Reporting of Indian Health Service Coverage in the American Community Survey

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Abstract

Response error in surveys affects the quality of data which are relied on for numerous research and policy purposes. We use linked survey and administrative records data to examine reporting of a particular item in the American Community Survey (ACS) – health coverage among American Indians and Alaska Natives (AIANs) through the Indian Health Service (IHS). We compare responses to the IHS portion of the 2014 ACS health insurance question to whether or not individuals are in the 2014 IHS Patient Registration data. We evaluate the extent to which individuals misreport their IHS coverage in the ACS as well as the characteristics associated with misreporting. We also assess whether the ACS estimates of AIANs with IHS coverage represent an undercount. Our results will be of interest to researchers who rely on survey responses in general and specifically the ACS health insurance question. Moreover, our analysis contributes to the literature on using administrative records to measure components of survey error.

Introduction

The Indian Health Service (IHS) is a public health program that provides health care primarily to members of American Indian tribes and Alaska Natives. Researchers studying this program often rely on survey data to understand who accesses IHS (Bhaskar and O'Hara 2017; Brown et al. 2000; Johnson et al. 2010; Zuckerman et al. 2004). American Indians and Alaska Natives (AIANs) represent a small population and potential misreporting about their health coverage may have large impacts on the final survey statistics. As AIANs have been found to have lower access to health care and poorer health status compared to other race groups (Johnson et al. 2010, Zuckerman et al. 2004), accurate statistics on IHS participation are particularly important to understanding the health care needs of this underserved population.

Our study evaluates the quality of IHS coverage reporting among AIANs in the American Community Survey (ACS). We ask three main research questions – first, how accurate are ACS estimates of the total number of AIANs with IHS coverage; second, what is the extent of misreporting of IHS coverage in the ACS; and third, what characteristics are associated with this misreporting. To answer these questions, we use data from the 2014 ACS and the 2014 IHS Patient Registration file, which includes data on all individuals who have ever been registered at an Indian Health Service facility. First, we compare ACS estimates of AIANs with IHS coverage with IHS coverage estimates derived from the IHS file. To further evaluate misreporting of IHS coverage for our second and third research questions, we link the data using probabilistic linkage techniques and compare individuals' responses regarding IHS coverage in the ACS to whether or not they are present in the IHS Patient Registration file. We measure two types of misreporting: 1) those who do not report IHS coverage when the administrative records suggest they have been registered with the IHS ("false negatives") and 2) those who report having IHS coverage when the administrative records suggest they do not ("false positives"). Our focus is on AIANs though we do present some general findings for the total population as well, as some non-AIANs are eligible for care through the IHS.

Our findings on reporting accuracy are important to healthcare researchers who rely on survey data to generate estimates of healthcare coverage and access, both broadly and specifically for the AIAN population. Bhaskar and O'Hara (2017) use ACS estimates to evaluate IHS coverage of AIANs by insurance type. They find that AIANs who are uninsured and those with Medicaid coverage are more likely to have IHS coverage compared to those with private health insurance coverage. Living on tribal lands is found to be associated with greater likelihood of having IHS coverage and while there is some variation by insurance type, higher family income and having children are also associated with greater likelihood of having IHS coverage. These findings are all dependent on the accuracy of the ACS estimates of IHS coverage. Disparities in health care access and outcomes for the AIAN population

relative to other groups makes accurate measurement of IHS coverage particularly critical (Johnson et al. 2010; Zuckerman et al. 2004). Policy makers aiming to understand and improve access to care for AIANs in an effort to improve health outcomes for this group need to have an accurate understanding of how AIANs currently access health services. It is already known from previous work that using survey data to study AIAN health care is particularly difficult given the small size of this population. Johnson et al. (2010), for example, find that based on the different methodologies and measures used in surveys, estimates of the AIAN population and their insurance coverage can vary substantially. Estimates of insurance coverage are also dependent on the accuracy with which respondents answer survey questions, thus it is important for researchers to be aware of the accuracy of reporting of IHS coverage.

Our findings on reporting of IHS coverage specifically can also offer insight into the quality of data on reporting of health insurance and health care access more broadly. Our results also contribute to efforts within the U.S. Census Bureau to understand the quality of survey data to improve imputation procedures for cases where responses are missing. Specifically by evaluating the impact of imputation status on misreporting, we provide insight on the accuracy of responses imputed by Census Bureau editing procedures. Finally, our research contributes to methodological literature on the use of administrative records as a tool for evaluating survey error. The issues we encounter when using IHS administrative records to evaluate IHS coverage responses in the ACS, as well as the benefits we gain when linking these datasets, are applicable to other research using administrative records and survey data to measure the quality of reporting on a variety of topics.

Indian Health Service

Compared to other race groups, AIANs, have lower rates of health insurance, significant barriers to accessing care, and poorer health outcomes as evidenced by higher rates of diabetes and cardiovascular disease among other conditions (Artiga et al. 2013; Johnson et al. 2010; Zuckerman et al. 2004). This continues to be true despite the federal government's responsibility to provide care to many AIANs which is done through the IHS. The IHS provides health care services primarily to members of federally recognized AIAN tribes through programs and facilities located on or near Indian reservations as well as certain urban areas (Department of Health and Human Services 2014; Walke 2008). Services are provided either directly through federally or tribally run hospitals and centers or through contract service providers (Aronovitz 2005). Eligibility for direct care from the IHS is generally restricted to members of federally recognized tribes and their descendants (Aronovitz 2005; James et al. 2009). For care through contract providers, individuals must live in a Contract Health Service Delivery Area (CHSDA), geographic areas defined based on proximity to reservations (Aronovitz 2005). There are exceptions that allow some non-AIANs to be eligible for services – for example, commissioned officers of the public health service on

duty at IHS facilities and beneficiaries of the Veterans Affairs (VA) who do not live in proximity to a VA facility may be eligible for some services.[1]

Official IHS estimates indicate that in 2013, there were 2.7 million Indian registrants in the IHS system, with an active user population of 1.6 million Indians (Department of Health and Human Services 2013). The IHS is not an insurance program, but rather a program that delivers health services to eligible patients. IHS users may have health insurance from public or private sources, or they may be uninsured. A recent study using ACS data finds that about 34 percent of AIANs with IHS coverage have private insurance, 18 percent have Medicaid or Medicare, while close to 50 percent are uninsured (Bhaskar and O'Hara 2017). Research has documented several limitations of the effectiveness of IHS in delivering health services, including difficulty for individuals to access its services due to distance to care, and long wait times (Aronovitz 2005; Forquera 2001). However, access to IHS facilities and doctors has been found to have an important impact on access to care – AIANs with IHS coverage have higher rates of health care utilization compared to those without IHS coverage (Zuckerman et al. 2003). As such, the IHS is potentially critical to health outcomes for AIAN individuals, and for the overall health of this group as a whole.

Using Administrative Records to Evaluate Reporting Accuracy in Sample Surveys

The ACS has become a primary data source for statistics for federal and state governments as well as researchers and commercial organizations on a wide range of topics. Researchers studying small populations, such as AIANs, often rely on the ACS due to its large sample size and design, which oversamples American Indian reservations (Murphy and Huggins 2015). Because the ACS and other sample surveys often comprise the primary source of information available to social science researchers studying small populations, it is critically important that this information be accurate.

It is concerning therefore, that in recent years researchers have found a decline in the quality of survey data (Meyer et al. 2015). Part of this decline is a result of increasing nonresponse – including nonresponse by entire household units and nonresponse to individual survey items (Groves 2006; Meyer et al. 2015). To counter item nonresponse, statistical organizations use a variety of methods to impute responses for missing data (Meyer et al. 2015). When individuals do respond to surveys, studies have found increasing inaccuracy in responses, also known as measurement error (Meyer et al. 2015).

