields described above. The major difference is that the number of surnames is limited to the 12,215 names which are classified as Heavily Hispanic. In addition to the surname data described above, we also furnish two additional tables which are:

(2) Electronic Table 3—STARTS is a file of 1465 three letter combination which start Spanish surname.

(3) Electronic Table 4—ENDS is a file of Buechley's 1114 three letter combinations which end Spanish surname.

The entries appearing in STARTS and ENDS are primarily a product of Buechley's research; but Passel and Word uncovered some inconsistencies which were relayed to Buechley in 1978. This version of STARTS and ENDS does not incorporate those additions to Buechley's original work.

10.2 POINT VALUES FOR INFREQUENTLY OCCURRING SURNAMES

In Section 7.0 of this paper (Rarely Occurring Surnames: or Where Do Statistics End and When Does Common Sense Take Over?) we allude to the fact that proportion Hispanic would not and could not be the sole determinant for whether a prospective surname is Spanish and to which of the five categories (Heavily, Generally, Moderately, Occasionally, and Rarely) the surname is assigned.

From rereading the description of Field 9 in Section 10.1.2, it is immediately clear that any surname appearing 9 or more times is classified solely on the basis of proportion Spanish and any surname with fewer than 5 householder occurrences will be classified on the basis of point value. Some names appearing 5 to 9 times in the SOR file are assigned a Hispanic category based on proportion Hispanic while other surnames with 5 to 9 SOR appearances are classified only on point value.

As described in Section 7.0 there are three characteristics that can be used to classify a surname. These characteristics are:

(1) proportion of times possessor of surname is Spanish, (2) whether or not the surname follows acceptable Spanish language constructions, and (3) whether or not the 1980 research assigned that surname to be Spanish. We assigned points for each of these three attributes, with the assignment following the order described below:

1. For "householders" with a given surname captured in the SOR sample, how often does the possessor of that surname provide a positive Hispanic response? Give each Hispanic response a value of +3 and each non-Hispanic response a value of negative 3.

2. Does the surname adhere to or violate “orthographic correctness?” If the surname follows all 5 orthographic rules assign the surname a value of +2; assign a value of -2 for each violation.

> For example, DAVIS (which could be pronounced Dah Vees) violates no orthographic precepts. The starting three letters D A V appear in DAVILLA, the ending three letters V I S occur in OROVIS. DAVIS contains no W’s, no K’s, nor does it contain a double letter. All five American surnames occurring more frequently than DAVIS (eg. SMITH, JOHNSON, WILLIAMS, BROWN, and JONES) violate at least one of the orthographic rules which typify “Spanish” surnames.

3. Did the surname appear on the Census Bureau’s 1980 Spanish Surname List? Give the surname a value of +1 if yes, and a value of -1 if no.

The point value of the surname is defined to be total points divided by total occurrences. If a name occurs only once, it could have a value as high as +6.00, and a theoretical low of -14.00. For example, the surname WEEKS receives -10 points on the orthographic variable alone. For frequently occurring surnames, the number of points awarded for orthographics and appearance on the 1980 Spanish surname list has very little weight. We illustrate this point with a surname occurring 100 times and a success rate of 95 percent.

AN ILLUSTRATION OF POINT SCORE CALCULATION:

Based on 100 observations

	Answers		Points Awarded		
	Yes	No	Yes	No	Total
(1) Response to Spanish origin question	95	5	285	-15	270
(2) Orthographics	1		2		2
(3) Appearance on 1980 List	1		1		1
Total Points			288	-15	273
Point Score					2.73

A frequently occurring Heavily Hispanic surname will achieve a point value ranging between 1.5 and 3.0. Point values of 2.5 to 2.7 are typical. The Heavily Hispanic standard for **infrequently** occurring surnames is set at equal to or greater than 2.00. It is possible for a surname appearing exactly one time on the SOR file with a single positive Spanish response to fall in the Heavily Hispanic category even though the surname did not appear on the 1980 Spanish surname list. But that surname **must** satisfy all five orthographic principles to receive the Heavily Hispanic designation.

The point values for Generally Hispanic were set at +1.00 to +1.99. The bounds for Moderately Hispanic were pegged from -0.50 to +0.99. As might be expected, the point values used in classifying infrequently occurring surnames parallel the values for frequently occurring surnames. We decided that it was virtually impossible to make an Occasionally Hispanic determination for infrequently occurring surnames. For that reason Spanish categories 0401 and 0402 (Appendix Table B) do not exist.

10.3 COMPARING HEAVILY HISPANIC WITH RARELY HISPANIC SURNAMES

Here we compare attributes of surnames for category 125—surnames with at least 25 Hispanic responses that are more than 75 percent Hispanic with category 5500 (surnames with more than 500 non-Hispanic responses that are less than 5 percent Hispanic). Data for the remaining 26 categories can be found in Appendix Table C.

Category	**125**	**5500**
Number of Surnames	639	353
Number of Observations	115,526	522,614
Percent Hispanic	94.2	0.7
Percent residing in Spanish States	86.3	37.2
Percent Passing Buechley	99.8	21.8
Percent on 1980 List	100.0	0.0

The analytic data associated with these most diverse categories of surnames aptly illustrate the points that we have made throughout the text.

1. Nearly 95 percent (94.2) of the male householder population with commonly “acknowledged” Spanish surnames identified themselves as Hispanic in the 1990 Census. Less than 1 percent of male householders with the most frequently occurring “non-Spanish” surname identified as Hispanic in the 1990 Census.

2. 86.3 percent of the persons possessing commonly “acknowledged” Spanish surnames reside in 11 states. The 1990 Census found 87.7 percent of the Hispanic origin population living in those same 11 states. By contrast, only 37 percent of persons with Anglo surnames reside in those same 11 states.

3. For the 639 surnames appearing in Appendix Table A, there are 638 surnames (99.8 percent) adhering to the Buechley rules. The one exception (COTTO) contains a double T. Although Buechley’s rules reject all doubletons except RR and LL, Spanish surnames containing a double T have been found in the SOR file.

4. Finally, all of the 639 most frequently occurring Spanish surnames were previously (1980) classified as Spanish. Not one of the 353 frequently occurring “Anglo” names were ever candidates for inclusion on a Spanish surname list.

APPENDIX TABLE A: 639 MOST FREQUENTLY OCCURRING HEAVILY HISPANIC SURNAMES

(Number to right of surname indicates relative ranking among Spanish surnames)

Abeyta	476	Baca	157	Carrion	340	Dominguez	63	Guardado	587
Abrego	534	Badillo	515	Carvajal	478	Dominquez	448	Guerra	85
Abreu	416	Baez	193	Casanova	419	Duarte	201	Guerrero	54
Acevedo	112	Baeza	456	Casares	600	Duenas	499	Guevara	211
Acosta	60	Bahena	616	Casarez	458	Duran	76	Guillen	311
Acuna	370	Balderas	359	Casas	341	Echevarria	394	Gurule	539
Adame	326	Ballesteros	552	Casillas	271	Elizondo	379	Gutierrez	24
Adorno	549	Banda	339	Castaneda	123	Enriquez	173	Guzman	43
Agosto	597	Banuelos	378	Castellanos	261	Escalante	349	Haro	471
Aguayo	409	Barajas	220	Castillo	25	Escamilla	275	Henriquez	480
Aguilar	45	Barela	405	Castro	37	Escobar	139	Heredia	336
Aguilera	243	Barragan	526	Cavazos	228	Escobedo	244	Hernadez	528
Aguirre	104	Barraza	381	Cazares	406	Esparza	169	Hernandes	520
Alanis	598	Barrera	111	Ceballos	498	Espinal	500	Hernandez	5
Alaniz	267	Barreto	497	Cedillo	571	Espino	469	Herrera	33
Alarcon	364	Barrientos	432	Ceja	410	Espinosa	143	Hidalgo	282
Alba	404	Barrios	200	Centeno	459	Espinoza	68	Hinojosa	229
Alcala	424	Batista	418	Cepeda	467	Esquibel	460	Holguin	372
Alcantar	567	Becerra	226	Cerda	296	Esquivel	231	Huerta	188
Alcaraz	599	Beltran	158	Cervantes	99	Estevez	619	Hurtado	253
Alejandro	550	Benavides	208	Cervantez	479	Estrada	52	Ibarra	114
Aleman	347	Benavidez	310	Chacon	213	Fajardo	382	Iglesias	489
Alfaro	207	Benitez	172	Chapa	247	Farias	428	Irizarry	233
Alicea	303	Bermudez	227	Chavarria	306	Feliciano	205	Jaime	442
Almanza	387	Bernal	168	Chavez	22	Fernandez	29	Jaimes	588
Almaraz	551	Berrios	299	Cintron	348	Ferrer	360	Jaquez	553
Almonte	614	Betancourt	290	Cisneros	135	Fierro	395	Jaramillo	171
Alonso	238	Blanco	163	Collado	536	Figueroa	59	Jasso	472
Alonzo	264	Bonilla	153	Collazo	318	Flores	13	Jimenez	35
Altamirano	466	Borrego	398	Colon	53	Florez	429	Jiminez	490
Alva	568	Botello	516	Colunga	434	Fonseca	335	Juarez	78
Alvarado	56	Bravo	194	Concepcion	426	Franco	116	Jurado	603
Alvarez	27	Briones	457	Contreras	71	Frias	461	Laboy	540
Amador	281	Briseno	433	Cordero	180	Fuentes	97	Lara	94
Amaya	265	Brito	333	Cordova	142	Gaitan	573	Laureano	604
Anaya	195	Bueno	316	Cornejo	441	Galarza	449	Leal	176
Anguiano	477	Burgos	209	Corona	186	Galindo	179	Lebron	400
Angulo	438	Bustamante	274	Coronado	221	Gallardo	232	Ledesma	300
Aparicio	535	Bustos	399	Corral	353	Gallegos	73	Leiva	622
Apodaca	273	Caballero	268	Corrales	601	Galvan	125	Lemus	297
Aponte	236	Caban	439	Correa	159	Galvez	307	Leon	95
Aragon	230	Cabrera	105	Cortes	175	Gamboa	354	Lerma	322
Arana	581	Cadena	440	Cortez	64	Gamez	302	Leyva	258
Aranda	285	Caldera	582	Cotto	468	Gaona	501	Limon	383
Arce	288	Calderon	107	Covarrubias	518	Garay	538	Linares	368
Archuleta	289	Calvillo	617	Crespo	278	Garcia	1	Lira	401
Arellano	190	Camacho	98	Cruz	17	Garibay	527	Llamas	554
Arenas	525	Camarillo	425	Cuellar	246	Garica	620	Loera	412
Arevalo	321	Campos	84	Curiel	572	Garrido	430	Lomeli	555
Arguello	569	Canales	260	Davila	129	Garza	26	Longoria	192
Arias	166	Candelaria	366	Deanda	584	Gastelum	586	Lopez	4
Armas	615	Cano	167	Dejesus	131	Gaytan	462	Lovato	502
Armendariz	447	Cantu	102	Delacruz	151	Gil	262	Loya	420
Armenta	417	Caraballo	317	Delafuente	585	Giron	411	Lozada	541
Armijo	377	Carbajal	367	Delagarza	371	Godinez	388	Lozano	122
Arredondo	212	Cardenas	106	Delao	602	Godoy	621	Lucero	124
Arreola	365	Cardona	214	Delapaz	537	Gomez	15	Lucio	481
Arriaga	397	Carmona	252	Delarosa	164	Gonzales	12	Luevano	491
Arroyo	132	Carranza	269	Delatorre	237	Gonzalez	6	Lugo	137
Arteaga	332	Carrasco	210	Deleon	81	Gracia	389	Lujan	215
Atencio	496	Carrasquillo	570	Delgadillo	427	Granado	519	Luna	66
Avalos	250	Carreon	583	Delgado	46	Granados	350	Macias	115
Avila	86	Carrera	517	Delrio	393	Griego	435	Madera	542
Aviles	245	Carrero	618	Delvalle	334	Grijalva	470	Madrid	185
Ayala	65	Carrillo	77	Diaz	14	Guajardo	308	Madrigal	270

