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## Evaluating an Electronic Measure of Colorectal Cancer Screening at Indian Health Service Facilities, 2008-2010

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### Abstract

**Background**—Colorectal cancer (CRC) is a leading cause of cancer mortality in American Indian and Alaska Native (AIAN) people, and incidence rates vary considerably among AIAN populations throughout the United States. Screening has the potential to prevent CRC deaths by detection and treatment of early disease or removal of precancerous polyps. Surveillance of CRC screening is critical to efforts to improve delivery of this preventive service, but existing CRC screening surveillance methods for AIAN are limited. The Government Performance and Results Act (GPRA) CRC screening clinical care measure provides data on CRC screening among AIAN populations.

**Purpose**—The aim of this study was to evaluate the accuracy of the GPRA measure for CRC screening (sensitivity, specificity, positive predictive value and negative predictive value), determine reasons for CRC screening misclassification (procedures noted as screening when they were actually diagnostic exams), and to suggest opportunities for improving surveillance for CRC screening nationwide for AIAN populations.

**Methods**—Medical record reviews (paper and electronic) were compared to the GPRA-reported CRC screening status for 1,071 patients receiving care at tribal health facilities. A total of 8 tribal health facilities (2 small, 3 medium, and 3 large) participated in the study from the Pacific Coast,

the Southwest, the Southern Plains, and Alaska IHS regions. Screening-eligible patients were identified using queries of the local electronic health record from January 2007 to December 2008, and medical chart reviews were completed at participating facilities from September 2008 to June 2010.

**Results**—Among 545 patients classified as screened by the GPRA measure, 305 (56%, CI: 52%-60%) had a false positive for screening as compared with medical record review. The overall sensitivity of the GPRA measure for CRC screening was 93% (CI=89%-95%) while specificity was 62% (CI: 59%-66%). The most common reasons for misclassification were for diagnostic or surveillance tests to be recorded as screening (67%), as well as medical record miscoding (18%) due to miscoding, charting errors, screenings performed outside the IHS, testing for a non-screening purpose, and categorization of patients as screened when a test had been ordered but not actually completed.

**Conclusions**—This study found that the GPRA CRC screening clinical measure overestimates the true screening rate due to the inclusion of diagnostic and surveillance exams, especially colonoscopy, as well as misclassification errors. The results of this study suggest a need to more accurately use the ICD-9 diagnostic code V76.51, which was associated with frequent coding errors. In combination with other programmatic efforts that focus on screening average- risk, asymptomatic American Indian and Alaska Native persons, improving the coding used for CRC screening may help to more accurately detect decreases in AIAN CRC incidence and mortality.

## Background

Colorectal cancer (CRC) is a leading cause of cancer mortality in American Indian and Alaska Native (AIAN) people.<sup>1</sup> Among AIAN people overall incidence and death rates from CRC are similar to the United States (U.S.) White population.<sup>2</sup> However, AIAN people are a geographically dispersed, heterogeneous population. Incidence rates of CRC among AIAN groups vary considerably throughout the U.S., with the highest rates found in Alaska (102.6 per 100,000) and the Northern Plains (72.5 per 100,000), and the lowest in the Southwest U.S. (21.0 per 100,000).<sup>3</sup> CRC presents in AIAN people with more advanced disease at diagnosis as compared to non-Hispanic Whites.<sup>3-6</sup>

In the U.S., CRC incidence and death rates for men and women of all races/ethnicities declined from 1997-2006, whereas CRC AIAN rates did not decline, except for incidence rates for AIAN men.<sup>7</sup> Declining national trends in CRC incidence and mortality among adults 50 years and older have been largely attributed to increases in CRC screening.<sup>7-11</sup> Screening has the potential to prevent CRC by detection and removal of precancerous polyps in the colon and rectum, as well as detecting early cancer at less costly, more treatable stages.<sup>8,12-14</sup> The most common screening options include tests that primarily detect cancer (stool tests) and those are more likely to detect cancer and precancerous growths, including flexible sigmoidoscopy and colonoscopy.<sup>15-17</sup> The United States Preventive Services Task Force (USPSTF) recommends routine CRC screening for average-risk men and women, ages 50-75, using annual high-sensitivity guaiac-based fecal occult blood tests (gFOBT) or immunochemical fecal occult blood tests (FIT); flexible sigmoidoscopy every five years combined with high-sensitivity fecal occult blood testing every three years; or colonoscopy every ten years. For adults aged 76 to 85, the USPSTF

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does not recommend routine screening but acknowledges that there may be considerations that support screening in an individual patient or first-time screening for those who have not previously been screened.<sup>13,18</sup>