The main technique used to quantify measurement or response error is to compare survey responses to some external data source in which the same individuals also appear. In some cases, reinterviews are conducted wherein a sample of the original survey respondents are re-asked essentially

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[1] Information on non-AIANs eligible for IHS services can be found on the IHS website at: https://www.ihs.gov/ihm/index.cfm?module=dsp_ihm_pc_p2c4#2-4.2J

the same questions and differences in responses are evaluated. In 2012, the U.S. Census Bureau conducted a reinterview for the ACS (Murphy 2014). This work found that for most questionnaire items on the ACS, response error is not a major concern though they did identify certain topics, such as income and year of naturalization, for which reliability may be a problem. In other studies, administrative records have been used as the external data source to which survey data are compared for topics such as program participation, income, education, and health insurance coverage (Bhaskar et al. 2016; Meyer and Mittag 2015; Moore et al. 2000; Noon et al. 2016; Taeuber et al. 2004). Administrative records have been compared to survey data both in aggregate and at the individual level using linked data.

This approach of linking survey responses to administrative records has been useful in documenting measurement error in Medicaid and Medicare survey responses. Recent work by Noon et al. (2016) compares the Current Population Survey Annual Social and Economic Supplement (CPS ASEC) estimate of the Medicaid covered population to enrollment counts using data from the National Medicaid Statistical Information System (MSIS) and finds the CPS ASEC undercounts Medicaid coverage by between 22 and 31 percent in recent years. Another recent study conducts a similar analysis using Medicare enrollment data and finds a much lower undercount of Medicare enrollment relative to the findings on Medicaid (Bhaskar et al. 2016).

Both studies find that that misreporting was not random, but rather was associated predictably with social and demographic characteristics. Characteristics associated with misreporting of Medicaid and Medicare coverage include: reported coverage by other health insurance programs, insurance coverage of others in the household, citizenship status, year of entry, labor force participation, and disability status (Bhaskar et al. 2016; Noon et al. 2016). In addition, both studies found that imputed responses (in cases of item nonresponse or incomplete and invalid responses) contributed to a large portion of misreported coverage.

Theory and Empirical Expectations

We ground our empirical expectations for the outcome of our study in both previous research on the accuracy of reporting on health coverage, and in theory about survey recall as it pertains to the complexity of the recall task, and the salience of the topic to the respondent. We expect that characteristics associated with greater usage and need for health care services may be tied to greater reporting accuracy. Survey recall theory asserts that respondents are more likely to report accurately on topics that have a high degree of salience to them. Salient topics include those that are highly relevant to respondents' daily lives, that have emotional importance, and/or that affect their finances (Linton 2000). In the context of the present study, IHS coverage is likely most salient to American Indians and particularly those who are members of tribes and living in areas with IHS facilities. For most users,

eligibility and access to IHS is largely tied to tribe membership and geography (Aronovitz 2005; James et al. 2009). Thus, we expect individuals who identify as AIAN, those who report a tribe, and those who live on or near reservations (and thus are likely more familiar with IHS) will report more accurately on their IHS coverage, or lack thereof. Use or non-use of IHS services may be more salient for individuals who identify with a tribe and live on or near reservations, because of their relevance to individual identities and experiences, and because of greater awareness of the IHS program. For non-AIANs who have used IHS facilities, past IHS coverage may not be recalled because it is not aligned with these individual's racial or ethnic identity.

Health care coverage is likely highly salient to individuals who regularly receive frequent care. For example, those who report having a disability in the ACS may be more likely to seek regular care and be aware of their coverage, and thus be more accurate in their reporting of IHS coverage. In addition, IHS coverage may be particularly significant for individuals without insurance who must pay out of pocket for health services and to those with relatively more constrained finances because of the associated costs. We expect that individuals with low socioeconomic status (SES) as measured by educational attainment, will be more likely to report accurately on IHS use. Among individuals who have used IHS care in the past, we expect that those who have visited an IHS clinic recently (i.e., for whom IHS services are more salient) will be less likely to misreport than those who last visited longer ago.

Survey recall theory also asserts that respondents report less accurately on topics in which their own experience has a high degree of complexity (Sudman et al. 1996). For example, previous research has documented lower accuracy in reporting of employment among individuals with many short spells of employment (Mathiowetz and Duncan 1988; Manzoni et al. 2010). In the context of the present study, complexity of the recall task would involve multiple ways of accessing and/or paying for health services. Noon et al. (2016) found that individuals with multiple types of insurance coverage report on their coverage less accurately. We expect that in the present study, individuals with health insurance will be less likely to report accurately on their IHS coverage. In addition, individuals who are employed may be more likely to have insurance and/or access to health care through their employers. Thus, we expect that employed individuals will report less accurately on their IHS use.

Accuracy of reporting may also be tied to whether an individual is responding about their own health coverage or about coverage of another household member. While we cannot determine who within each household is responding to the survey, previous research suggests that for decennial censuses, it is usually the householder or his/her spouse that provides information for all members of the household (DeMaio and Bates 1990; Sweet 1990a and 1990b). If we assume that to be true for our sample, we would expect to find greater accuracy in reporting among householders/spouses relative to other household members. Previous research finds that among individuals with Medicare coverage, those living in

households where another member is reported as having Medicare in the CPS ASEC are more likely to have an accurate response to the survey themselves (Bhaskar et al. 2016). We may similarly find greater accuracy in reporting of IHS coverage among those who live in households where another member was reported as having IHS coverage. Bhaskar et al. (2016) and Noon et al. (2016) also find greater accuracy in survey responses that are reported by someone in the household versus those that require imputation due to a missing or invalid response. In line with these findings, we expect to find higher rates of error in IHS coverage response among imputed responses compared to those reported by someone in the household.

Data and Methods

We use data from the 2014 Indian Health Services (IHS) Patient Registration file and the 2014 American Community Survey (ACS). The 2014 IHS Patient Registration file is a set of administrative records generated by IHS providers at the clinic level for the purpose of managing information on the medical care that individual IHS patients receive. It contains data on all individuals who have ever visited an IHS doctor or facility, and for whom a registration form was sent to the National Data Warehouse, a national data repository for the IHS. Therefore, the file includes data both on current IHS participants and also on people who may not be currently accessing IHS care but have at some point in the past visited an IHS facility. Individuals who are eligible to receive care through the IHS but have never visited an IHS facility or doctor are not in the file. We exclude all records in the IHS file with a state outside the fifty states or District of Columbia, resulting in 3.6 million unique records. The IHS file includes an "Indian indicator" variable which we use to restrict the file to AIANs with IHS coverage (2.5 million).

The 2014 ACS includes data on 5.1 million unweighted people. Using survey weights that account for survey design this represents a population of 318.9 million. The ACS includes a question that asks "Is this person currently covered by any of the following types of health insurance or health coverage plans." Respondents are asked to select a "yes" or "no" checkbox to indicate whether they are covered by several types of health insurance or programs, including the IHS. For the majority of people, responses regarding IHS coverage were provided in response to the survey, but some cases were imputed due to a missing or invalid response. In the 2014 ACS, approximately 12 percent of responses to the IHS portion of the health insurance question were allocated.[2]

First, we compare ACS estimates of the total number of AIANs with IHS coverage to the number of AIANs with IHS coverage according to the IHS file in order to assess to what extent the ACS may undercount the total number of AIANs with IHS coverage. To generate our undercount estimate, we

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[2] Allocation rates for ACS variables can be found at: https://www.census.gov/acs/www/methodology/sample-size-and-data-quality/item-allocation-rates/index.php#health_insurance

compare the number of AIANs on the IHS file to the number of AIANs estimated to have IHS coverage by the 2014 ACS. For this portion of the analysis we evaluate ACS estimates and the IHS file separately. In addition to factors such as survey coverage, an undercount (or overcount) may result in part from response errors that we evaluate in our next two research questions. Because the IHS file includes individuals who have died, we exclude individuals who died prior to 2014.

Next, we link individuals in the 2014 ACS and the 2014 IHS file to evaluate inconsistencies in reporting. Prior to linkage, unique, protected identifiers are first assigned to each file through probabilistic matching techniques which use personally identifiable information on the files such as name, date of birth, address, gender, and in the case of the IHS file Social Security Number. After the assignment of these unique identifiers, all personal information is removed to preserve confidentiality. For more information about this process, see Wagner and Layne (2014).