APPENDIX TABLE A: 639 MOST FREQUENTLY OCCURRING HEAVILY HISPANIC SURNAMES

(Number to right of surname indicates relative ranking among Spanish surnames)

Maestas	304	Nazario	545	Posada	593	Salcedo	532	Vaca	636
Magana	248	Negrete	324	Prado	294	Salcido	309	Valadez	330
Malave	521	Negron	216	Preciado	531	Saldana	219	Valdes	240
Maldonado	51	Nevarez	369	Prieto	313	Saldivar	445	Valdez	47
Manzanares	623	Nieto	251	Puente	358	Salgado	184	Valdivia	524
Mares	402	Nieves	120	Puga	609	Salinas	80	Valencia	127
Marin	177	Nino	626	Pulido	444	Samaniego	511	Valentin	257
Marquez	61	Noriega	344	Quesada	484	Sanabria	454	Valenzuela	110
Marrero	178	Nunez	58	Quezada	292	Sanches	431	Valladares	577
Marroquin	312	Ocampo	355	Quinones	146	Sanchez	8	Valle	235
Martinez	2	Ocasio	361	Quinonez	413	Sandoval	55	Vallejo	386
Mascarenas	589	Ochoa	91	Quintana	140	Santacruz	631	Valles	396
Mata	138	Ojeda	255	Quintanilla	277	Santana	117	Valverde	548
Mateo	503	Olivares	272	Quintero	162	Santiago	41	Vanegas	637
Matias	529	Olivarez	305	Quiroz	218	Santillan	562	Varela	223
Matos	202	Olivas	291	Rael	463	Sarabia	632	Vargas	36
Maya	556	Olivera	558	Ramirez	10	Sauceda	512	Vasquez	23
Mayorga	605	Olivo	475	Ramon	407	Saucedo	239	Vazquez	62
Medina	30	Olmos	507	Ramos	20	Sedillo	594	Vega	49
Medrano	191	Olvera	276	Rangel	133	Segovia	523	Vela	182
Mejia	93	Ontiveros	301	Rascon	610	Segura	241	Velasco	293
Melendez	109	Oquendo	530	Raya	561	Sepulveda	280	Velasquez	96
Melgar	624	Ordonez	421	Razo	492	Serna	249	Velazquez	130
Mena	323	Orellana	443	Regalado	403	Serrano	89	Velez	83
Menchaca	482	Ornelas	283	Rendon	287	Serrato	612	Veliz	578
Mendez	39	Orosco	452	Renteria	256	Sevilla	613	Venegas	375
Mendoza	32	Orozco	147	Resendez	485	Sierra	187	Vera	197
Menendez	337	Orta	436	Reyes	19	Sisneros	563	Verdugo	579
Meraz	543	Ortega	50	Reyna	149	Solano	315	Verduzco	638
Mercado	103	Ortiz	16	Reynoso	325	Solis	90	Vergara	495
Merino	557	Osorio	338	Rico	295	Soliz	385	Viera	415
Mesa	342	Otero	174	Rincon	522	Solorio	446	Vigil	136
Meza	156	Ozuna	559	Riojas	574	Solorzano	564	Villa	134
Miramontes	606	Pabon	590	Rios	48	Soria	437	Villagomez	465
Miranda	79	Pacheco	92	Rivas	88	Sosa	118	Villalobos	225
Mireles	298	Padilla	57	Rivera	9	Sotelo	328	Villalpando	596
Mojica	343	Padron	508	Rivero	373	Soto	34	Villanueva	145
Molina	67	Paez	607	Robledo	509	Suarez	101	Villareal	423
Mondragon	450	Pagan	148	Robles	82	Tafoya	455	Villarreal	87
Monroy	544	Palacios	181	Rocha	121	Tamayo	414	Villasenor	392
Montalvo	254	Palomino	627	Rodarte	493	Tamez	595	Villegas	165
Montanez	286	Palomo	591	Rodrigez	629	Tapia	141	Yanez	266
Montano	203	Pantoja	356	Rodriguez	3	Tejada	513	Ybarra	189
Montemayor	504	Paredes	357	Rodriquez	38	Tejeda	464	Zambrano	488
Montenegro	505	Parra	217	Rojas	74	Tellez	352	Zamora	108
Montero	351	Partida	453	Rojo	510	Tello	565	Zamudio	639
Montes	154	Patino	345	Roldan	391	Teran	633	Zapata	224
Montez	451	Paz	327	Rolon	611	Terrazas	533	Zaragoza	376
Montoya	70	Pedraza	592	Romero	28	Tijerina	362	Zarate	331
Mora	119	Pedroza	422	Romo	222	Tirado	329	Zavala	170
Morales	18	Pelayo	546	Roque	486	Toledo	363	Zayas	514
Moreno	31	Pena	42	Rosado	144	Toro	346	Zelaya	580
Mota	483	Perales	384	Rosales	113	Torres	11	Zepeda	234
Moya	279	Peralta	263	Rosario	126	Torrez	242	Zuniga	155
Munguia	506	Perea	390	Rosas	152	Tovar	204		
Muniz	160	Peres	560	Roybal	408	Trejo	206		
Munoz	40	Perez	7	Rubio	128	Trevino	72		
Murillo	183	Pichardo	608	Ruelas	630	Trujillo	69		
Muro	625	Pina	196	Ruiz	21	Ulibarri	566		
Najera	319	Pineda	161	Ruvalcaba	575	Ulloa	494		
Naranjo	473	Pizarro	628	Saavedra	314	Urbina	374		
Narvaez	474	Polanco	320	Saenz	199	Urena	634		
Nava	198	Ponce	150	Saiz	487	Urias	576		
Navarrete	380	Porras	547	Salas	100	Uribe	284		
Navarro	75	Portillo	259	Salazar	44	Urrutia	635		

APPENDIX TABLE B: SPANISH SURNAME CATEGORIES

In Section 10.1.2 we described the file layout of the nine data fields associated with each surname. Now we concentrate on data field 1. The first two characters in field 1 denote Hispanic classification (01 for Heavily, 02 for Generally, 03 for Moderately, 04 for Occasionally and 05 for Rarely). The 3rd and 4th characters represent a frequency indicator.

When the frequency indicator (positions 3 and 4) takes on numerical values 05 through 25 (05, 10, 15, 25), Hispanic classification (Heavily, Generally, etc.) is determined strictly on the basis of proportion Hispanic as described in Section 5 of the text. When the frequency indicators are 01 or 02, (those names with 4 or fewer positive or negative) responses), we need to be more innovative. See Point Values for Infrequently Occurring Surnames. (Section 10.2 of this Appendix.)

Heavily Hispanic Surnames

Category	Entries	Description
0125	639	Surnames that are Heavily Hispanic with at least 25 positive Hispanic responses.
0115	251	Surnames that are Heavily Hispanic with at least 15 but no more than 24 positive responses.
0110	263	Surnames that are Heavily Hispanic with at least 10 but no more than 14 positive responses.
0105	625	Surnames that are Heavily Hispanic with at least 5 but no more than 9 positive responses.
0102	2463	Surnames that are Heavily Hispanic with at least 2 but no more than 4 positive responses.
0101	7974	Surnames that are Heavily Hispanic with exactly 1 positive Hispanic response.

Generally Hispanic Surnames

Category	Entries	Description
0225	39	Surnames that are Generally Hispanic with at least 25 positive Hispanic responses.
0215	25	Surnames that are Generally Hispanic with at least 15 but no more than 24 positive responses.
0210	25	Surnames that are Generally Hispanic with at least 10 but no more than 14 positive responses.
0205	106	Surnames that are Generally Hispanic with at least 5 but no more than 9 positive responses.
0202	354	Surnames that are Generally Hispanic with at least 2 but no more than 4 positive responses.
0201	218	Surnames that are Generally Hispanic with exactly 1 positive Hispanic response.

Moderately Hispanic Surnames

Category	Entries	Description
0325	11	Surnames that are Moderately Hispanic with at least 25 positive Hispanic responses.
0315	10	Surnames that are Moderately Hispanic with at least 15 but no more than 24 positive responses.
0310	21	Surnames that are Moderately Hispanic with at least 10 but no more than 14 positive responses.
0305	68	Surnames that are Moderately Hispanic with at least 5 but no more than 9 positive responses.
0302	260	Surnames that are Moderately Hispanic with at least 2 but no more than 4 positive responses.
0301	3611	Surnames that are Moderately Hispanic with exactly 1 positive Hispanic response.

Appendix Table B (continued)

For reasons cited in “Point Values for Infrequently Occurring Surnames”, Hispanic surname categories 0401 and 0402 do not exist.

Occasionally Hispanic Surnames

Category	Entries	Description
0425	5	Surnames that are Occasionally Hispanic with at least 25 positive Hispanic responses.
0415	13	Surnames that are Occasionally Hispanic with at least 15 but no more than 24 positive responses.
0410	16	Surnames that are Occasionally Hispanic with at least 10 but no more than 14 positive responses.
0405	65	Surnames that are Occasionally Hispanic with at least 5 but no more than 9 positive Hispanic responses.

Rarely Hispanic Surnames

Category	Entries	Description
5500	353	Surnames that are Rarely Hispanic with at least 500 negative responses and 1 or more positive Hispanic responses.
5100	1141	Surnames that are Rarely Hispanic with at least 100 but no more than 499 negative responses and 1 or more positive responses.
5025	1411	Surnames that are Rarely Hispanic with at least 25 but no more than 99 negative responses and 1 or more positive responses.
5010	986	Surnames that are Rarely Hispanic with at least 10 but no more than 24 negative responses and at least 1 but no more than 4 positive responses.
5005	969	Surnames that are Rarely Hispanic with at least 5 but no more than 9 negative responses and at least 1 positive response.
5001	3354	Surnames that are Rarely Hispanic with at least 1 but no more than 4 negative responses and at least 1 positive Hispanic response.

Category 5001 may include some surnames with 0 positive responses (and 1 to 4 negative responses) provided that that surname exists on the 1980 Spanish surname list.

The careful reader may have already realized that the 28 categories listed here do not encompass every surname appearing on the SOR file. For example a surname with 2 positive Hispanic responses and 50 negative responses would be tabulated in category 5025. Another surname with 0 (zero) positive responses and 50 negative responses would not be tabulated in any of the 28 categories. In fact, no surname with zero positive Hispanic responses in the SOR file (excepting surnames classified as Spanish in 1980) appear in Appendix Table B.

Because of this convention, the summary tabulations shown in Appendix Table C tend to overstate the proportion Hispanic within the Rarely Hispanic Classification. This phenomena is most noticeable with infrequently occurring surnames.