Surveillance of CRC screening is critical to efforts to improve delivery of this preventive service. States perform surveillance for selected types of cancer screening through the Behavioral Risk Factor Surveillance System (BRFSS). Using Healthy People 2010 measures, BRFSS data from 2010 showed that 49% of AIAN respondents ages 50-75 had a colonoscopy within ten years compared with 62.5% of U.S. Whites.<sup>19</sup> A similar percentage of AIAN (15%) over age 50 had used a blood stool test within the past year as U.S. Whites (11%).<sup>20</sup> However, BRFSS has recognized limitations in rural AIAN populations due to poor phone penetrance in rural areas, the frequent use of cell phones as a primary household line, and the voluntary nature of its surveys.<sup>21,22</sup> The AIAN screening rate remains far below the Healthy People 2020 target (based on National Health Interview Study data) of 70.5% of adults being up-to-date with the USPSTF CRC screening recommendations.<sup>23</sup>

In 1993, the U.S. Congress enacted the Government Performance and Results Act (GPRA) to improve the program performance of federal agencies. The Indian Health Service (IHS) uses GPRA reporting to provide an assessment of the quality of healthcare delivered in the Indian health system on an annual basis. GPRA mandates the tracking and reporting of IHS clinical care measures to Congress and the Office of Management and Budget (OMB). The IHS GPRA measures were developed using the Health Effectiveness Data and Information Set (HEDIS) coding guidelines. There are currently 22 clinical GPRA measures reported by IHS, including diabetes, dental access and care, immunizations, cancer screening, behavioral health screening, cardiovascular disease prevention, and HIV screening. Specific benchmarks for each measure are set annually, and are used for quality improvement, performance measurement, public health care, epidemiology, and research. Tribal and Federal programs report IHS GPRA data through the Clinical Reporting System (CRS). This is a software application which extracts data out of the Resource Patient Management System (RPMS), the centralized electronic health record for the Indian Health Service.

The CRC screening measure was added as a GPRA performance measure in 2006, and remains the major source of national CRC screening prevalence data among AIAN. AIAN screening rates reported through GPRA have been increasing nationwide, from 22% in 2006 to 46% in 2012. However, screening rates in 2012 vary considerably by IHS region from 33% in the IHS Phoenix Area to 60% in the IHS Oklahoma Area.<sup>24</sup> Although CRC incidence and mortality can be reduced substantially through screening and early detection, the AIAN CRC screening rate using USPSTF recommendations remains far lower than other screen-detectable cancers including breast and cervical cancer in this population.<sup>24</sup>

The aims of this study were to evaluate the accuracy of the GPRA measure for CRC screening, determine reasons for false positive and false negative GPRA CRC screening misclassification, and suggest opportunities for improving surveillance for CRC screening nationwide for AIAN populations.

## Methods

The CRC screening definition used for the IHS GPRA measure is based on diagnostic and procedure codes in the electronic medical record (RPMS). The numerator for the GPRA CRC screening measure included AIAN patients who received fecal occult blood tests or fecal immunochemical test during the report period, flexible sigmoidoscopy or double contrast barium enema (DCBE) in the past 5 years, or colonoscopy in the past 10 years. Use of DCBE as a screening test was included in the GPRA CRC screening measure until 2013 when it was removed to bring the measure in line with changes in the national USPSTF recommendations. Additionally, until 2009, documented refusals in the past year also counted towards meeting the CRC screening clinical GPRA measure. Numerator codes for FOBT or FIT include Current Procedural Terminology (CPT) codes 82270, 82274, 89205, G0107, G0328, G0394, Logical Observation Identifier Names and Codes (LOINC) taxonomy, and site-populated taxonomy: BGP GPRA FOB TESTS. For flexible sigmoidoscopy the allowable codes include Procedure code 45.24, CPT 45330 through 45345, and G0104. For DCBE the allowable codes include CPT or VRad 74280, G0106, and G0120. For colonoscopy the allowable codes include International Classification of Diseases, Ninth Revision (ICD-9) Purpose of Visit (POV) code V76.51, Procedure codes 45.22, 45.23, 45.25, 45.42, 45.43 and CPT codes 44388 through 44394.

The denominator for the GPRA CRC screening measure includes all living active clinical patients (2 or more visits to a health facility within the previous 3 years) aged 51-80 residing in the service area during the reporting period. Denominator exclusions include a documented history of colorectal cancer or total colectomy with POV codes 153.\*, 154.0, 154.1, 197.5, V10.05, CPT codes G0213 through G0215, G0231, 44150 through 44151, 44152, 44153, 44155 through 44158, 44210 through 44212, and procedure code 45.8.