Once the unique identifiers are assigned to the ACS and IHS data, we link the files. Not all records are assigned a unique identifier. For the 2014 ACS, 92.1 percent of individuals were assigned a unique identifier while 97.3 percent of percent of individuals in the 2014 IHS file were assigned a unique identifier. Previous research has documented biases in the assignment of unique identifiers where some groups such as immigrants and recent movers have lower rates of assignment (Bond et al. 2014). To account for bias introduced by observations that cannot be linked because they were not assigned a unique identifier, we adjust ACS sample weights with inverse probability treatment weights, estimated based on characteristics that are associated with the assignment of unique identifiers. These characteristics include race, Hispanic origin, age, imputation status of age, sex, nativity, marital status, and recent migration. All results shown in the paper are based on the adjusted ACS weights. The assignment of unique identifiers on the IHS file is high across characteristics so we do not reweight these data.

We measure two types of inconsistencies in IHS coverage reporting - which we refer to as false negatives and false positives - based on responses to the IHS portion of the ACS health insurance question and whether or not individuals are in the IHS file. False negatives are measured as individuals who despite being in the IHS administrative records data, did not indicate they use IHS in the ACS. The universe for measuring false negatives includes all records in the ACS-IHS linked data. There are about 71,000 unweighted people in the 2014 ACS that link to the 2014 IHS file. Using our adjusted weights, which account for both ACS design and the assignment of unique identifiers, this represents approximately 2.8 million people.

False positives are defined as those who report having IHS in the ACS but were not found in the IHS administrative file. The universe for measuring false positives includes all linkable records (i.e., records assigned unique identifiers) in the ACS who report having IHS coverage. There are about 44,000

unweighted people in the 2014 ACS were assigned unique identifiers and reported having IHS coverage. Using the adjusted weights, this represents approximately 1.5 million people.

We first show estimates of false positive and false negative reporting for the total population and separately for AIANs and non-AIANs. We define AIANs based on responses to the ACS question on race. Specifically we define AIAN as those who report an AIAN race, whether it is their only response or in combination with other races. We then evaluate characteristics associated with each type of response error for the AIANs in our sample, using descriptive statistics and logistic regression to model separately the probabilities of an ACS respondent reporting a false negative response or false positive response. We include in each model several independent variables including: flag variables to indicate whether or not a tribe was reported in response to the race question[3] and whether or not an AIAN ancestry was reported in response to the ancestry question[4], Hispanic origin, age, sex, nativity, health insurance coverage, and disability status. For a separate set of models restricted to adults ages 25 and higher, we also include variables on educational attainment, marital status, and employment. A variable on the IHS file indicates when the information for a person was last known to be reviewed or updated. When evaluating false negatives, we incorporate this variable into our analysis in order to give us some sense of how recently a person visited an IHS doctor or facility.

Limitations

While there are many benefits to using linked administrative records and survey data, differences between the data sources present some challenges. The ACS question on health insurance and coverage plans measures *current* coverage. The IHS file, on the other hand, includes all individuals who have ever been registered at an IHS facility. It therefore includes individuals who used IHS many years ago but for whom IHS is not a current source of coverage and does not include individuals who are eligible to receive IHS care but have never visited an IHS facility. The file also only includes patients for whom a record was sent to the national repository, thus if there is any underreporting by individual clinics this will impact who is in the file. These factors introduce error into our assessment of the accuracy of total ACS estimate of AIANs with IHS coverage. Specifically, our measurement of an undercount is based on a comparison of the ACS estimate of the population with IHS coverage and the population based on the IHS file that has visited an IHS facility at some point.

Differences between the data sources also introduce error in our estimates of false positive and negative reporting of IHS coverage. The inclusion of individuals who have not visited an IHS facility recently and for whom IHS is not a current source of coverage presents a limitation for our assessment of

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[3] The ACS race question includes a write-in option where individuals may write their "enrolled or principal tribe".
[4] The ACS includes an open ended question that asks "What is this person's ancestry or ethnic origin?"

false negative errors. We consider individuals who are in the IHS file yet report "no" to having IHS coverage to be false negatives yet some of these individuals may be in the file because IHS was previously, but not currently, a source of coverage. To address this limitation we use the variable on the IHS file that indicates when a patient's information was last updated at an IHS facility. Additionally, we define false positives as individuals who indicate having IHS coverage in the ACS but are not present in the IHS file; however some of these individuals may be eligible for IHS care and therefore "covered" but simply have never visited or been registered at an IHS facility. Thus while we use the terms "false negative" and "false positive", what we are identifying are inconsistencies between survey response and presence in IHS data, but some of these inconsistencies may not necessarily reflect incorrect reporting.

Results

Does the ACS undercount the IHS-covered population?

In Table 1, we compare estimates of the IHS covered AIAN population from the 2014 ACS and the 2014 IHS file in an effort to evaluate the accuracy of the ACS estimates of IHS coverage. As shown in the first row, the 2014 ACS estimates suggest there are 1.3 million AIANs with IHS coverage. The 2014 IHS file contains unique records for 2.5 million AIANs who have at some point been registered at an IHS facility. When we link records with unique identifiers to the 2014 Numident, we find that 166 thousand died prior to 2014. We then compare the 2.5 million AIANs who, based on the 2014 IHS file, have been registered at an IHS facility at some point and who are currently alive to the 1.3 million IHS covered AIANs estimated by the ACS. This comparison suggests the ACS undercounts the number of AIANs with IHS coverage by 41.5 percent. In other words, the ACS estimate based self-reported IHS coverage is substantially lower than the number of AIANs who have ever been registered with the IHS. The 2014 ACS estimate of AIANs with IHS coverage (1.3 million) is also lower than what IHS estimated to be its active user population of 1.6 million Indians in 2013.

Table 2 shows the calculation of false negatives and false positives using the linked IHS-ACS data with our adjusted weights for both the total population and for those who are AIAN alone or in combination. Of the estimated population of 2.8 million people in the ACS-IHS matched universe, about 1.2 million (41.7 percent) indicated having IHS coverage in the ACS. The remaining 1.6 million (or 58.3 percent) are considered false negatives – they are in the IHS file but did not report having IHS coverage in the ACS. Of the matched ACS-IHS estimated population, 1.6 million (57.1 percent) reported their race as AIAN alone or in combination with another race in the ACS.[5] The remaining 1.1 million did not report

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[5] Note that race information in the ACS is not always consistent with the Indian indicator variable on the IHS file. Among records in both the 2014 ACS and 2014 IHS file, race information was consistent (i.e. AIAN alone or in combination with another race in the ACS and Indian in the IHS file or not AIAN alone or in combination in the ACS and not Indian in the IHS file) for 83.6 percent of records.

as AIAN. As mentioned earlier, some individuals who are not AIAN, such as commissioned officers of public health programs or veterans without access to VA services, are eligible for IHS. This relatively high number of non-AIAN individuals may also be influenced by high rates of fluidity in race reporting among AIANs as evidenced by previous research (Liebler et al. 2016). Some of these individuals who did not report an AIAN race in the 2014 ACS may still identify as AIAN and at other times or in different contexts may report an AIAN race. However, we do find differences in false negative reporting of IHS coverage among those who did and those who did not report an AIAN race in the ACS. Specifically, consistent with our expectations, those who reported an AIAN race alone or in combination with another race have a much lower rate of false negatives, 30.8 percent, compared to those who do not report an AIAN race, 94.9 percent.

To measure false positives, we evaluate whether individuals who reported having IHS coverage in the ACS were in fact in the IHS file. Of the 1.5 million people who reported having IHS coverage and were assigned a unique identifier for linking, 1.2 million (77.3 percent) matched to the IHS file. The remaining 339,000, or 22.7 percent, were false positives in that they were not in the IHS file despite having reported having IHS coverage. The majority of individuals who report IHS coverage are AIAN alone or in combination (1.3 million AIANs versus 202,800 non-AIAN). However, again consistent with our expectations, the false positive rate is higher among those who are not AIAN (69.9 percent) compared to those who are AIAN alone or in combination (15.3 percent).