APPENDIX TABLE C: SELECTED SUMMARY STATISTICS FOR SPANISH SURNAMES

Heavily Hispanic

Category	**101**	**102**	**105**	**110**	**115**	**125**
Number of Names	7974	2463	625	263	251	639
Occurrences	7974	6626	4300	3295	5080	115526
Percent Hispanic	100.0	96.1	94.8	94.6	93.5	94.2
Percent in Spanish State	82.9	86.2	85.9	86.6	86.2	86.3
Percent Buechley-Yes	99.4	97.1	98.4	99.2	100.0	99.8
Percent on 1980 List	22.3	69.2	93.0	97.3	100.0	100.0

Generally Hispanic

Category	**201**	**202**	**205**	**210**	**215**	**225**
Number of Names	218	354	106	25	25	39
Occurrences	436	1041	1046	449	726	4038
Percent Hispanic	50.0	77.9	64.8	64.6	63.8	64.0
Percent in Spanish State	76.1	78.6	78.4	77.3	75.5	73.8
Percent Buechley-Yes	100.0	50.6	92.5	100.0	100.0	97.4
Percent on 1980 List	100.0	14.1	71.7	68.0	68.0	66.7

Moderately Hispanic

Category	**301**	**302**	**305**	**310**	**315**	**325**
Number of Names	3611	260	68	21	10	11
Occurrences	4288	1345	1187	640	522	1190
Percent Hispanic	71.4	49.7	37.2	39.2	38.1	39.6
Percent in Spanish State	75.2	69.2	65.9	65.6	60.7	61.7
Percent Buechley-Yes	32.2	82.7	94.1	90.5	100.0	100.0
Percent on 1980 List	17.0	34.6	25.0	14.3	10.0	9.1

Occasionally Hispanic

Category			**405**	**410**	**415**	**425**
Number of Names			65	16	13	5
Occurrences			3265	1445	2253	1375
Percent Hispanic			12.6	12.1	11.5	17.7
Percent in Spanish State			53.7	51.9	56.3	39.1
Percent Buechley-Yes			72.3	87.5	100.0	80.0
Percent on 1980 List			1.5	0.0	0.0	0.0

Rarely Hispanic

Category	**5001**	**5005**	**5010**	**5025**	**5100**	**5500**
Number of Names	3354	969	986	1411	1141	353
Occurrences	7940	7642	16689	74881	249666	522614
Percent Hispanic	41.5	15.6	7.7	2.5	1.0	0.7
Percent in Spanish State	62.4	54.6	48.2	41.0	38.4	37.2
Percent Buechley-Yes	22.9	44.6	39.1	31.1	24.8	21.8
Percent on 1980 List	7.0	3.2	1.0	0.0	0.0	0.0

It is important to note the low proportion of surnames in categories 102 (69.2 percent) and 101 (22.3 percent) that were classified as Hispanic in 1980. The evidence (proportion Hispanic, a pass on Buechley, and residence in 11 states where most Hispanic reside) suggests that the majority of persons possessing these names are borne by persons of Hispanic origin. But an examination of those surnames on a case by case basis suggests that the precise spelling of many of the names is incorrect. In other words, the sizeable number of surnames recorded as **VILLANVEVA** are almost assuredly a misinterpretation of **VILLANUEVA.**

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Appendix B
Asian and Pacific Islander Surnames List Documentation

The Asian and Pacific Islander Surname List:

As Developed from Census 2000

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U.S. Bureau of the Census

December 3, 2002

This paper reports the results of research and analysis undertaken by Census Bureau staff. It has undergone a Census Bureau review more limited in scope than that given to official Census Bureau publications. This report is released to inform interested parties of ongoing research and to encourage discussion of work in progress.

ABSTRACT

The Census Bureau has previously released a Spanish Surname list based on past decennial censuses. Among researchers, there is a demand for a similar list based on Asian race and Pacific Islander race. We call this list the Asian and Pacific Islander (API) Surname List.

We produced the API Surname List as a tool for the specific purpose of acting as an input to a logistic regression model that imputes missing race on administrative records. However, the API Surname List may be applied to other research as a comparison tool or even as a basic race imputation tool.

After preliminary edits, we summed the number of times a Census respondent with a given surname chose a race. We then calculated the proportion of persons with that surname by race; we divided the surname count for each race by the total count for each surname. Finally, we summed all of the Asian and Pacific Islander race proportions for each surname. We divided surnames into two groups: those with an API proportion of 0.50 or greater and those with a proportion less than 0.50. Note that only surnames with an API proportion of 0.50 or greater made the final list. Given these restrictions, about 56.8% of the API population had a surname on the final surname list. The count was 11,446 surnames.

To protect the privacy of the individual respondent, we set a minimum of 50 occurrences on Census 2000 as the limit for inclusion of a surname on the list. There is no link on the list to a respondent's geographic data, age, or first name; therefore no identification of an individual respondent is possible. Given this condition, we believe the API Surname List does not violate Title XIII or other U.S. privacy laws.

Although we combined eleven API races together, we did not limit the use of the data to our purposes only. Because of the method used, race specific lists can be readily derived using the same data. Researchers interested in a specific race such as Chinese or Korean can derive a surname list for that race only. Data comparison or race imputation are just two applications of the API Surname List.

INTRODUCTION

The Asian and Pacific Islander (API) population has rapidly grown from a small minority a few decades ago to large and ethnically diverse population groups. Since 1980, the Census Bureau has allowed for more accurate self-identification of race, including the introduction of eleven race categories for the API race. Thanks partially to better API race reporting stemming from the new category scheme, interest in detailed race data has spurred a demand for a surname list tied to Census Asian and Native Hawaiian/Pacific Islander (NHPI) races.

The principal purpose for the API Surname list is to improve race and ethic origin models on administrative records. Other applications of the API Surname list include, but are not limited to:

- Imputation of missing race on administrative records, surveys and censuses

- Planning for special enumeration methods focusing on the race of the respondent

- Evaluation of research data by comparison

Although an API race category was on included Census 1990, there is no single API race category on Census 2000.We assembled a race category called API from Census 2000 data, specifically for our race models. However, the API Surname list was designed to be flexible, in that a surname list specific to race can be produced for any of the eleven Asian or NHPI race groups.

This flexibility may provide the researcher with an alternative to a pervasive problem when using demographic survey or administrative data for survey or research: inaccurate or incomplete race data. The association of a surname with the Asian or NHPI race groups will allow researchers to fill missing data, or at the very least make reasonable assumptions about the race of the respondent based on their surname.

The possibility of using surname to enhance Census operations has been explored for many years at the Census Bureau. Various Spanish surname lists were produced from the censuses of 1950, 1960, 1970, 1980, and 1990. For example, the 1950 Spanish Surname List helped identify Hispanic population found in the five southwestern states of Arizona, California, Colorado, New Mexico, and Texas. More comprehensive lists were developed as additional data became available. For example, the 1980 Spanish Surname List attempted to link the geographic distribution of a Spanish name to the distribution of the Hispanic population in the United States.

Previous logistical race modeling efforts include research from Bye (1998), who compiled an API surname file based on four existing files:

1. From the Census Bureau, the 1990 Post Enumeration Survey (PES)
2. From the Social Security Administration (SSA) NUMIDENT file, a list of Hawaiian-born persons obtaining Social Security Numbers (SSN)

3. From SSA NUMIDENT, a list of over-50 persons born in 19 Asian countries who had an SSN in 1995 or earlier
4. From an Immigration and Naturalization Service file, a list of naturalized citizens born in 19 Asian countries

The resulting list contributed to the Census Numident Race and Ethnicity Individual Level Regression Model (Bye 1998). Note that the universe was somewhat limited due to a small sample size of API respondents.

Lauderdale and Kestenbaum (2000) attempted to improve Asian ethnic category identification. To this end, they compiled six Asian surname lists based on six major Asian ethnic categories using Social Security Administration data.

The 1990 Spanish Surname list (Word and Perkins 1996) was based on the Census Spanish Origin File (SOR). Since the SOR uses race self-identification, with a direct connection to a respondent's Hispanic origin and their first and last name, we considered the 1990 Spanish Surname list as the best model for our API Surname list, based on Census 2000.

The extensive race data associated with surnames from Census 2000 provided a unique opportunity to develop an API Surname list (Philipp 2001). Census 2000 was the first decennial census in which surnames were captured to data files. The methodology is similar to the 1990 Spanish Surname List, in that it relies on a Census respondent's actual race self-identification. The size of this file (over 282 million records, with nearly 12 million self identified as API) is self-validating, and no sampling error was introduced.

About 2.4 percent of Census 2000 respondents chose more than one race. In our methodology, if a respondent chose more than one race, we tallied each race as a fraction of the total. For example, if a Census respondent chose Chinese, Vietnamese, and Korean as their race makeup, each race was counted as 0.333, for a total of 1.0 for that person. It should also be noted we made no attempt to tally any write-in race, due to the small number of write-ins and the complications involved with interpretation and translation to an electronic file. We also excluded imputed race responses, which were not self-identified.

Maintaining the privacy of all U.S. citizens is a primary concern of the Census Bureau. Since the API Surname List is expected to be available to other Federal agencies, academia, and the public, certain limitations protecting the individual's privacy were required. To protect the privacy of the individual respondent, we set a minimum of 50 occurrences on Census 2000 as the limit for inclusion of a surname on the list. There is no link on the list to a respondent's geographic data, age, or first name; therefore no identification of an individual respondent is possible. Given this condition, we believe the API Surname List does not violate Title XIII of the U.S. Code. The Census Bureau's Disclosure Review Board reviewed and approved these measures used for API Surname List privacy protection.

METHODOLOGY

Each Census 2000 respondent was asked to self-identify race. There were fifteen general race check boxes including eleven Asian/NHPI race boxes. Based on that data we tallied the surname count for each Census 2000 race.

A few pre-edits were done in preparation for calculation of the API proportion. About 20 million records with surnames or races with the following conditions were excluded:

1. Surname was only filled with blanks or character strings of “A” or “X”. Note that “A” and “X” were by far the most common nonsensical character strings, and most others drop out after additional exclusions based on number of times a surname occurred on Census 2000.
2. Surname was only a single character (except “O”). We allowed the single character surname “O” because of the possibility of some Asians spelling their surname this way. About 770 Asians on Census 2000 have a surname given as “O”.
3. Race was only a write in race. No write in race was allowed.
4. No race chosen. Only unedited race was used, and no imputed race was allowed.

These four edits excluded about 20 million records, or about 7.6% of the U.S. population. After editing, about 262 million records were processed. Of those, about 10.9 million were self-identified as one or more of the Asian or NHPI races. About 8.5% of the API respondents were excluded by the pre-edits.

Each time a race was chosen for a particular surname, we tallied it. Race was then divided by the total surname count to produce a proportion. The next step was to sum all of the proportions for each surname to give a total API proportion. The calculation is as follows:

$$\text{API Proportion for surname} =$$

$$\frac{\text{(Chinese + Japanese + Vietnamese + Korean + Asian Indian + Filipino + Other Asian +}\atop\text{Native Hawaiian + Guamanian/Chamorro + Samoan + Other Pacific Islander)}}{\text{Total API Population by surname}}$$

The data in Table 1 illustrate the proportion for the sample surname “Nguyen”.

Table 1. API Calculation for Surname “Nguyen”

Census 2000 Surname	Census 2000 Race	Race Percentage
NGUYEN	Chinese	0.0072
	Japanese	0.0006
	Vietnamese	0.9412
	Korean	0.0013
	Asian Indian	0.0049
	Filipino	0.0015
	Other Asian	0.0203
	Native Hawaiian	0.0001
	Guamanian / Chamorro	0.0000
	Samoan	0.0001
	Other Pacific Islander	0.0004
	Total API %	**0.9773**
	Other Races	0.0224
	TOTAL	**1.0000**

In this example, the proportion tally was rounded to the 4th significant digit. Note that the proportion calculation was taken out to the 6th significant digit on the API Surname List.

After adding the race proportions and calculating the API proportion, we broke out the resulting proportions by surname into two groups: “75% or Greater” API, and “50% to 74%” API. We then resorted by descending Census surname count within each API grouping. For example, the surname “Chan” had a calculated API proportion of about 94%. The total Census 2000 frequency of occurrence was 65,956. “Chan” was placed in the “75% or Greater” grouping. Therefore the surname “Chan” was ranked the tenth most common API surname in the U.S. API population.

This approach was adopted because there are API surnames that had a very high API percentage, but a low overall count of Census respondents. The inverse was also true: surnames with a lower API proportion but a very high Census 2000 count occurred. In the case of “Smith”, the API proportion was about 0.0054, but the respondent count was over 2.2 million. Numerically, Smith was the most common name on our list, but on Census 2000, 99.5% of persons with the surname “Smith” self identify race as something other than one of the eleven races that comprise API.