In this study medical record review was defined as the gold standard for determining screening status. Medical record review included the review of electronic health records with keyword searches and document review as well as examination of paper records with review of progress notes and relevant reports. Screening tests were defined as tests ordered without presenting symptoms or signs. Non-screening tests were defined as tests ordered for diagnostic or surveillance purposes. Diagnostic testing was defined as testing due to the presence of symptoms or signs. Surveillance testing was defined as follow-up endoscopy for high risk patients, especially those with a history of adenomatous polyps, inflammatory bowel disease, or after colorectal cancer resection.

This analysis focused on two main outcomes, including: 1) the ability of the GPRA measure to serve as a predictor of true screening status as determined by chart review using sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) and 2) reasons for screening status misclassification, including errors due to miscoding, charting errors, screenings performed outside the IHS, testing for a non-screening purpose, and categorization of patients as screened when a test had been ordered but not actually completed.

The study protocol was reviewed and approved by the Indian Health Service National Institutional Review Board (IRB) as well as the Alaska Area IRB, and had relevant tribal clearance in the participating IHS regions.

## Outcome Measures and Statistical Analysis

A sample size of 8 IHS facilities was chosen to represent different tribal facility sizes and geographical distribution (see Figure 1). Eight tribal health facilities participated in the study: two sites in the Pacific Coast IHS region, two in the Southwest region, one in the Southern Plains region, and three in Alaska. Screening-eligible patients were identified using queries of the local electronic health record from 2007 to 2008, and medical chart reviews were completed at participating facilities from September 2008 to June 2010.

Patient records were selected at random from screened and unscreened groups using a 1:1 ratio. A total of 150 patient charts at three large and three medium size facilities and 75 to 100 patient charts at two small facilities were determined to be an appropriate sample size of charts to review to determine true CRC screening rates, assuming 80% power to detect a difference between GPRA classification and medical record classification and an alpha of 0.05. Statistical analysis was performed with SPSS for Windows, Version 20.0 (IBM, Chicago, IL, USA). Proportions and confidence intervals were calculated for categorical data. Binomial tests were used to calculate confidence intervals for the sensitivity and specificity of the GPRA measure using the results of the medical chart review as the gold standard.

## Results

General patient demographics and clinical characteristics are shown in Table 1. The mean patient age was 60.3 years and the male to female ratio was approximately 2:3. The majority of patients (42%) were from Alaska, 23% were from the Southwest, 21% were from the Pacific Coast, and 14% were from the Southern Plains. A total of 29 patients (3%) had a family history of colorectal neoplasia, 92 (9%) had a personal history of adenomatous polyps, and 40 (4%) had a personal history of colorectal neoplasia documented in the medical record, all of which contribute to an increased risk of CRC warranting more frequent screening and/or surveillance.

Among 545 patients classified as screened by the GPRA measure, 305 (56%, CI: 52%-60%) had a false positive for screening as compared with medical record review. The overall sensitivity of the GPRA measure for CRC screening was 93% (CI=89%-95%) while specificity was 62% (CI: 59%-66%) (Table 2). Sensitivity and specificity were not significantly different when refusals were removed from the analysis. Of 545 patients screened according to the GPRA measure, 240 were screened according to chart review yielding a positive predictive value of 44% (CI: 40%-48%). Of 526 unscreened per the measure, 507 were unscreened by chart review, yielding a negative predictive value of 99% (CI: 97%-99%).

The most common reason for misclassification was for diagnostic or surveillance tests to be recorded as screening (67%) (Table 1). The next most common reason for misclassification

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was miscoding as another type of procedure (18%), followed by tests that were ordered but not completed (8%), tests that were not captured as screening by the electronic health record (6%), and tests that were done outside the facility (2%). The use of the code V76.51 was especially prone to error, resulting in 96% of all miscoding occurrences. According to the GPRA measure, the most frequent screening type was colonoscopy. However, on medical record review which corrected GPRA misclassifications, the most frequent actual screening type was fecal occult blood testing. While the majority of fecal occult blood tests (78%) were determined in chart review to be for screening purposes, the majority of colonoscopies (64.9%) were found to be for diagnostic or surveillance purposes. Flexible sigmoidoscopy and double contrast barium enemas (DCBE) were infrequently used tests. There were no significant differences in GPRA misclassification by sex or IHS facility, but there was greater misclassification among patients over age 60, primarily due to a higher proportion of diagnostic and surveillance colonoscopies completed within this age group (data not shown).