For the remainder of our analysis, we focus on AIANs, as they are the main target population of the IHS and most IHS research that uses survey data focuses on AIAN health. We show false positive and negative rates among AIANs by characteristics in Table 3 (false positives) and Table 4 (false negatives). Table 3 includes the 1.3 million estimated people that reported having IHS coverage in the ACS and were assigned unique identifiers so we are able to determine if they are in fact in the IHS file. As stated earlier, about 1.1 million AIANs (84.7 percent) who reported having IHS coverage in the ACS were present in the IHS file. For 197,407 (or 15.3 percent) we classify their response as a false positive - they reported having IHS coverage in the ACS but were not present in the IHS file. As shown in Table 3, there is variation in the percent that report a false positive by characteristics. IHS coverage responses by Hispanic and foreign-born AIANs are more likely to be false positive relative to non-Hispanic and native AIANs. As expected, false positive error varies by geography. The majority of AIANs in our sample live in Contract Health Service Delivery Areas (CHSDAs), and we find that these individuals have a lower rate of reporting a false positive (11.0 percent) compared to those living outside of CHSDAs (50.7 percent). This is expected as these individuals in these areas likely have greater accessibility to IHS services and awareness of the program and thus are more accurate in their reporting. Of the 1.3 million records in our false positive universe, IHS coverage was imputed for about 90,000 (6.9 percent). For these individuals,

their response was incomplete or invalid and the Census Bureau's editing procedures were used to impute a response. Imputed responses were more likely to be false positives relative to responses that were reported by the individual or a member of their household.

Table 4 shows false negative rates among the 1.6 million AIANs in the ACS-IHS linked data by these same characteristics and we find similar results. Hispanics and foreign-born AIANs are more likely to report false negatives compared to non-Hispanics and the native born. Again consistent with expectations, those who live outside CHSDAs are more likely to falsely report not having IHS coverage compared to those in CHSDAs. As found with false positives, imputed IHS coverage responses are more likely to be false negatives compared to responses as reported by a respondent. We also show false negative rates by the year an individual's information was last reviewed or updated in the IHS registration system. Unsurprisingly, those whose information has been updated more recently, suggesting they have visited an IHS doctor or facility more recently, are less likely to report false negatives. However we find for the 144,000 AIANs whose information was updated with an IHS office or facility in 2014, about 27,000 or 18.9 percent were false negatives as they reported not having IHS coverage in the 2014 ACS. If we focus on those whose information was updated at an IHS facility within five years of the survey (2010-2014), we find 206,000 (25.2 percent) AIANs reported false negatives.

Next, we evaluate the characteristics associated with both types of misreporting of IHS coverage among AIANs using logistic regression techniques. Table 5 shows odds ratios for our two models. Model 1 assesses the characteristics associated with false positive reporting and Model 2 shows results for false negative reporting. We generally find that most characteristics have similar associations with both types of misreporting as found in our descriptive analysis. IHS coverage responses for children are more likely to be false positives or false negatives compared to adults. This may be a result of differences in health insurance coverage among children and adults within a family as well as a factor of who is responding to the survey.

We find that Hispanic AIANs are more likely to misreport their IHS coverage relative to non-Hispanic AIANs. Additionally, the foreign born are about 4.5 times more likely to misreport their IHS coverage as false positives or false negatives relative to the native born. Hispanics and the foreign born are a very small portion of our samples, and it's possible these characteristics are associated with lower awareness about the IHS program which may lead to more errors in reporting.

Our regression analysis confirms our descriptive finding that geographic factors are associated with IHS coverage reporting error. Living in CHSDAs is associated with lower odds of both false positive (odds ratio = 0.14) and false negative reporting (odds ratio = 0.45). Once again due to eligibility rules as well as accessibility, individuals in CHSDAs are more likely to be aware of IHS programs and more accurate in their reporting.

Consistent with our expectations based on previous research, reporting having health insurance coverage (through employer sponsored insurance, directly purchased insurance, Medicare, Medicaid, TRICARE or other military health care, VA, or other health insurance coverage) in response to the same question in which IHS coverage is reported is associated with higher likelihoods of both types of response error (odds ratio = 1.38 for false positive, 2.28 for false negative). In other words, among AIANs who report having IHS coverage in the ACS, those who report having private or public health insurance coverage are more likely to respond to the portion of the question about IHS coverage in a manner that is inconsistent with whether or not they are in the IHS file. AIANs with disabilities have lower odds of reporting false negatives compared to those with no reported disability. Our regression model includes a variable about relationship to the householder from the ACS. For AIANs who are the householder or spouse, we find that their IHS coverage responses are more likely to be false positives relative to those who were another relative, non-relative of the householder or living in group quarters. Householders and their spouses are less likely to report false negatives relative to others in the household and those living in group quarters. Living in a household where another individual was reported as having IHS coverage in the ACS is associated with lower odds of reporting error, particularly false negative reporting. For our false positive model the odds ratio is 0.69 and for the false negative model the odds ratio is 0.04. Familiarity with the program and multiple individuals in a household using IHS care may lead to greater accuracy in reporting.

In our false negative model, we use the variable from the IHS file that indicates when an individual's information was last updated to approximate when an individual may have last visited an IHS doctor or center. As with our descriptive analysis, more time since the last appointment is associated with greater odds of misreporting. Finally, in both models we find that imputed responses about IHS coverage are more likely to be misreports compared to reported responses that did not require any imputation. In Model 1, we find that imputed responses indicating that individuals have IHS coverage are 4 times more likely to be false positives relative to responses of IHS coverage reported by individuals (or other members of their household). Results from Model 2 indicate that among individuals in both the ACS and IHS data, those with imputed responses were 6 times more likely to be false negatives relative to as reported responses. This is not surprising but it is important to note that imputation procedures are resulting in misclassification of IHS coverage for some AIANs.

Given our finding that a substantial number of individuals in the IHS file as well as the ACS-IHS linked data were not AIAN (as recorded in the IHS file or reported in the race question to the ACS), as well as the fact that misreporting of IHS coverage is much higher among non-AIANs, we conduct a similar logistic regression for non-AIAN individuals. Appendix Table A shows odds ratio results for similar models as presented in Table 5, except here we restrict our analysis to those whose response to the

2014 ACS race question did not include AIAN. It is interesting to note that many of the same characteristics that are associated with IHS coverage reporting error for AIANs are similarly associated with reporting error among non-AIANs. We do find some differences in results for non-AIANS (as shown in Appendix Table A) relative to results for AIANs (as shown in Table 5). For example, AIAN ancestry is significantly associated with lower odds of misreporting among those that do not report an AIAN race while this variable is not significant in the AIAN model.

Table 6 shows results from a second set of models that are restricted to the AIAN population ages 25 and older and include additional socioeconomic variables. We find similar patterns as discussed above for the variables included in both models – among AIANs ages 25 and higher, living in CHSDAs, and having a non-imputed response to the IHS portion of the health insurance question are associated with lower odds of false positive and negative reporting. As with AIANs of all ages, among those ages 25 and higher non-Hispanic native AIANs are less likely to report false positives or false negatives compared to Hispanic foreign-born AIANs. We find that some of the socioeconomic variables added in this model are associated with misreporting. For example, married AIANs are more likely than those who have never been married to report false positives and false negatives. Those who have been widowed, separated, or divorced are less likely to report false negatives compared to never-married AIANs. Employment status is generally not a significant factor, though AIANs who are not in the labor force are less likely than employed individuals to report false positives. AIANs with a bachelor's degree or higher are more likely to report a false positive compared to AIANs with no high school degree. Conversely, AIANs with a high school degree or higher are less likely to report false negatives compared to AIANs with no high school degree. AIANs who report SSI receipt are more likely to report false positives but less likely to report false negatives.