RESULTS

The total unique surname record count after editing was 8,435,198. Note, however, that the figure comprised *all* of the surnames on the API Surname list, including those with a small API proportion or a low Census 2000 count. Many surnames occurring only a few times contained errors in spelling, which is reflected in the high total surname count. Table 3 describes the distribution of occurrence for all surnames on the API Surname file.

Table 3. Frequency Distribution of Surname Count, API and Non-API

Frequency Category	**Surname Count**	**API Proportion ≥ 0.50**	**API Proportion < 0.50**
1 - 9	7,620,343	524,316	7,096,027
10 - 49	552,964	35,687	517,277
50 +	261,891	11,446	250,445
TOTAL	**8,435,198**	**571,449**	**7,863,749**

As Table 3 shows, a vast majority of API surnames occur nine times or fewer. Only about 262,000 surnames occurred 50 or more times. 11,446 names were retained on the final API Surname list, after exclusion of surnames that occur less than fifty times or had an API proportion of less than 0.50. Also see Tables A1 and A2 in the Appendix section for the first 25 surnames in the two proportion categories.

Table 4 summarizes the coverage of the edited API population. The category pertaining to the final API Surname List is "50 or more, 0.50 or > API". About 56.8% of the Asian and Pacific Islander population has a surname that occurred 50 or more times and had an API proportion of 0.50 or more.

Table 4. Coverage of the API Population

Surname occurrence	Proportion API Category	API Population	Percentage %
1 to 9	< 0.50 API	74,777	0.7
10 to 49	< 0.50 API	182,557	1.7
50 or more	< 0.50 API	2,973,322	27.4
1 to 9	≥ 0.50 API	843,449	7.8
10 to 49	≥ 0.50 API	624,261	5.7
50 or more	≥ 0.50 API	6,169,085	56.8
		*10,867,451	

*This figure is the count of API respondents not excluded during preliminary edits

To evaluate the API Surname List, we did a simple list-to-list comparison against the first 50 surnames on six Asian races: Asian Indian, Chinese, Filipino, Japanese, Korean, and Vietnamese. We compared these six lists to six lists of the same races as produced by Lauderdale and Kestenbaum (2000). We considered it a successful match for any given surname if our surname fell within the first 50 on both our list and the Lauderdale-Kestenbaum list. The Lauderdale–Kestenbaum lists are based on SSA data for Asians born outside of the United States before 1941. Table 5 summarizes the results the list comparison evaluation.

Table 5. Summary of Evaluation Match

Race	Number of Matches Among First 50	Percentage Matching
Asian Indian	31 out of 50	62%
Chinese	41 out of 50	82%
Filipino	5 out of 50	10%
Japanese	38 out of 50	76%
Korean	41 out of 50	82%
Vietnamese	35 out of 50	70%

The results show a match from 62% to 82%, except for Filipino. The Lauderdale and Kestenbaum Filipino list includes many Hispanic names. They did not calculate proportion Filipino as we did in our methodology. Our approach specifically pulls out the strongest Filipino names first *then* sorts by count. Filipinos make up a much smaller population than do non-Filipinos who share the same surnames. The disparity of the Filipino lists illustrates how the two approaches could produce radically different results under certain circumstances.

DISCUSSION

The distribution of surnames in the API Surname list consists most strongly of Chinese, Vietnamese, Asian Indian and Korean names, followed by Japanese and Filipino names (see appendix tables A1 and A2). Ethnicities with a small representation in terms of U.S. population are generally overwhelmed by the surnames of the more populous Asian ethnic groups. Asian Indian, Korean, Chinese and Vietnamese names dominate the top of list, due to the large populations of these ethnic groups. Ethnic groups such as Hawaiian and Samoan have relatively small U.S. populations, and so fail to make the top rankings of surnames.

The question of how to consistently identify Filipino surnames remains unanswered with this surname list. Since so many Filipino surnames are Hispanic, Filipinos and Hispanics may get lumped together using this methodology. How to unravel that is not addressed here, and further research is required. It seems that a geographic component may be necessary.

CONCLUSION AND FURTHER RESEARCH

Race results from Census 2000 were used as a basis for a tally of API surnames. API proportion was calculated and presented. Surnames were grouped by API proportion and ranked by frequency within that grouping.

There were 8.4 million distinct surnames derived from Census 2000, but, after sorting by the highest API proportion (0.50 or greater) only 11,446 occurred 50 or more times on Census 2000. This was the final API Surname list. We were able to account for about 56.8% of the API population using these exclusion rules.

The highest-ranking races in terms of combined API proportion and frequency were Chinese, Asian Indian, Vietnamese, and Korean. Japanese and Filipino names rank somewhat lower, and Pacific Islander rank even lower due to their low frequency.

Lowering the limit of Census 2000 frequency should be considered. Doing so will increase the coverage. Also, the coverage problem illustrates one flaw with using the approach of a pre-sort by proportion. Unfortunately, there is no clear advantage to either a straight tally or to a pre-sort by proportion and then a tally.

In the spirit of the research precedence set in the last two decades by Word and Perkins on a Hispanic surname list, Bye for his API list contributing to his race model, and Lauderdale and Kestenbaum on six ethic Asian surname lists, this research may also serve to continue work on name list research. Additional factors such as geography should be considered, since many API respondents are clustered in specific areas like Southern California. The Filipino population is a prime example of a centralized population that could benefit from a geographical component.

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APPENDIX

Table A1 – Top 25 API Surnames for the API Population - Proportion: ≥ 0.75

RANK	SURNAME	CENSUS	PERCENT	API	USUAL
		COUNT	API	COUNT	RACE (50% +)*
1	NGUYEN	290,101	97.8	283,719	Vietnamese
2	KIM	191,623	96.6	185,108	Korean
3	PATEL	143,325	95.3	136,589	Asian Indian
4	TRAN	129,138	97.6	126,039	Vietnamese
5	CHEN	99,871	96.7	96,575	Chinese
6	WONG	98,064	92.4	90,611	Chinese
7	LE	74,646	97.1	72,481	Vietnamese
8	SINGH	67,651	82.0	55,474	Asian Indian
9	WANG	66,645	95.8	63,846	Chinese
10	CHAN	65,956	94.0	61,999	Chinese
11	CHANG	65,202	93.1	60,703	Chinese
12	YANG	64,345	95.1	61,192	Other Asian / Chinese
13	PHAM	54,512	97.6	53,204	Vietnamese
14	LI	54,119	98.0	53,037	Chinese
15	LIN	49,645	96.8	48,056	Chinese
16	LIU	48,458	97.3	47,150	Chinese
17	WU	43,958	97.5	42,859	Chinese
18	LAM	43,150	89.7	38,706	Chinese
19	HUANG	42,432	97.8	41,498	Chinese
20	HO	39,073	96.0	37,510	Chinese
21	HUYNH	37,479	97.9	36,692	Vietnam
22	SHAH	36,801	91.9	33,820	Asian Indian
23	YU	35,672	97.9	34,923	Chinese
24	CHUNG	35,450	94.0	33,323	Korean
25	CHOI	34,856	98.2	34,229	Korean
			TOTAL	**1,829,341**	

*If no race totaled 50% or more, the most common races were totaled until 50% was reached

Table A2 – Top 25 API Surnames for the API Population -API Proportion: 0.50 to 0.74

RANK	SURNAME	CENSUS COUNT	PERCENT API	API COUNT	USUAL RACE (50% +)*
1	PARK	80,782	67.7	54,689	Korean
2	KHAN	42,044	74.6	31,365	Asian Indian / Other Asian
3	AHMED	23,944	59.7	14,295	Asian Indian / Other Asian
4	JUNG	17,036	59.1	10,068	Korean / Chinese
5	DOAN	15,225	59.6	9,074	Vietnamese
6	AHMAD	10,488	58.0	6,083	Other Asian / Asian Indian
7	TOM	10,083	56.5	5,697	Chinese / Japanese
8	MATHEW	9,895	67.9	6,719	Asian Indian
9	RAHMAN	9,734	69.9	6,804	Asian Indian / Other Asian
10	MALIK	9,680	53.3	5,159	Other Asian / Asian Indian
11	REDDY	9,608	60.9	5,851	Asian Indian
12	HUSSAIN	9,022	74.2	6,694	Asian Indian / Other Asian
13	MOY	8,397	73.4	6,163	Chinese
14	RAO	8,298	74.9	6,215	Asian Indian
15	LING	8,223	51.2	4,210	Chinese / Other Asian
16	LUM	7,961	74.3	5,915	Chinese
17	AMIN	7,229	74.1	5,357	Asian Indian
18	DOMINGO	7,226	66.8	4,827	Filipino
19	PERSAUD	7,087	50.2	3,558	Asian Indian/ Other Asian / Black
20	TOLENTINO	6,321	60.6	3,831	Filipino
21	PASCUAL	6,255	53.1	3,321	Filipino
22	DELROSARIO	5,198	69.6	3,618	Filipino
23	SIM	4,869	64.0	3,116	Korean / Other Asian
24	MAN	4,430	70.6	3,128	Chinese / Korean
25	KATO	4,417	72.8	3,216	Japanese
			TOTAL	**218,973**	

*If no race totaled 50% or more, the most common races were totaled until 50% was reached

Appendix C
Detailed Tables Comparing Use of Hospital and Emergency Room Services for Selected Ambulatory Care Sensitive Conditions by EDB Race/Ethnicity and CAHPS Self-Reported Race/Ethnicity

Table C1.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of cellulitis in previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	1,085	0.55	1,013	0.54	0.93	0.99
Black	94	0.60	84	0.60	0.89	1.00
Hispanic	27	0.88	63	0.71	2.33	0.81
A/PI	11	0.55	11	0.39	1.00	0.71
AI/AN	4	1.07	10	0.89	2.50	0.83
Other/unreported	7	0.33	47	0.55	6.71	1.69

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C2.

Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of chronic lung disease (asthma or chronic obstructive pulmonary disease) in previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	2,484	1.25	2,303	1.24	0.93	0.99
Black	223	1.42	196	1.40	0.88	0.99
Hispanic	43	1.40	121	1.37	2.81	0.98
A/PI	8	0.40	8	0.28	1.00	0.71
AI/AN	4	1.07	19	1.69	4.75	1.58
Other/unreported	13	0.61	128	1.51	9.85	2.48

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C3.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of congestive heart failure in previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	2,543	1.28	2,353	1.26	0.93	0.98
Black	341	2.17	302	2.15	0.89	0.99
Hispanic	39	1.27	123	1.39	3.15	1.10
A/PI	14	0.70	16	0.57	1.14	0.81
AI/AN	7	1.87	20	1.77	2.86	0.95
Other/unreported	19	0.89	149	1.75	7.84	1.98

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C4.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of hypertension in previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	828	0.42	774	0.42	0.93	1.00
Black	198	1.26	183	1.30	0.92	1.04
Hispanic	25	0.81	62	0.70	2.48	0.86
A/PI	6	0.30	9	0.32	1.50	1.07
AI/AN	1	0.27	4	0.35	4.00	1.33
Other/unreported	14	0.65	40	0.47	2.86	0.72

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C5.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of seizures in previous 12 months by EDBRACE and SELFRACE

Race/ethnicity	EDBRACE		SELFRACE		Ratio*	
	Number	Percent	Number	Percent	Numbers	Percents
White	350	0.18	317	0.17	0.91	0.96
Black	73	0.46	65	0.46	0.89	1.00
Hispanic	9	0.29	36	0.41	4.00	1.39
A/PI	4	0.20	5	0.18	1.25	0.89
AI/AN	1	0.27	8	0.71	8.00	2.66
Other/unreported	11	0.51	17	0.20	1.55	0.39