Discussion

We used the ACS and -IHS administrative records data to investigate the accuracy of survey estimates of IHS coverage as well as the consistency of individuals' responses on IHS coverage in the ACS with their presence or absence in IHS administrative records listing all IHS participants. We focused our analysis on AIANs, as IHS access is critical to the overall healthcare access of AIAN individuals, who have disproportionately high rates of health problems including diabetes and cardiovascular disease among other conditions (Artiga et al. 2013; Johnson et al. 2010; Zuckerman et al. 2004).

We first compared ACS estimates of IHS coverage with information from the IHS file. Our findings indicate that the ACS estimate of AIANs with IHS coverage undercounts by 41 percent the total number of AIANs who according to the administrative records file have ever received care through the IHS. This is quite substantial and is comparable to what previous work has found for survey reporting of

Medicaid coverage (about 35-39 percent) and much higher than what similar work found for reporting of Medicare coverage (about 5 percent) (Bhaskar et al. 2016; Noon et al. 2016). However it is important to point out some differences between our work and these studies. The Medicare and Medicaid research compared responses from survey data to administrative records data on enrollment. Individuals in the administrative records files used included all those with Medicaid or Medicare coverage regardless of whether or not they had used their coverage to receive healthcare. Additionally the administrative records only included those currently enrolled in either program. As we use clinic-based administrative data on those who ever received care through the IHS and for whom a record was sent to the national data repository, our measure of the ACS undercount of AIANs with IHS coverage is somewhat limited. Despite these limitations, the difference between the ACS estimates and those from the IHS file are important to note. Along with our finding that the ACS undercounts the total number of AIANs who have ever received care through the IHS, the ACS estimate of AIANs with IHS coverage is lower than what the IHS estimates to be its active user population.

To further evaluate the discordance between the ACS and IHS file, we linked the ACS and IHS data, and we compared survey responses with the presence or absence of a person in the IHS administrative records. We found among AIANs who report having IHS coverage in the ACS, close to 200,000 or 15.3 percent, are not present in the IHS file ("false positives") Among those ACS respondents who are present in the IHS file, about 490,000, or 30.8 percent, report not having IHS coverage in the ACS ("false negatives"). While not our focus, it is worth noting that there are a substantial number of non-AIANs on the IHS file indicating that they at some point have received IHS care. IHS coverage responses among non-AIANs in the ACS are highly inconsistent with whether or not individuals are in the IHS. This is not surprising, as non-AIAN individuals may more commonly receive IHS health care services temporarily and due to federal and military job postings in geographically remote locations.

We evaluated characteristics associated with false positive and false negative reporting of IHS coverage, according to expectations grounded in survey recall theory of task salience and complexity, and in previous literature on reporting accuracy specifically of health coverage. We find that among AIANs, geography, Hispanic origin, nativity, age, IHS coverage of others in the household, and imputation status of the IHS response in the ACS are all associated with misreporting and that these characteristics have similar associations with both types of misreporting. It is not surprising that we find a strong association between geography and IHS reporting. Geographic access is often a barrier to receiving care from the IHS (Aronovitz 2005). AIANs living in CHSDAs have greater access to care and are eligible for additional contract services in addition to direct IHS care, making the existence of the IHS more salient to their experience. They may be more likely to know about, and to rely on IHS facilities and doctors, and thus more accurate in their reporting. Hispanics and foreign-born AIAN represent a small portion of our

sample. The higher rates of misreporting for these groups may be a result of lower awareness of the IHS. Our finding that coverage is more likely to be misreported for children may be related to differences in eligibility and health insurance coverage within families and households as well as who in the household is responding to the survey.

Among AIANs of all ages, when the respondent is the householder or spouse of the householder, we find lower rates of false negative reporting compared to responses for other relatives, non-relatives, or individuals living in a group quarters. This is expected if we assume based on previous research (DeMaio and Bates 1990; Sweet 1990a and 1990b) that the householder or their spouse is the one responding to the survey questions. We would expect these individuals to have greater knowledge of their own health coverage relative to that of others in the household. However, householder/spouses are more likely to incorrectly report having IHS coverage (false positives) and when we restrict our sample to ages 25 and higher and include additional socioeconomic variables, relationship to the householder is no longer significantly associated with false negative or positive reporting of IHS coverage. We find that when other individuals in the household are reported as having IHS coverage, both types of misreporting are lower. Other household members having IHS coverage is likely associated with greater awareness of the IHS and more accurate responses. Among adults, we find that married AIANs are more likely to misreport IHS coverage relative to those who have never been married. Coverage may be more complex among married individuals who may have shared or separate insurance coverage and may be eligible for multiple types of coverage (e.g., coverage through the spouse's insurance), making accurate reporting more difficult. We find that employed individuals and those with higher education are more likely to report false positives. Again this may be a result of complexity in coverage being associated with increased misreporting - these individuals may have access to more types of insurance (for example, coverage through employer-sponsored insurance as well as IHS coverage) Finally, while not surprising it is important to note the high odds ratios we find for imputed IHS coverage responses. Imputed responses about IHS coverage are significantly more likely to be inconsistent with whether or not AIANs are in the IHS file.

We also investigated whether false negative misreporting could be explained by the recency of individuals' visits to IHS facilities—i.e., whether those who had gone longer since receiving IHS care (and for whom IHS care was less salient) would be more likely to falsely report that they did not have IHS coverage. As noted above, some of these individuals may have not visited an IHS facility for many years, thus their ACS response may not be incorrect – IHS may not be a current source of coverage. When we looked at those who visited an IHS facility in the same year of the survey, 2014, we found about 27,000 individuals, 18.9 percent, incorrectly reported no IHS coverage in the ACS. When we included those AIANs who visited an IHS facility within five years of the survey (2010-2014), we found

about 207,000, 25.2 percent, report false negatives. It is difficult to ascertain what people consider a current source of coverage and how the timing of their last IHS visit may be associated with this, but when we focus on those who visited an IHS facility in the last five years we find a similar number of individuals report false negatives as false positives. Because we find misreporting of IHS coverage even among those with recent IHS visits, under-reporting of IHS coverage appears not to be entirely due to forgetting of longer-ago clinic visits. It may be that some IHS participants may be unaware that the care they receive is sponsored by the IHS program.

We find substantial misreporting of IHS coverage in the ACS. These findings are important for researchers who use survey data – ACS or otherwise - to study IHS coverage and its impact on AIAN health. AIANs represent a small population. The 2014 ACS estimates suggest there were 5.4 million individuals who were AIAN alone or in combination with another race in the United States, representing less than 2 percent of the total U.S. population, and 1.3 million AIANs with IHS coverage. Thus while the number of individuals whose responses about IHS coverage are inconsistent with being in the IHS file are small (200,000 false positives and 490,000 false negatives), the number is substantial given the small number of individuals in total estimated to have IHS coverage.

Our study points to high degrees of inconsistency in reporting of IHS care in the ACS and presence in IHS administrative records data, and this should be kept in mind by researchers using survey data to study IHS coverage. However, our results are largely consistent with theory and existing research on survey reporting accuracy, to the extent that individuals for whom the IHS has low salience, and those who have, or are likely to have, more complexity in their health coverage report less accurately on IHS use. Recent research has used ACS data on IHS coverage to evaluate IHS coverage among AIANs by insurance type while previous work has relied on data from the National Survey of America's Families to compare access and utilization of health services by AIANs to access and utilization by non-Hispanic whites (Bhaskar and O'Hara 2017, Zuckerman et al. 2004). As these studies rely on survey data of reported IHS coverage the results are impacted by misreporting.

Our findings are also important to Census Bureau officials who impute data regarding IHS coverage when it is missing. Our findings suggest that imputed data has high rates of inconsistency with whether or not individuals are in the IHS file. Again while the construction of the IHS file means that not all inconsistent responses are incorrect, this is still an important finding and should be considered as editing procedures are developed and evaluated.

Finally, our results contribute to the growing literature on using administrative records to evaluate survey quality. We show how linking survey and administrative records can provide important information on misreporting of heath care, in line with previous studies on Medicaid and Medicare (Bhaskar et al. 2016; Noon et al. 2016).