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C6.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of diabetes in previous 12 months by EDBRACE and SELFRACE

Race/ethnicity	EDBRACE		SELFRACE		Ratio*	
	Number	Percent	Number	Percent	Numbers	Percents
White	866	0.44	767	0.41	0.89	0.94
Black	267	1.70	252	1.80	0.94	1.06
Hispanic	27	0.88	85	0.96	3.15	1.09
A/PI	9	0.45	15	0.53	1.67	1.19
AI/AN	7	1.87	16	1.42	2.29	0.76
Other/unreported	17	0.80	58	0.68	3.41	0.86

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C7.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of pneumonia in previous 12 months by EDBRACE and SELFRACE

Race/ethnicity	EDBRACE		SELFRACE		Ratio*	
	Number	Percent	Number	Percent	Numbers	Percents
White	2,891	1.46	2,699	1.45	0.93	0.99
Black	193	1.23	179	1.28	0.93	1.04
Hispanic	41	1.33	114	1.29	2.78	0.97
A/PI	14	0.70	15	0.53	1.07	0.76
AI/AN	9	2.41	27	2.40	3.00	1.00
Other/unreported	23	1.08	137	1.61	5.96	1.50

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C8.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of dehydration in previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	891	0.45	844	0.45	0.95	1.01
Black	86	0.55	80	0.57	0.93	1.04
Hispanic	14	0.46	27	0.31	1.93	0.67
A/PI	5	0.25	6	0.21	1.20	0.85
AI/AN	0	0.00	3	0.27	.	.
Other/unreported	2	0.09	38	0.45	19.00	4.78

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C9.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of urinary tract infection in previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	1,417	0.72	1,334	0.72	0.94	1.00
Black	153	0.97	140	1.00	0.92	1.03
Hispanic	24	0.78	61	0.69	2.54	0.88
A/PI	10	0.50	7	0.25	0.70	0.50
AI/AN	2	0.53	11	0.98	5.50	1.83
Other/unreported	8	0.37	61	0.72	7.63	1.92

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C10.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of ulcer in previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	474	0.24	455	0.24	0.96	1.02
Black	39	0.25	39	0.28	1.00	1.12
Hispanic	9	0.29	19	0.21	2.11	0.73
A/PI	2	0.10	5	0.18	2.50	1.78
AI/AN	4	1.07	2	0.18	0.50	0.17
Other/unreported	5	0.23	13	0.15	2.60	0.65

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C11.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of hypoglycemia in previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	72	0.04	66	0.04	0.92	0.98
Black	19	0.12	15	0.11	0.79	0.89
Hispanic	2	0.07	6	0.07	3.00	1.04
A/PI	0	0.00	1	0.04	.	.
AI/AN	1	0.27	1	0.09	1.00	0.33
Other/unreported	2	0.09	7	0.08	3.50	0.88

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C12.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of hypokalemia in previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	94	0.05	86	0.05	0.91	0.97
Black	19	0.12	17	0.12	0.89	1.00
Hispanic	1	0.03	5	0.06	5.00	1.74
A/PI	1	0.05	2	0.07	2.00	1.42
AI/AN	0	0.00	1	0.09	.	.
Other/unreported	0	0.00	4	0.05	.	.

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C13.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of ENT infection in previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	571	0.29	520	0.28	0.91	0.97
Black	100	0.64	88	0.63	0.88	0.99
Hispanic	22	0.72	55	0.62	2.50	0.87
A/PI	5	0.25	7	0.25	1.40	1.00
AI/AN	3	0.80	6	0.53	2.00	0.66
Other/unreported	12	0.56	37	0.44	3.08	0.78

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C14.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of influenza in previous 12 months by EDBRACE and SELFRACE

Race/ethnicity	EDBRACE		SELFRACE		Ratio*	
	Number	Percent	Number	Percent	Numbers	Percents
White	129	0.07	121	0.07	0.94	1.00
Black	21	0.13	20	0.14	0.95	1.07
Hispanic	2	0.07	6	0.07	3.00	1.04
A/PI	1	0.05	4	0.14	4.00	2.85
AI/AN	0	0.00	1	0.09	.	.
Other/unreported	3	0.14	4	0.05	1.33	0.34

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table C15.
Number, percentage, and ratio of Medicare CAHPS beneficiaries with hospital or emergency room admission with a diagnosis of malnutrition in previous 12 months by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	22	0.01	18	0.01	0.82	0.87
Black	3	0.02	3	0.02	1.00	1.12
Hispanic	0	0.00	0	0.00	.	.
A/PI	0	0.00	0	0.00	.	.
AI/AN	0	0.00	1	0.09	.	.
Other/unreported	1	0.05	4	0.05	4.00	1.01

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Appendix D
Detailed Tables Comparing Use of Hospital Services for Selected Diagnoses by EDB Race/Ethnicity and CAHPS Self-Reported Race/Ethnicity

Table D1.
Number, percentage, and ratio of Medicare beneficiaries hospitalized in past 12 months with heart disease diagnosis by EDBRACE and SELFRACE

Race/ethnicity	EDBRACE		SELFRACE		Ratio*	
	Number	Percent	Number	Percent	Numbers	Percents
White	8,118	4.10	7,666	4.12	0.94	1.01
Black	625	3.97	563	4.01	0.90	1.01
Hispanic	116	3.77	297	3.36	2.56	0.89
A/PI	43	2.14	54	1.91	1.26	0.89
AI/AN	12	3.21	44	3.90	3.67	1.22
Other/unreported	53	2.48	343	4.04	6.47	1.63

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table D2.
Mean payment and mean length of stay of Medicare beneficiaries hospitalized in past 12 months with heart disease diagnosis by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio[*]	
Race/ethnicity	Payment	Length of stay	Payment	Length of stay	Payments	Lengths of stay
White	$11,997.41	6.04	$12,029.60	6.03	1.00	1.00
Black	$9,372.78	6.25	$9,237.18	6.21	0.99	0.99
Hispanic	$9,466.03	7.80	$10,568.04	7.12	1.12	0.91
A/PI	$15,232.49	7.44	$13,234.39	5.93	0.87	0.80
AI/AN	$10,270.42	5.25	$12,499.59	6.75	1.22	1.29
Other/unreported	$12,529.34	5.77	$11,575.92	6.08	0.92	1.05

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table D3.
Number, percentage, and ratio of Medicare beneficiaries hospitalized in past 12 months with cerebrovascular disease diagnosis by EDBRACE and SELFRACE

Race/ethnicity	EDBRACE		SELFRACE		Ratio*	
	Number	Percent	Number	Percent	Numbers	Percents
White	2,360	1.19	2,218	1.19	0.94	1.00
Black	206	1.31	181	1.29	0.88	0.99
Hispanic	27	0.88	86	0.97	3.19	1.11
A/PI	7	0.35	6	0.21	0.86	0.61
AI/AN	3	0.80	12	1.06	4.00	1.33
Other/unreported	18	0.84	118	1.39	6.56	1.65

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table D4.
Mean payment and mean length of stay of Medicare beneficiaries hospitalized in past 12 months with cerebrovascular disease diagnosis by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Payment	Length of stay	Payment	Length of stay	Payments	Lengths of stay
White	$5,402.38	4.39	$5,414.01	4.35	1.00	0.99
Black	$6,015.53	5.51	$6,111.46	5.76	1.02	1.04
Hispanic	$6,026.85	6.07	$5,409.19	5.19	0.90	0.85
A/PI	$5,516.43	2.29	$5,590.00	2.00	1.01	0.88
AI/AN	$5,594.33	1.00	$4,926.00	2.92	0.88	2.92
Other/unreported	$4,557.22	3.33	$5,226.19	4.71	1.15	1.41

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table D5.
Number, percentage, and ratio of Medicare beneficiaries hospitalized in past 12 months with pneumonia diagnosis by EDBRACE and SELFRACE

Race/ethnicity	EDBRACE		SELFRACE		Ratio[*]	
	Number	Percent	Number	Percent	Numbers	Percents
White	2,108	1.06	1,974	1.06	0.94	1.00
Black	149	0.95	139	0.99	0.93	1.05
Hispanic	31	1.01	89	1.01	2.87	1.00
A/PI	11	0.55	11	0.39	1.00	0.71
AI/AN	10	2.67	19	1.69	1.90	0.63
Other/unreported	22	1.03	99	1.17	4.50	1.13

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table D6.
Mean payment and mean length of stay of Medicare beneficiaries hospitalized in past 12 months with pneumonia diagnosis by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Payment	Length of stay	Payment	Length of stay	Payments	Lengths of stay
White	$5,302.54	6.16	$5,300.75	6.19	1.00	1.00
Black	$6,518.36	6.42	$6,642.64	6.40	1.02	1.00
Hispanic	$6,328.03	7.45	$6,366.07	6.46	1.01	0.87
A/PI	$4,562.64	6.00	$4,787.18	5.18	1.05	0.86
AI/AN	$3,976.50	2.90	$5,631.79	4.95	1.42	1.71
Other/unreported	$8,347.23	7.86	$5,105.99	6.25	0.61	0.80

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table D7.
Number, percentage, and ratio of Medicare beneficiaries hospitalized in past 12 months with malignant neoplasm diagnosis by EDBRACE and SELFRACE

Race/ethnicity	EDBRACE		SELFRACE		Ratio*	
	Number	Percent	Number	Percent	Numbers	Percents
White	1,738	0.88	1,651	0.89	0.95	1.01
Black	127	0.81	118	0.84	0.93	1.04
Hispanic	18	0.59	56	0.63	3.11	1.08
A/PI	14	0.70	15	0.53	1.07	0.76
AI/AN	1	0.27	7	0.62	7.00	2.32
Other/unreported	13	0.61	64	0.75	4.92	1.24

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table D8.
Mean payment and mean length of stay of Medicare beneficiaries hospitalized in past 12 months with malignant neoplasm diagnosis by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Payment	Length of stay	Payment	Length of stay	Payments	Lengths of stay
White	$9,780.43	6.06	$9,662.76	6.03	0.99	0.99
Black	$8,640.39	6.18	$8,635.61	6.27	1.00	1.01
Hispanic	$8,651.83	3.83	$10,005.95	5.61	1.16	1.46
A/PI	$14,856.50	11.36	$14,244.00	9.00	0.96	0.79
AI/AN	$131.00	2.00	$7,388.71	5.00	56.40	2.50
Other/unreported	$8,516.92	6.23	$12,068.17	7.14	1.42	1.15

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table D9.
Number, percentage, and ratio of Medicare beneficiaries hospitalized in past 12 months with fracture diagnosis by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Number	Percent	Number	Percent	Numbers	Percents
White	1,666	0.84	1,571	0.84	0.94	1.00
Black	55	0.35	49	0.35	0.89	1.00
Hispanic	21	0.68	52	0.59	2.48	0.86
A/PI	8	0.40	11	0.39	1.38	0.98
AI/AN	2	0.53	7	0.62	3.50	1.16
Other/unreported	9	0.42	71	0.84	7.89	1.99

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Table D10.
Mean payment and mean length of stay of Medicare beneficiaries hospitalized in past 12 months with fracture diagnosis by EDBRACE and SELFRACE

	EDBRACE		SELFRACE		Ratio*	
Race/ethnicity	Payment	Length of stay	Payment	Length of stay	Payments	Lengths of stay
White	$6,174.39	5.58	$6,188.13	5.57	1.00	1.00
Black	$7,398.04	6.31	$7,430.45	6.29	1.00	1.00
Hispanic	$6,923.52	6.38	$6,925.58	6.17	1.00	0.97
A/PI	$7,065.63	6.63	$7,770.91	6.18	1.10	0.93
AI/AN	$9,050.50	5.00	$4,788.71	4.14	0.53	0.83
Other/unreported	$7,291.67	5.00	$5,835.04	5.63	0.80	1.13

* Ratio = number (percent) according to SELFRACE/number (percent) according to EDBRACE.