References

Aronovitz, Leslie. 2005. Indian Health Service, Health Services Are Not Always Available to Native Americans. Report to Committee on Indian Affairs, U.S. Senate, United States Government Accoutability Office (GAO).

Artiga, S., R. Arguello, and P. Duckett. 2013. Health Coverage and Care for American Indians and Alaska Natives. *Issue Brief. The Henry J. Kaiser Family Foundation*

Bhaskar, R and B. O'Hara. 2017. Indian Health Service Participation among American Indians and Alaska Natives in Federal Tribal Areas. *Journal of Healthcare for the Poor and Underserved*, 28(4): 1361-1375.

Bhaskar, R., J. Noon, B. O'Hara, and V. Velkoff. 2016. Medicare Coverage and Reporting: A Comparison of the Current Population Survey and Administrative Records. Center for Administrative Records Research and Applications Working Paper 2016-12. Washington, DC: U.S. Census Bureau.

Bond, B., J.D. Brown, A. Luque, and A. O'Hara. 2014. The Nature of Bias When Studying Only Linkable Person Records: Evidence from the American Community Survey. Center for Administrative Records Research and Applications Working Paper 2014-08. Washington, DC: U.S. Census Bureau.

Brown, E.R., V. Ojeda, R. Wyn, and R. Levan. 2000. Racial and Ethnic Disparities in Access to Health Insurance and Health Care. UCLA Center for Health Policy Research and The Henry J. Kaiser Family Foundation. Available at: https://escholarship.org/uc/item/4sf0p1st

DeMaio, Theresa J. and Nancy A. Bates. 1990. "Who Fills Out the Census Form?" Proceedings of the Survey Research Methods Section of the American Statistical Association.

Department of Health and Human Services: Indian Health Services. 2014. Trends in Indian Health 2014 Edition. Part 1. Indian Health Service Structure.

Department of Health and Human Services: Indian Health Services. 2013. Final User Population Estimates – FY 2013. Available at: https://www.ihs.gov/california/tasks/sites/default/assets/File/FY2013UserPopulationMemo.pdf

Forquera, R. Urban Indian Health. *Issue Brief. The Henry J. Kaiser Family Foundation*, 2001.

Groves, R. 2006. Nonresponse Rates and Nonresponse Bias in Household Surveys. Public Opinion Quarterly, Vol 70(5): 646-675.

James, C., K. Schwartz, and J. Berndt. 2009. A profile of American Indians and Alaska Natives and their health coverage. *Kaiser Family Foundation.*

Johnson P.J., L.A. Blewett, L.T. Call, and M. Davern. 2010. American Indian/Alaska Native Uninsurance Disparities: A Comparison of 3 Surveys. *American Journal of Public Health* 100(10):1972.

Liebler, C.A., R. Bhaskar, and S.R. Porter. 2016. "Joining, Leaving, and Staying in the American Indian/Alaska Native Race Category Between 2000 and 2010." Demography 53(2):507-540.

Linton, Marigold. 2000. "Transformations of Memory in Everyday Life." *Memory Observed: Remembering in Natural Contexts.* Ed. Ulric Neisser and Ira D. Hyman. New York: Worth Publishers.

Manzoni, Anna, Jeroen K. Vermunt, Ruud Luijkx and Ruud Muffels. 2010. "Memory Bias in Retrospectively Collected Employment Careers: A Model-Based Approach to Correct for Measurement Error." *Sociological Methodology.* 40: 39-73.

Mathiowetz, Nancy and Greg J. Duncan. 1988. "Out of Work, Out of Mind: Response Errors in Retrospective Reports of Unemployment." *Journal of Business and Economic Statistics* 6: 221-229.

Meyer, B.D. and N. Mittag. 2015. Using Linked Survey and Administrative Data to Better Measure Income: Implications for Poverty, Program Effectiveness and Holes in the Safety Net. Working Paper 21676. National Bureau of Economic Analysis, Cambridge, MA Available at: http://www.nber.org/papers/w21676.pdf

Meyer, B. D., W.K.C. Mok, and J.X.Sullivan. 2015. Household Surveys in Crisis. Working Paper 21399. National Bureau of Economic Analysis, Cambridge, MA. Available at: http://www.nber.org/papers/w21399.pdf

Moore, J.C., L.L. Stinson, and E.J.Welniak Jr. 2000. Income Measurement Error in Surveys: A Review. *Journal of Official Statistics*, Vol 16(4): 331-361.

Murphy, J.L., and B. Huggins. 2015. Retirement Income Among American Indians and Alaska Natives in the American Community Survey. Research and Statistics Notes No. 2015-01. Social Security Office of Retirement and Disability Policy. Available at https://www.ssa.gov/policy/docs/rsnotes/rsn2015-01.html

Murphy, P. 2014. American Community Survey 2012 Content Reinterview Survey. 2014 American Community Survey Research and Evaluation Report Memorandum Series #ACS14-RER-01. Washington DC: U.S. Census Bureau.

Noon, J.M., L.E. Fernandez, and S.R. Porter. 2016. Response Error and the Medicaid Undercount in the Current Population Survey. Center for Administrative Records Research and Applications Working Paper 2016-11. Washington, DC: U.S. Census Bureau.

Sudman, Seymour, Norman M. Bradburn and Norbert Schwarz. 1996. *Thinking about Answers: The Application of Cognitive Processes to Survey Methodology.* San Francisco: Jossey-Bass Publishers.

Sweet, Elizabeth M. 1990a. "Who Fills Out the Census Questionnaire Study?" 1990 DSSD REX Memorandum Series #PP-9. U.S. Census Bureau.

Sweet, Elizabeth M. 1990b. "Who Provides Information for Enumerator Return Census Questionnaires?" 1990 DSSD REX Memorandum Series #PP-11. U.S. Census Bureau.

Taeuber, C., Resnick, D., Love, S., Staveley, J., Wilde, P., and Larson, R. 2004. Differences in Estimates of Food Stamp Program Participation between Surveys and Administrative Records. Unpublished manuscript.

Wagner, D. and M. Layne. 2014. The Person Identification Validation System (PVS): Applying the Center for Administrative Records Research and Applications' (CARRA) Record Linkage Software. Center for Administrative Records Research and Applications Working Paper 2014-01. Washington, DC: U.S. Census Bureau. Available at: https://www.census.gov/content/dam/Census/library/working-papers/2014/adrm/carra-wp-2014-01.pdf

Walke, R 2008. Indian Health Service: Health Care Delivery, Status, Funding, and Legislative Issues. Congressional Research Service Report RL33022.

Zuckerman S, J. Haley, Y. Roubideaux, and M. Lillie-Blanton. 2004. Health service access, use, and insurance coverage among American Indians/Alaska Natives and Whites: what role does the Indian Health Service play? *American Journal of Public Health* 94(1):53.

Table 1. Estimating the American Community Survey (ACS) Undercount of American Indians and Alaska Natives (AIANs) with Indian Health Service (IHS) Coverage

Row	Description	Estimate
A	AIANs who report having IHS coverage in the 2014 ACS	1,340,427
B	AIANs in 2014 IHS file	2,456,916
C	Number who died prior to 2014	165,747
D = B - C	Number alive as of 2014	2,291,169
E = 1-(A/D)*100	**Estimated ACS undercount of IHS Coverage among AIANs**	**41.5%**

Source: 2014 American Community Survey and 2014 Indian Health Service Patient Registration File

Note: Estimate shown in Row A is based on ACS sample weights.