Source: Medicare claims for respondents to the 2000 and 2001 Medicare fee-for-service CAHPS surveys.

Appendix E
Results of the GeoCode Program Processing for Each of the 10 Segments of the Unloaded EDB

Table E-1. Summary of Geocode Process—10 Segments of the EDB

	Segment A		Segment B		Segment C		Segment D		Segment E	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Original Number of Records	4,175,981	100.0	4,176,579	100.0	4,172,623	100.0	4,174,515	100.0	4,174,478	100.0
Number of Records Excluded (uncodeable)	522,208	12.5	523,411	12.5	521,963	12.5	522,584	12.5	523,093	12.5
Addresses Processed	3,653,773	87.5	3,653,168	87.5	3,650,660	87.5	3,651,931	87.5	3,651,385	87.5
...Successfully Geocoded (First Iteration)	3,468,148	94.9	3,428,289	93.8	3,530,614	96.7	3,450,337	94.5	3,525,112	96.5
...Successfully Geocoded eFOM records	156,056	4.3	195,331	5.3	90,397	2.5	172,184	4.7	96,743	2.6
...Total Failed	29,569	0.8	29,548	0.8	29,649	0.8	29,410	0.8	29,530	0.8
GeoCoding Success Rate	3,624,204	99.2	3,623,620	99.2	3,621,011	99.2	3,622,521	99.2	3,621,855	99.2
Percent Total EDB Records Matched		86.8		86.8		86.8		86.8		86.8
Success Details*										
Accurate Match	2,233,063	61.1	2,254,395	61.7	2,216,107	60.7	2,250,186	61.6	2,214,577	60.7
Place Not Found	358,724	9.8	359,293	9.8	358,076	9.8	358,132	9.8	357,373	9.8
Address match with no parity	31,071	0.9	30,500	0.8	30,917	0.8	30,309	0.8	31,425	0.9
Closest address match	201,923	5.5	196,852	5.4	202,410	5.5	197,391	5.4	204,371	5.6
Fuzzy street type match	431,175	11.8	427,080	11.7	440,254	12.1	421,217	11.5	439,905	12.0
Phonetic match	194,215	5.3	189,210	5.2	195,242	5.3	191,660	5.2	196,307	5.4
Place-based ZIP match	88,798	2.4	86,879	2.4	88,932	2.4	86,273	2.4	89,939	2.5
Spelling corrected	1	0.0	2	0.0	0	0.0	0	0.0	2	0.0
State centroid used	5,209	0.1	5,146	0.1	5,142	0.1	5,267	0.1	5,385	0.1
Street end used	19,607	0.5	19,823	0.5	20,583	0.6	20,106	0.6	20,244	0.6
ZIP centroid used	328,377	9.0	315,860	8.6	331,704	9.1	323,002	8.8	332,934	9.1
Inaccurate direction	114,640	3.1	114,647	3.1	115,663	3.2	110,300	3.0	116,368	3.2
Failure Details										
Failed due to syntax error	29,145	0.8	29,162	0.8	29,224	0.8	28,976	0.8	29,132	0.8
…Missing or invalid house number	19,430	0.5	19,417	0.5	19,656	0.5	19,516	0.5	19,570	0.5
…Missing or invalid state name/abbr	2	0.0	0	0.0	0	0.0	1	0.0	0	0.0
…Missing or invalid ZIP code	9,676	0.3	9,723	0.3	9,540	0.3	9,427	0.3	9,532	0.3
…Incomplete or malformed address	37	0.0	22	0.0	28	0.0	32	0.0	30	0.0
Failed due to lookup error	156,480	4.3	195,717	5.4	90,822	2.5	172,618	4.7	97,141	2.7
…Failed to open data member (eFOM)	156,056	4.3	195,331	5.3	90,397	2.5	172,184	4.7	96,743	2.6
…No address data for state	424	0.0	386	0.0	425	0.0	434	0.0	398	0.0

Table E-1. Summary of Geocode Process—10 Segments of the EDB (continued)

	Segment F		Segment G		Segment H		Segment I		Segment J	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Original Number of Records	4,174,190	100.0	4,170,103	100.0	4,175,319	100.0	4,175,265	100.0	4,173,354	100.0
Number of Records Excluded (uncodeable)	522,026	12.5	522,192	12.5	522,258	12.5	522,400	12.5	521,631	12.5
Addresses Processed	3,652,164	87.5	3,647,911	87.5	3,653,061	87.5	3,652,865	87.5	3,651,723	87.5
...Successfully Geocoded (First Iteration)	3,538,203	96.9	3,522,042	96.5	3,497,582	95.7	3,623,163	99.2	3,524,839	96.5
...Successfully Geocoded eFOM records	84,717	2.3	96,241	2.6	125,896	3.4	0	0.0	97,159	2.7
...Total Failed	29,244	0.8	29,628	0.8	29,583	0.8	29,702	0.8	29,725	0.8
GeoCoding Success Rate	3,622,920	99.2	3,618,283	99.2	3,623,478	99.2	3,623,163	99.2	3,621,998	99.2
Percent Total EDB Records Matched		86.8		86.8		86.8		86.8		86.8
Success Details*										
Accurate Match	2,212,761	60.6	2,222,499	60.9	2,234,355	61.2	2,191,365	60.0	2,221,824	60.8
Place Not Found	356,615	9.8	354,990	9.7	356,623	9.8	355,336	9.7	356,696	9.8
Address match with no parity	31,613	0.9	31,606	0.9	31,189	0.9	32,965	0.9	31,565	0.9
Closest address match	204,464	5.6	202,226	5.5	202,028	5.5	208,880	5.7	203,574	5.6
Fuzzy street type match	440,250	12.1	440,687	12.1	436,847	12.0	447,863	12.3	435,201	11.9
Phonetic match	196,387	5.4	195,666	5.4	193,766	5.3	200,816	5.5	195,255	5.3
Place-based ZIP match	89,544	2.5	88,709	2.4	88,774	2.4	91,420	2.5	89,277	2.4
Spelling corrected	2	0.0	0	0.0	1	0.0	2	0.0	0	0.0
State centroid used	5,301	0.1	5,254	0.1	5,277	0.1	5,412	0.1	5,113	0.1
Street end used	19,990	0.5	20,264	0.6	19,897	0.5	20,709	0.6	20,311	0.6
ZIP centroid used	335,171	9.2	332,030	9.1	329,949	9.0	343,215	9.4	332,062	9.1
Inaccurate direction	116,339	3.2	105,470	2.9	105,296	2.9	118,945	3.3	115,179	3.2
Failure Details										
Failed due to syntax error	28,812	0.8	29,210	0.8	29,158	0.8	29,266	0.8	29,301	0.8
…Missing or invalid house number	19,266	0.5	19,585	0.5	19,484	0.5	19,632	0.5	19,590	0.5
…Missing or invalid state name/abbr	0	0.0	1	0.0	0	0.0	0	0.0	1	0.0
…Missing or invalid ZIP code	9,519	0.3	9,592	0.3	9,648	0.3	9,592	0.3	9,678	0.3
…Incomplete or malformed address	27	0.0	32	0.0	26	0.0	42	0.0	32	0.0
Failed due to lookup error	85,149	2.3	96,659	2.6	126,321	3.5	436	0.0	97,583	2.7
…Failed to open data member (eFOM)	84,717	2.3	96,241	2.6	125,896	3.4	0	0.0	97,159	2.7
…No address data for state	432	0.0	418	0.0	425	0.0	436	0.0	424	0.0

*Note: Success detail categories reflect distribution of accuracy codes. These codes are NOT mutually exclusive. Some addresses can have up to 3 or 4 accuracy codes associated with them.

Appendix F
List of Potential SES Variables Extracted from 2000 U.S. Census and Values of the Categories Used for Percentages

Appendix F

List of Potential SES Variables Extracted from 2000 U.S. Census and Values of the Categories Used for Percentages

Each variable is identified by "NAME","the name of the data record or polygon" and "KEY","the key for the data record or polygon". Note, that for percentage tables, the key includes the level of the variable for which the percentages are reported.

Sex by Education

"P037001","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037001 Total"
"P037002","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037002 Male"
"P037003","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037003 No schooling completed"
"P037004","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037004 Nursery to 4th grade"
"P037005","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037005 5th and 6th grade"
"P037006","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037006 7th and 8th grade"
"P037007","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037007 9th grade"
"P037008","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037008 10th grade"
"P037009","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037009 11th grade"
"P037010","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037010 12th grade, no diploma"
"P037011","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037011 High school graduate (includes equivalency)"
"P037012","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037012 Some college, less than 1 year"
"P037013","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037013 Some college, 1 or more years, no degree"
"P037014","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037014 Associate degree"
"P037015","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037015 Bachelor's degree"
"P037016","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037016 Master's degree"
"P037017","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037017 Professional school degree"

"P037018","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037018   Doctorate degree"
"P037019","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037019   Female"
"P037020","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037020   No schooling completed"
"P037021","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037021   Nursery to 4th grade"
"P037022","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037022   5th and 6th grade"
"P037023","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037023   7th and 8th grade"
"P037024","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037024   9th grade"
"P037025","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037025   10th grade"
"P037026","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037026   11th grade"
"P037027","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037027   12th grade, no diploma"
"P037028","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037028   High school graduate (includes equivalency)"
"P037029","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037029   Some college, less than 1 year"
"P037030","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037030   Some college, 1 or more years, no degree"
"P037031","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037031   Associate degree"
"P037032","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037032   Bachelor's degree"
"P037033","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037033   Master's degree"
"P037034","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037034   Professional school degree"
"P037035","P Tables 2000 P037 Sex by Educational Attainment for the Population 25+ Years P037035   Doctorate degree"

Sex by Employment Status

"P043001","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043001 Total"
"P043002","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043002   Male"
"P043003","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043003   In labor force"

"P043004","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043004 In Armed Forces"
"P043005","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043005 Civilian"
"P043006","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043006 Employed"
"P043007","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043007 Unemployed"
"P043008","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043008 Not in labor force"
"P043009","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043009 Female"
"P043010","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043010 In labor force"
"P043011","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043011 In Armed Forces"
"P043012","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043012 Civilian"
"P043013","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043013 Employed"
"P043014","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043014 Unemployed"
"P043015","P Tables 2000 P043 Sex by Employment Status for the Population 16+ Years P043015 Not in labor force"

Sex by Industry for Civilian Employees

"P049001","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population 16+ Years P049001 Total"
"P049002","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population 16+ Years P049002 Male"
"P049003","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population 16+ Years P049003 Agriculture, forestry, fishing and hunting, and mining"
"P049004","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population 16+ Years P049004 Agriculture, forestry, fishing and hunting"
"P049005","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population 16+ Years P049005 Mining"
"P049006","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population 16+ Years P049006 Construction"
"P049007","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population 16+ Years P049007 Manufacturing"
"P049008","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population 16+ Years P049008 Wholesale trade"
"P049009","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population 16+ Years P049009 Retail trade"