Table 2. False Negative and False Positive Errors of Indian Health Service (IHS) Coverage Reporting in the American Community Survey (ACS)

Calculation of False Negative[1] and Positive[2] Errors	Total		American Indian/Alaska Native alone or in comination		Not American Indian/Alaska Native	
	Estimate	Pct	Estimate	Pct	Estimate	Pct
False Negatives						
Total Estimated ACS-IHS Matched Population	2,775,634	100.0%	1,584,499	100.0%	1,191,135	100.0%
Matched records that reported having IHS coverage in the ACS	1,157,793	41.7%	1,096,779	69.2%	61,014	5.1%
False negatives	1,617,841	58.3%	487,720	30.8%	1,130,121	94.9%
False Positives						
Estimated linkable population that report having IHS coverage in the ACS	1,496,985	100.0%	1,294,185	100.0%	202,800	100.0%
Match to IHS file	1,157,793	77.3%	1,096,779	84.7%	61,014	30.1%
False positives	339,192	22.7%	197,407	15.3%	141,786	69.9%

Source: 2014 ACS and 2014 IHS Patient Registration File

Note: Population estimates based on ACS sample weights adjusted by the inverse probability of being assigned a unique identifier for linking across data sources.

[1] False negatives are measured as individuals who are in the IHS administrative data but do not indicate having IHS coverage in the ACS.

[2] False positives are measured as individuals who report having IHS coverage in the ACS but do not match to the IHS file.

Table 3. Characteristics of False Positive Reporting[1] of Indian Health Service (IHS) coverage:
American Indian or Alaska Native (AIAN) alone or in combination

Characteristics in American Community Survey (ACS)	Linkable population that reports having IHS coverage in ACS	Consistent report (in IHS file)		False positive (not in IHS file)	
		Estimate	Pct	Estimate	Pct
Total	1,294,185	1,096,779	84.7%	197,407	15.3%
Sex					
Male	630,257	529,485	84.0%	100,772	16.0%
Female	663,928	567,293	85.4%	96,635	14.6%
Age					
0 to 18	446,694	359,712	80.5%	86,982	19.5%
19 to 25	154,045	138,555	89.9%	15,490	10.1%
26 to 34	165,359	145,558	88.0%	19,801	12.0%
35 to 44	155,823	136,751	87.8%	19,071	12.2%
45 to 64	265,006	228,608	86.3%	36,398	13.7%
65 or older	107,259	87,595	81.7%	19,664	18.3%
Hispanic origin					
Hispanic	86,609	63,484	73.3%	23,125	26.7%
Non-Hispanic	1,207,577	1,033,295	85.6%	174,282	14.4%
AIAN Ancestry					
AIAN ancestry reported at all in ACS	1,116,089	965,804	86.5%	150,286	13.5%
No AIAN ancestry reported in ACS	178,096	130,975	73.5%	47,121	26.5%
Tribe reporting					
Reported a tribe	1,080,918	924,872	85.6%	156,046	14.4%
Geography					
Lives in an IHS Contract Health Service Delivery Area	1,156,259	1,028,788	89.0%	127,471	11.0%
Does not live in an IHS Contract Health Service Delivery Area	137,926	67,991	49.3%	69,935	50.7%
Urban	665,027	521,340	78.4%	143,687	21.6%
Rural	629,158	575,438	91.5%	53,720	8.5%
Region					
Northeast	20,474	12,940	63.2%	7,534	36.8%
Midwest	217,445	180,223	82.9%	37,222	17.1%
South	383,147	313,050	81.7%	70,096	18.3%
West	673,119	590,565	87.7%	82,553	12.3%
Nativity					
Native	1,289,576	1,094,824	84.9%	194,751	15.1%
Foreign born	4,610	1,954	42.4%	2,655	57.6%
Imputation Status of IHS coverage					
Imputed	89,504	50,474	56.4%	39,030	43.6%
Not Imputed	1,204,681	1,046,304	86.9%	158,377	13.1%
Health Insurance					
Private	459,706	362,402	78.8%	97,304	21.2%
Public	526,061	443,690	84.3%	82,371	15.7%
Uninsured	402,452	359,174	89.2%	43,278	10.8%
Disability					
Has a disability	191,091	164,284	86.0%	26,807	14.0%
Does not have a disability	1,103,094	932,495	84.5%	170,600	15.5%
Other Household Members have IHS coverage					
Yes	996,929	864,721	86.7%	132,208	13.3%
No	297,256	232,058	78.1%	65,199	21.9%

Source: 2014 ACS and 2014 IHS Patient Registration File

Note: Population estimates based on ACS sample weights adjusted by the inverse probability of being assigned a unique identifier for linking across data sources.

[1] False positives are measured as individuals who report having IHS coverage in the ACS but do not match to the IHS file.

Table 4. Characteristics of False Negative Reporting [1] of Indian Health Service (IHS) Coverage
American Indian/Alaska Native (AIAN) alone or in combination with another race

Characteristics in American Community Survey (ACS)	Total Estimated ACS-IHS Matched Population	Matched Records that Correctly Report IHS		Report False Negative	
		Estimate	Pct	Estimate	Pct
Total	1,584,499	1,096,779	69.2%	487,720	30.8%
Sex					
Male	765,002	529,485	69.2%	235,517	30.8%
Female	819,496	567,293	69.2%	252,203	30.8%
Age					
0 to 18	501,405	359,712	71.7%	141,693	28.3%
19 to 25	204,440	138,555	67.8%	65,885	32.2%
26 to 34	220,355	145,558	66.1%	74,797	33.9%
35 to 44	204,574	136,751	66.8%	67,822	33.2%
45 to 64	331,161	228,608	69.0%	102,553	31.0%
65 or older	122,564	87,595	71.5%	34,969	28.5%
Hispanic origin					
Hispanic	111,266	63,484	57.1%	47,782	42.9%
Non-Hispanic	1,473,232	1,033,295	70.1%	439,938	29.9%
AIAN Ancestry					
AIAN ancestry reported at all in ACS	1,353,664	965,804	71.3%	387,860	28.7%
No AIAN ancestry reported in ACS	230,835	130,975	56.7%	99,860	43.3%
Tribe reporting					
Reported a tribe	1,322,258	924,872	69.9%	397,386	30.1%
Geography					
Lives in an IHS Contract Health Service Delivery Area	1,403,700	1,028,788	73.3%	374,912	26.7%
Does not live in an IHS Contract Health Service Delivery Area	180,799	67,991	37.6%	112,808	62.4%
Urban	827,865	521,340	63.0%	306,525	37.0%
Rural	756,634	575,438	76.1%	181,195	23.9%
Region					
Northeast	23,737	12,940	54.5%	10,797	45.5%
Midwest	273,553	180,223	65.9%	93,330	34.1%
South	414,086	313,050	75.6%	101,035	24.4%
West	873,123	590,565	67.6%	282,558	32.4%
Nativity					
Native	1,578,303	1,094,824	69.4%	483,478	30.6%
Foreign born	6,196	1,954	31.5%	4,242	68.5%
Imputation Status of IHS coverage					
Imputed	160,566	50,474	31.4%	110,092	68.6%
Not Imputed	1,423,932	1,046,304	73.5%	377,628	26.5%
Health Insurance					
Private	595,947	362,402	60.8%	233,545	39.2%
Public	647,065	443,690	68.6%	203,375	31.4%
Medicaid	524,906	358,298	68.3%	166,608	31.7%
Uninsured	439,284	359,174	81.8%	80,110	18.2%
Disability					
Has a disability	238,687	164,284	68.8%	74,402	31.2%
Does not have a disability	1,345,812	932,495	69.3%	413,318	30.7%
Other Household Members have IHS coverage					
Yes	953,252	864,721	90.7%	88,531	9.3%
No	631,247	232,058	36.8%	399,189	63.2%
Year information was last updated with IHS [2]					
2014	144,135	116,848	81.1%	27,287	18.9%
2013	269,792	204,562	75.8%	65,230	24.2%
2012	165,752	120,935	73.0%	44,817	27.0%
2011	130,086	93,508	71.9%	36,578	28.1%
2010	110,251	77,311	70.1%	32,940	29.9%
Before 2010 / missing	764,483	483,615	63.3%	280,868	36.7%

Source: 2014 ACS and 2014 IHS Patient Registration File

Note: Population estimates based on ACS sample weights adjusted by the inverse probability of being assigned a unique identifier for linking across data sources.

[1] False positives are measured as individuals who report having IHS coverage in the ACS but do not match to the IHS file.