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"P049010","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049010        Transportation and warehousing, and utilities"
"P049011","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049011          Transportation and warehousing"
"P049012","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049012          Utilities"
"P049013","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049013        Information"
"P049014","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049014        Finance, insurance, real estate and rental and leasing"
"P049015","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049015          Finance and insurance"
"P049016","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049016          Real estate and rental and leasing"
"P049017","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049017        Professional, scientific, management, administrative, and waste
management services"
"P049018","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049018          Professional, scientific, and technical services"
"P049019","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049019          Management of companies and enterprises"
"P049020","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049020          Administrative and support and waste management services"
"P049021","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049021        Educational, health and social services"
"P049022","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049022          Educational services"
"P049023","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049023          Health care and social assistance"
"P049024","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049024        Arts, entertainment, recreation, accommodation and food
services"
"P049025","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049025          Arts, entertainment, and recreation"
"P049026","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049026          Accommodation and food services"
"P049027","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049027        Other services (except public administration)"
"P049028","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049028        Public administration"
"P049029","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049029      Female"
"P049030","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049030        Agriculture, forestry, fishing and hunting, and mining"
"P049031","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049031          Agriculture, forestry, fishing and hunting"
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"P049032","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049032          Mining"
"P049033","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049033        Construction"
"P049034","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049034        Manufacturing"
"P049035","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049035        Wholesale trade"
"P049036","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049036        Retail trade"
"P049037","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049037        Transportation and warehousing, and utilities"
"P049038","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049038          Transportation and warehousing"
"P049039","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049039          Utilities"
"P049040","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049040        Information"
"P049041","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049041        Finance, insurance, real estate and rental and leasing"
"P049042","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049042          Finance and insurance"
"P049043","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049043          Real estate and rental and leasing"
"P049044","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049044        Professional, scientific, management, administrative, and waste
management services"
"P049045","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049045          Professional, scientific, and technical services"
"P049046","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049046          Management of companies and enterprises"
"P049047","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049047          Administrative and support and waste management services"
"P049048","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049048        Educational, health and social services"
"P049049","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049049          Educational services"
"P049050","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049050          Health care and social assistance"
"P049051","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049051        Arts, entertainment, recreation, accommodation and food
services"
"P049052","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049052          Arts, entertainment, and recreation"
"P049053","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population
16+ Years P049053          Accommodation and food services"
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"P049054","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population 16+ Years P049054 Other services (except public administration)"
"P049055","P Tables 2000 P049 Sex by Industry for the Employed Civilian Population 16+ Years P049055 Public administration"

Sex by Occupation

"P050001","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050001 Total"
"P050002","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050002 Male"
"P050003","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050003 Management, professional, and related occupations"
"P050004","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050004 Management, business, and financial operations occupations"
"P050005","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050005 Management occupations, except farmers and farm managers"
"P050006","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050006 Farmers and farm managers"
"P050007","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050007 Business and financial operations occupations"
"P050008","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050008 Business operations specialists"
"P050009","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050009 Financial specialists"
"P050010","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050010 Professional and related occupations"
"P050011","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050011 Computer and mathematical occupations"
"P050012","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050012 Architecture and engineering occupations"
"P050013","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050013 Architects, surveyors, cartographers, and engineers"
"P050014","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050014 Drafters, engineering, and mapping technicians"
"P050015","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050015 Life, physical, and social science occupations"
"P050016","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050016 Community and social services occupations"
"P050017","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050017 Legal occupations"
"P050018","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050018 Education, training, and library occupations"

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"P050019","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050019            Arts, design, entertainment, sports, and media
occupations"
"P050020","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050020            Healthcare practitioners and technical
occupations"
"P050021","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050021              Health diagnosing and treating practitioners and
technical occupations"
"P050022","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050022              Health technologists and technicians"
"P050023","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050023        Service occupations"
"P050024","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050024          Healthcare support occupations"
"P050025","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050025          Protective service occupations"
"P050026","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050026            Fire fighting, prevention, and law enforcement
workers, including supervisors"
"P050027","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050027            Other protective service workers, including
supervisors"
"P050028","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050028          Food preparation and serving related occupations"
"P050029","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050029          Building and grounds cleaning and maintenance
occupations"
"P050030","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050030          Personal care and service occupations"
"P050031","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050031        Sales and office occupations"
"P050032","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050032          Sales and related occupations"
"P050033","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050033          Office and administrative support occupations"
"P050034","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050034        Farming, fishing, and forestry occupations"
"P050035","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050035        Construction, extraction, and maintenance
occupations"
"P050036","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050036          Construction and extraction occupations"
"P050037","P Tables 2000 P050 Sex by Occupation for the Employed Civilian
Population 16+ Years P050037            Supervisors, construction and extraction
workers"
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"P050038","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050038   Construction trades workers"

"P050039","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050039   Extraction workers"

"P050040","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050040   Installation, maintenance, and repair occupations"

"P050041","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050041   Production, transportation, and material moving occupations"

"P050042","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050042   Production occupations"

"P050043","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050043   Transportation and material moving occupations"

"P050044","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050044   Supervisors, transportation and material moving workers"

"P050045","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050045   Aircraft and traffic control occupations"

"P050046","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050046   Motor vehicle operators"

"P050047","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050047   Rail, water and other transportation occupations"

"P050048","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050048   Material moving workers"

"P050049","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050049   Female"

"P050050","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050050   Management, professional, and related occupations"

"P050051","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050051   Management, business, and financial operations occupations"

"P050052","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050052   Management occupations, except farmers and farm managers"

"P050053","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050053   Farmers and farm managers"

"P050054","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050054   Business and financial operations occupations"

"P050055","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050055   Business operations specialists"

"P050056","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050056   Financial specialists"

"P050057","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050057   Professional and related occupations"

"P050058","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050058   Computer and mathematical occupations"

"P050059","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050059 Architecture and engineering occupations"

"P050060","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050060 Architects, surveyors, cartographers, and engineers"

"P050061","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050061 Drafters, engineering, and mapping technicians"

"P050062","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050062 Life, physical, and social science occupations"

"P050063","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050063 Community and social services occupations"

"P050064","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050064 Legal occupations"

"P050065","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050065 Education, training, and library occupations"

"P050066","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050066 Arts, design, entertainment, sports, and media occupations"

"P050067","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050067 Healthcare practitioners and technical occupations"

"P050068","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050068 Health diagnosing and treating practitioners and technical occupations"

"P050069","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050069 Health technologists and technicians"

"P050070","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050070 Service occupations"

"P050071","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050071 Healthcare support occupations"

"P050072","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050072 Protective service occupations"

"P050073","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050073 Fire fighting, prevention, and law enforcement workers, including supervisors"

"P050074","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050074 Other protective service workers, including supervisors"

"P050075","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050075 Food preparation and serving related occupations"

"P050076","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050076 Building and grounds cleaning and maintenance occupations"

"P050077","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050077 Personal care and service occupations"

"P050078","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050078 Sales and office occupations"
"P050079","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050079 Sales and related occupations"
"P050080","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050080 Office and administrative support occupations"
"P050081","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050081 Farming, fishing, and forestry occupations"
"P050082","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050082 Construction, extraction, and maintenance occupations"
"P050083","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050083 Construction and extraction occupations"
"P050084","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050084 Supervisors, construction and extraction workers"
"P050085","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050085 Construction trades workers"
"P050086","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050086 Extraction workers"
"P050087","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050087 Installation, maintenance, and repair occupations"
"P050088","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050088 Production, transportation, and material moving occupations"
"P050089","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050089 Production occupations"
"P050090","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050090 Transportation and material moving occupations"
"P050091","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050091 Supervisors, transportation and material moving workers"
"P050092","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050092 Aircraft and traffic control occupations"
"P050093","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050093 Motor vehicle operators"
"P050094","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050094 Rail, water and other transportation occupations"
"P050095","P Tables 2000 P050 Sex by Occupation for the Employed Civilian Population 16+ Years P050095 Material moving workers"

Household Income

"P052001","P Tables 2000 P052 Household Income in 1999 P052001 Total"
"P052002","P Tables 2000 P052 Household Income in 1999 P052002 Less than $10,000"

"P052003","P Tables 2000 P052 Household Income in 1999 P052003 $10,000 to $14,999"
"P052004","P Tables 2000 P052 Household Income in 1999 P052004 $15,000 to $19,999"
"P052005","P Tables 2000 P052 Household Income in 1999 P052005 $20,000 to $24,999"
"P052006","P Tables 2000 P052 Household Income in 1999 P052006 $25,000 to $29,999"
"P052007","P Tables 2000 P052 Household Income in 1999 P052007 $30,000 to $34,999"
"P052008","P Tables 2000 P052 Household Income in 1999 P052008 $35,000 to $39,999"
"P052009","P Tables 2000 P052 Household Income in 1999 P052009 $40,000 to $44,999"
"P052010","P Tables 2000 P052 Household Income in 1999 P052010 $45,000 to $49,999"
"P052011","P Tables 2000 P052 Household Income in 1999 P052011 $50,000 to $59,999"
"P052012","P Tables 2000 P052 Household Income in 1999 P052012 $60,000 to $74,999"
"P052013","P Tables 2000 P052 Household Income in 1999 P052013 $75,000 to $99,999"
"P052014","P Tables 2000 P052 Household Income in 1999 P052014 $100,000 to $124,999"
"P052015","P Tables 2000 P052 Household Income in 1999 P052015 $125,000 to $149,999"
"P052016","P Tables 2000 P052 Household Income in 1999 P052016 $150,000 to $199,999"
"P052017","P Tables 2000 P052 Household Income in 1999 P052017 $200,000 or more"
"P053001","P Tables 2000 P053 Median Household Income in 1999 (Dollars) P053001 Median household income in 1999"

Family Income

"P076001","P Tables 2000 P076 Family Income in 1999 P076001 Total"
"P076002","P Tables 2000 P076 Family Income in 1999 P076002 Less than $10,000"
"P076003","P Tables 2000 P076 Family Income in 1999 P076003 $10,000 to $14,999"
"P076004","P Tables 2000 P076 Family Income in 1999 P076004 $15,000 to $19,999"
"P076005","P Tables 2000 P076 Family Income in 1999 P076005 $20,000 to $24,999"
"P076006","P Tables 2000 P076 Family Income in 1999 P076006 $25,000 to $29,999"

"P076007","P Tables 2000 P076 Family Income in 1999 P076007 $30,000 to $34,999"
"P076008","P Tables 2000 P076 Family Income in 1999 P076008 $35,000 to $39,999"
"P076009","P Tables 2000 P076 Family Income in 1999 P076009 $40,000 to $44,999"
"P076010","P Tables 2000 P076 Family Income in 1999 P076010 $45,000 to $49,999"
"P076011","P Tables 2000 P076 Family Income in 1999 P076011 $50,000 to $59,999"
"P076012","P Tables 2000 P076 Family Income in 1999 P076012 $60,000 to $74,999"
"P076013","P Tables 2000 P076 Family Income in 1999 P076013 $75,000 to $99,999"
"P076014","P Tables 2000 P076 Family Income in 1999 P076014 $100,000 to $124,999"
"P076015","P Tables 2000 P076 Family Income in 1999 P076015 $125,000 to $149,999"
"P076016","P Tables 2000 P076 Family Income in 1999 P076016 $150,000 to $199,999"
"P076017","P Tables 2000 P076 Family Income in 1999 P076017 $200,000 or more"
"P077001","P Tables 2000 P077 Median Family Income in 1999 (Dollars) P077001 Median family income in 1999"

Per Capita Income

"P082001","P Tables 2000 P082 Per Capita Income in 1999 (Dollars) P082001 Per capita income in 1999"

Poverty Status by Age

"P087001","P Tables 2000 P087 Poverty Status in 1999 by Age P087001 Total"
"P087002","P Tables 2000 P087 Poverty Status in 1999 by Age P087002 Income in 1999 below poverty level"
"P087010","P Tables 2000 P087 Poverty Status in 1999 by Age P087010 Income in 1999 at or above poverty level"

Ratio of Income to Poverty Level

"P088001","P Tables 2000 P088 Ratio of Income in 1999 to Poverty Level P088001 Total"
"P088002","P Tables 2000 P088 Ratio of Income in 1999 to Poverty Level P088002 Under .50"
"P088003","P Tables 2000 P088 Ratio of Income in 1999 to Poverty Level P088003 50 to .74"