2 This variable is based on the 'cycle year' variable on the IHS file which indicates when a patient's information was last reviewed or updated i

Table 5. Odds of False Positive and False Negative Resporting of Indian Health Service (IHS) Coverage Response among American Indians and Alaska Natives (AIANs) in the American Community Survey (ACS)

	Mode1: False Positive Response[1]			Model 2: False Negative Response[2]		
	O.R.	S.E.	P-value	O.R.	S.E.	P-value
Reported a tribal affiliation	0.71	0.08	***	1.07	0.07	
Reported any AIAN ancestry	0.95	0.10		1.09	0.08	
Hispanic	1.50	0.12	***	1.54	0.11	***
Child	2.56	0.08	***	1.50	0.06	***
Female	0.89	0.05	*	1.08	0.04	
Foreign born	4.14	0.39	***	4.59	0.34	***
Reported any health insurance coverage	1.38	0.07	***	2.28	0.06	***
Has a disability	0.90	0.08		0.72	0.06	***
Years since information was last updated with IHS[3]				1.02	<0.01	***
Lives in an IHS Contract Health Service Delivery Area	0.14	0.08	***	0.45	0.06	***
Lives in an urban area	2.27	0.06	***	1.09	0.04	
Region of residence (vs. Northeast)						
Midwest	0.41	0.20	***	0.94	0.16	
South	0.61	0.20	*	0.55	0.16	***
West	0.36	0.21	***	1.06	0.15	
Respondent was the householder or spouse (vs. other relative, non relative, or unit was a group quarter)	1.11	0.04	**	0.72	0.03	***
Another individual in respondent's household reported having IHS coverage	0.69	0.09	***	0.04	0.07	***
IHS coverage response in the ACS was imputed	4.33	0.12	***	6.35	0.09	***
Intercept	1.12	0.22		1.10	0.21	
Unweighted N		40,500			47,800	
Weighted N		1,294,200			1,579,500	

Source: 2014 ACS and 2014 IHS Patient Registration File

*p<.05, **p<.01, ***p<.001

Notes: Population estimates based on ACS sample weights adjusted by the inverse probability of being assigned a unique identifier for linking across data sources. An SE value of <0.01 indicates the standard error rounds to zero but is not actually zero.

[1] The universe for Model 1 includes all linkable records (i.e. records assigned unique identifiers) in the ACS who report having IHS coverage. False positives are measured as individuals who report having IHS coverage in the ACS but do not match to the IHS file.

[2] The universe for Model 2 includes all records in the IHS-ACS linked data. False negatives are measured as individuals who are in the IHS administrative data but do not indicate having IHS coverage in the ACS.

[3] This variable is based on the 'cycle year' variable on the IHS file which indicates when a patient's information was last reviewed or updated in the IHS registration system.

Table 6. Odds of False Positive and False Negtive Resporting of Indian Health Service (IHS) Coverage Response among American Indians and Alaska Natives (AIANs) in the American Community Survey (ACS), Respondents Ages 25 and Older

Variables	Model 1: False Positive Response			Model 2: False Negative Response		
	O.R.	S.E.	P-value	O.R.	S.E.	P-value
Reported a tribal affiliation	0.79	0.10	*	1.08	0.07	
Reported any AIAN ancestry	1.00	0.12		1.01	0.09	
Hispanic	1.98	0.20	***	1.56	0.15	**
Female	0.93	0.07		1.25	0.05	***
Foreign born	4.25	0.48	**	2.85	0.40	**
Marital status (vs. never married)						
Currently married	1.40	0.10	**	1.36	0.06	***
Widowed, divorced, separated	0.88	0.12		0.81	0.07	**
Employment status (vs. employed or in military)						
Unemployed	0.89	0.14		0.98	0.12	
Not in labor force	0.80	0.10	*	0.88	0.07	
Educational attainment (vs. less than high school)						
High school	1.01	0.11		0.82	0.07	**
Some college	1.07	0.11		0.80	0.07	**
Bachelor's degree	1.46	0.14	**	0.72	0.12	**
Graduate degree	2.16	0.19	***	0.79	0.15	
Reported any health insurance coverage	1.04	0.10		2.24	0.07	***
Has a disability	1.06	0.10		0.93	0.07	
Receives Supplemental Security Income	1.34	0.11	**	0.57	0.08	***
Veteran status	1.39	0.12	**	1.05	0.11	
Years since information was last updated with IHS[3]				1.02	<0.01	***
Lives in an IHS Contract Health Service Delivery Area	0.13	0.08	***	0.42	0.08	***
Lives in an urban area	2.73	0.09	***	1.14	0.05	**
Region of residence (vs. Northeast)						
Midwest	0.31	0.24	***	0.93	0.18	
South	0.37	0.23	***	0.52	0.18	***
West	0.28	0.23	***	1.08	0.17	
Respondent was the householder or spouse (vs. other relative, non relative, or unit was a group quarter)	1.02	0.04		0.76	0.03	***
Another individual in respondent's household reported having IHS coverage	0.69	0.09	***	0.06	0.07	***
IHS coverage response in the ACS was imputed	7.83	0.13	***	7.11	0.10	***
Intercept	1.11	0.29		1.23	0.26	
Unweighted N		22,500			27,400	
Weighted N		713,800			902,100	

Source: 2014 ACS and 2014 IHS Patient Registration File

*p<.05, **p<.01, ***p<.001

Note: Population estimates based on ACS sample weights adjusted by the inverse probability of being assigned a unique identifier for linking across data sources. An SE value of <0.01 indicates the standard error rounds to zero but is not actually zero.

[1] False positives are measured as individuals who report having IHS coverage in the ACS but do not match to the IHS file.

[2] False negatives are measured as individuals who are in the IHS administrative data but do not indicate having IHS coverage in the ACS.

[3] This variable is based on the 'cycle year' variable on the IHS file which indicates when a patient's information was last reviewed or

Appendix Table A. Odds of False Positive and False Negtive Resporting of Indian Health Service (IHS) Coverage Response among non-American Indians and Alaska Natives (AIANs) in the American Community Survey (ACS)

	Mode1: False Positive Response			Model 2: False Negative Response		
	O.R.	S.E.	P-value	O.R.	S.E.	P-value
Reported any AIAN ancestry	0.14	0.18	***	0.12	0.11	***
Hispanic	1.16	0.23		1.21	0.20	
Child	2.17	0.19	***	1.00	0.16	
Female	1.14	0.14		1.38	0.09	***
Foreign born	15.68	1.01	**	9.56	0.94	*
Reported any public health insurance coverage	3.92	0.24	***	3.35	0.13	***
Has a disability	1.42	0.15	*	1.06	0.15	
Years since information was last updated with IHS[3]				1.05	0.01	***
Lives in an IHS Contract Health Service Delivery Area	0.13	0.18	***	0.59	0.14	***
Lives in an urban area	1.71	0.20	**	1.06	0.10	
Region of residence (vs. Northeast)						
Midwest	0.36	0.38	**	0.44	0.67	
South	0.22	0.37	***	0.40	0.67	
West	0.21	0.38	***	0.76	0.67	
Respondent was the householder or spouse (vs. other relative, non relative, or unit was a group quarter)	1.13	0.08		1.07	0.15	
Another individual in respondent's household reported having IHS coverage	0.48	0.17	***	0.08	0.13	***
IHS coverage response in the ACS was imputed	6.46	0.31	***	7.86	0.32	***
Intercept	9.83	0.50	***	26.04	0.65	***
Unweighted N		3,700			22,500	
Weighted N		202,800			1,186,500	

Source: 2014 ACS and 2014 IHS Patient Registration File

*p<.05, **p<.01, ***p<.001

Note: Population estimates based on ACS sample weights adjusted by the inverse probability of being assigned a unique identifier for linking across data sources.

[1] False positives are measured as individuals who report having IHS coverage in the ACS but do not match to the IHS file.

[2] False negatives are measured as individuals who are in the IHS administrative data but do not indicate having IHS coverage in the ACS.

[3] This variable is based on the 'cycle year' variable on the IHS file which indicates when a patient's information was last reviewed or updated in the IHS registration system.