"P088004","P Tables 2000 P088 Ratio of Income in 1999 to Poverty Level P088004 75 to .99"
"P088005","P Tables 2000 P088 Ratio of Income in 1999 to Poverty Level P088005 1.00 to 1.24"
"P088006","P Tables 2000 P088 Ratio of Income in 1999 to Poverty Level P088006 1.25 to 1.49"
"P088007","P Tables 2000 P088 Ratio of Income in 1999 to Poverty Level P088007 1.50 to 1.74"
"P088008","P Tables 2000 P088 Ratio of Income in 1999 to Poverty Level P088008 1.75 to 1.84"
"P088009","P Tables 2000 P088 Ratio of Income in 1999 to Poverty Level P088009 1.85 to 1.99"
"P088010","P Tables 2000 P088 Ratio of Income in 1999 to Poverty Level P088010 2.00 and over"

Median Rent

"H060001","H Tables 2000 H060 Median Rent Asked (Dollars) H060001 Median rent asked"

Median Home Value

"H085001","H Tables 2000 H085 Median Value (Dollars) for All Owner-Occupied Housing Units H085001 Median value"

Median Income by Race

"P152B001","P Tables 2000 P152B Median Household Income in 1999 (Dollars) (Black Alone Householder) P152B001 Median household income in 1999"
"P152C001","P Tables 2000 P152C Median Household Income in 1999 (Dollars) (AIAN Alone Householder) P152C001 Median household income in 1999"
"P152D001","P Tables 2000 P152D Median Household Income in 1999 (Dollars) (Asian Alone Householder) P152D001 Median household income in 1999"
"P152E001","P Tables 2000 P152E Median Household Income in 1999 (Dollars) (NHPI Alone Householder) P152E001 Median household income in 1999"
"P152F001","P Tables 2000 P152F Median Household Income in 1999 (Dollars) (Some Other Race Alone Householder) P152F001 Median household income in 1999"
"P152G001","P Tables 2000 P152G Median Household Income in 1999 (Dollars) (Two or More Races Householder) P152G001 Median household income in 1999"
"P152H001","P Tables 2000 P152H Median Household Income in 1999 (Dollars) (Hispanic Householder) P152H001 Median household income in 1999"
"P152I001","P Tables 2000 P152I Median Household Income in 1999 (Dollars) (White Alone, Not Hispanic Householder) P152I001 Median household income in 1999"

Median Income by Age

"P055002","P Tables 2000 P055 Age of Householder by Household Income in 1999 P055002	Householder under 25 years"
"P055019","P Tables 2000 P055 Age of Householder by Household Income in 1999 P055019	Householder 25 to 34 years"
"P055036","P Tables 2000 P055 Age of Householder by Household Income in 1999 P055036	Householder 35 to 44 years"
"P055053","P Tables 2000 P055 Age of Householder by Household Income in 1999 P055053	Householder 45 to 54 years"
"P055070","P Tables 2000 P055 Age of Householder by Household Income in 1999 P055070	Householder 55 to 64 years"
"P055087","P Tables 2000 P055 Age of Householder by Household Income in 1999 P055087	Householder 65 to 74 years"
"P055104","P Tables 2000 P055 Age of Householder by Household Income in 1999 P055104	Householder 75 years and over"

Number Below the Poverty Level by Race and Age Group

"P159B007","P Tables 2000 P159B Poverty Status in 1999 by Age (Black Alone) P159B007	18 to 64 years"
"P159B008","P Tables 2000 P159B Poverty Status in 1999 by Age (Black Alone) P159B008	65 to 74 years"
"P159B009","P Tables 2000 P159B Poverty Status in 1999 by Age (Black Alone) P159B009	75 years and over"
"P159C007","P Tables 2000 P159C Poverty Status in 1999 by Age (AIAN Alone) P159C007	18 to 64 years"
"P159C008","P Tables 2000 P159C Poverty Status in 1999 by Age (AIAN Alone) P159C008	65 to 74 years"
"P159C009","P Tables 2000 P159C Poverty Status in 1999 by Age (AIAN Alone) P159C009	75 years and over"
"P159D007","P Tables 2000 P159D Poverty Status in 1999 by Age (Asian Alone) P159D007	18 to 64 years"
"P159D008","P Tables 2000 P159D Poverty Status in 1999 by Age (Asian Alone) P159D008	65 to 74 years"
"P159D009","P Tables 2000 P159D Poverty Status in 1999 by Age (Asian Alone) P159D009	75 years and over"
"P159E007","P Tables 2000 P159E Poverty Status in 1999 by Age (NHPI Alone) P159E007	18 to 64 years"
"P159E008","P Tables 2000 P159E Poverty Status in 1999 by Age (NHPI Alone) P159E008	65 to 74 years"
"P159E009","P Tables 2000 P159E Poverty Status in 1999 by Age (NHPI Alone) P159E009	75 years and over"
"P159F007","P Tables 2000 P159F Poverty Status in 1999 by Age (Some Other Race Alone) P159F007	18 to 64 years"

"P159F008","P Tables 2000 P159F Poverty Status in 1999 by Age (Some Other Race Alone) P159F008	65 to 74 years"
"P159F009","P Tables 2000 P159F Poverty Status in 1999 by Age (Some Other Race Alone) P159F009	75 years and over"
"P159G007","P Tables 2000 P159G Poverty Status in 1999 by Age (Two or More Races) P159G007	18 to 64 years"
"P159G008","P Tables 2000 P159G Poverty Status in 1999 by Age (Two or More Races) P159G008	65 to 74 years"
"P159G009","P Tables 2000 P159G Poverty Status in 1999 by Age (Two or More Races) P159G009	75 years and over"
"P159H007","P Tables 2000 P159H Poverty Status in 1999 by Age (Hispanic) P159H007	18 to 64 years"
"P159H008","P Tables 2000 P159H Poverty Status in 1999 by Age (Hispanic) P159H008	65 to 74 years"
"P159H009","P Tables 2000 P159H Poverty Status in 1999 by Age (Hispanic) P159H009	75 years and over"
"P159I007","P Tables 2000 P159I Poverty Status in 1999 by Age (White Alone, Not Hispanic) P159I007	18 to 64 years"
"P159I008","P Tables 2000 P159I Poverty Status in 1999 by Age (White Alone, Not Hispanic) P159I008	65 to 74 years"
"P159I009","P Tables 2000 P159I Poverty Status in 1999 by Age (White Alone, Not Hispanic) P159I009	75 years and over"

Number At or Above the Poverty Level by Race and Age Group

"P159B015","P Tables 2000 P159B Poverty Status in 1999 by Age (Black Alone) P159B015	18 to 64 years"
"P159B016","P Tables 2000 P159B Poverty Status in 1999 by Age (Black Alone) P159B016	65 to 74 years"
"P159B017","P Tables 2000 P159B Poverty Status in 1999 by Age (Black Alone) P159B017	75 years and over"
"P159C015","P Tables 2000 P159C Poverty Status in 1999 by Age (AIAN Alone) P159C015	18 to 64 years"
"P159C016","P Tables 2000 P159C Poverty Status in 1999 by Age (AIAN Alone) P159C016	65 to 74 years"
"P159C017","P Tables 2000 P159C Poverty Status in 1999 by Age (AIAN Alone) P159C017	75 years and over"
"P159D015","P Tables 2000 P159D Poverty Status in 1999 by Age (Asian Alone) P159D015	18 to 64 years"
"P159D016","P Tables 2000 P159D Poverty Status in 1999 by Age (Asian Alone) P159D016	65 to 74 years"
"P159D017","P Tables 2000 P159D Poverty Status in 1999 by Age (Asian Alone) P159D017	75 years and over"
"P159E015","P Tables 2000 P159E Poverty Status in 1999 by Age (NHPI Alone) P159E015	18 to 64 years"

"P159E016","P Tables 2000 P159E Poverty Status in 1999 by Age (NHPI Alone)
P159E016 65 to 74 years"
"P159E017","P Tables 2000 P159E Poverty Status in 1999 by Age (NHPI Alone)
P159E017 75 years and over"
"P159F015","P Tables 2000 P159F Poverty Status in 1999 by Age (Some Other Race
Alone) P159F015 18 to 64 years"
"P159F016","P Tables 2000 P159F Poverty Status in 1999 by Age (Some Other Race
Alone) P159F016 65 to 74 years"
"P159F017","P Tables 2000 P159F Poverty Status in 1999 by Age (Some Other Race
Alone) P159F017 75 years and over"
"P159G015","P Tables 2000 P159G Poverty Status in 1999 by Age (Two or More Races)
P159G015 18 to 64 years"
"P159G016","P Tables 2000 P159G Poverty Status in 1999 by Age (Two or More Races)
P159G016 65 to 74 years"
"P159G017","P Tables 2000 P159G Poverty Status in 1999 by Age (Two or More Races)
P159G017 75 years and over"
"P159H015","P Tables 2000 P159H Poverty Status in 1999 by Age (Hispanic)
P159H015 18 to 64 years"
"P159H016","P Tables 2000 P159H Poverty Status in 1999 by Age (Hispanic)
P159H016 65 to 74 years"
"P159H017","P Tables 2000 P159H Poverty Status in 1999 by Age (Hispanic)
P159H017 75 years and over"
"P159I015","P Tables 2000 P159I Poverty Status in 1999 by Age (White Alone, Not
Hispanic) P159I015 18 to 64 years"
"P159I016","P Tables 2000 P159I Poverty Status in 1999 by Age (White Alone, Not
Hispanic) P159I016 65 to 74 years"
"P159I017","P Tables 2000 P159I Poverty Status in 1999 by Age (White Alone, Not
Hispanic) P159I017 75 years and over"

Proportion Below Poverty Level by Race and Age Group (Calculated from Census Number at or above and Number Below Poverty Level by Race and Age Group).

“pctpov18_64Black”, “Percent below the poverty level 18-64, Black Alone”
“pctpov65_75Black” , “Percent below the poverty level 65-74, Black Alone”
“pctpovover75Black” , “Percent below the poverty level over 75, Black Alone”
“pctpov18_64AIAN” , “Percent below the poverty level 18-64, AIAN Alone”
“pctpov65_75AIAN” , “Percent below the poverty level 65-74, AIAN Alone”
“pctpovover75AIAN” , “Percent below the poverty level over 75, AIAN Alone”
“pctpov18_64Asian” , “Percent below the poverty level 18-64, Asian Alone”
“pctpov65_75Asian” , “Percent below the poverty level 65-74, Asian Alone”
“pctpovover75Asian” , “Percent below the poverty level over 75, Asian Alone”
“pctpov18_64NHPI” , “Percent below the poverty level 18-64, NHPI Alone”
“pctpov65_75NHPI” , “Percent below the poverty level 65-74, NHPI Alone”
“pctpovover75NHPI” , “Percent below the poverty level over 75, NHPI Alone”
“pctpov18_64Other” , “Percent below the poverty level 18-64, Some Other Race Alone”
“pctpov65_75Other” , “Percent below the poverty level 65-74, Some Other Race Alone”

“pctpovover75Other” , “Percent below the poverty level over 75, Some Other Race Alone”
“pctpov18_64more2” , “Percent below the poverty level 18-64, Two or More Races”
“pctpov65_75more2” , “Percent below the poverty level 65-74, Two or More Races”
“pctpovover75more2” , “Percent below the poverty level over 75, Two or More Races”
“pctpov18_64Hispanic” , “Percent below the poverty level 18-64, Hispanic”
“pctpov65_75Hispanic” , “Percent below the poverty level 65-74, Hispanic”
“pctpovover75Hispanic” , “Percent below the poverty level over 75, Hispanic”
“pctpov18_64White” , “Percent below the poverty level 18-64, White Alone, Not Hispanic”
“pctpov65_75White” , “Percent below the poverty level 65-74, White Alone, Not Hispanic”
“pctpovover75White” , “Percent below the poverty level over 75, White Alone, Not Hispanic”