## Conclusions

To our knowledge, this is the first formal evaluation of an IHS GPRA clinical measure in comparison with medical chart review and RPMS review, and is unique in assessing how many patients captured in the GPRA numbers were truly receiving CRC screening versus diagnostic or follow-up tests. Many IHS tribal health facilities perform periodic data quality assurance audits to compare medical charts to the RPMS record. Additionally, several studies have examined the accuracy of specific diagnostic codes in the RPMS as compared to patient chart review, including conditions such as cervical cancer, obesity, and diabetes mellitus.<sup>25-28</sup>

This study found that the GPRA CRC screening clinical measure overestimates the true screening rate due to the inclusion of diagnostic and surveillance exams, especially colonoscopy procedures, as well as misclassification errors due to miscoding or categorizing patients as screened when a test had been ordered but not actually completed. There are several potential reasons why GPRA measures could be inaccurate: 1) an incorrect code is used such that the patient is not included in the numerator (miscoding), 2) screening information is not documented in RPMS; tests are sent to an outside facility for analysis and the results are not then entered into the facility medical record system; or the information is not yet entered into RPMS (data entry errors), or 3) the name of the test, especially for lab tests, is different than the site GPRA taxonomy and so is not included in the measure (incorrect taxonomy). The use of the code V76.51 was especially prone to error, resulting in the majority of all miscoding occurrences. This ICD-9 code is literally read as “special screening for malignant neoplasm of the colon.” With such a broad definition, coders use V76.51 for all of the types of screening tests with their different time intervals. GPRA however misinterprets this code as specifying colonoscopy suitable for 10 years, even if the actual screening was fecal occult blood testing which is only good for one year. These miscoding errors result in the GPRA measure showing patients as screened when in fact their screening is out of date. Overall the GPRA measure has a high sensitivity and negative predictive value, but a relatively low specificity and positive predictive value.

This study was subject to the following limitations. First, AIAN people access healthcare at multiple locations, so a patient's screening status at one facility might under represent their true screening status. However, this study focused on the accuracy of the GPRA measure, not on attempting to characterize screening prevalence. Second, the selected sites might not represent all IHS sites. However, the results at each site were similar, despite varying size and geographical distribution. Third, diagnostic and surveillance testing serve the screening function in most patients, even if not intended for screening, so contribute to understanding overall CRC screening trends in the AIAN population.

The results of this study suggest a need to more accurately use the ICD-9 diagnosis code V76.51, which was associated with frequent coding errors. Because this code does not distinguish one screening modality from another, it is not possible to ascertain the proper timeframe for the measure. Additional training for coders across the Indian Health Service is recommended to help reduce GPRA misclassification errors. In 2012, the V76.51 code was removed from HEDIS, as well as from the GPRA CRC measure for 2013. Miscoding also plays a role in automated RPMS reminders for screening, which can often be out-of-date. Caution is needed in interpreting the GPRA measure in the patient care setting, as many patients had a history of polyps and/or a family history of CRC, both of which require more frequent follow-up than GPRA intervals for the average risk population. Also, screening results could be entered into RPMS only after a screening test has been completed, to reduce the chance of recording tests that are ordered but not completed, or tests that require a change in the initial test order codes. It is also important to periodically audit RPMS reminders to make sure they coincide with actual screening. Addressing these issues could affect billing and reimbursement, provide quality improvement for the medical record, as well as improve the accuracy of GPRA for tracking screening rates at IHS facilities. Lastly, exploring alternative tools to the GPRA measure, such as oversampling AIAN in population-based surveys based on self report may help to better quantify the true CRC screening rate in AIAN populations.

CRC screening has been increasing substantially throughout IHS regions nationwide due to multiple intervention campaigns and greater emphasis by tribal providers on the benefits of early screening. Many providers in the IHS are embracing the idea to encourage universal use of fecal occult blood testing. Various centers are considering newer FOBT approaches such as the immunochemical FOBT that are more sensitive and sometimes require fewer samples for testing than the older guaiac-based FOBT.<sup>29-33</sup> The IHS has also created a strategic plan to increase CRC screening among AIAN populations, which focuses on four priority areas: 1) Health care professional education and practice, 2) Public education and awareness, 3) Health policy, and 4) Screening capacity.<sup>34</sup> Many activities are occurring within each of these areas, including trainings for tribal community health providers, development of health education materials for community members, convening regional IHS CRC summit meetings, conducting stool test research studies in tribal areas, and exploring ways to increase tribal member access to screening in rural and urban areas.<sup>35-38</sup> The impact of these combined efforts may be seen through a possible increase in AIAN CRC screening rate trends. Understanding the factors that impact the GPRA clinical measure for CRC screening, as well as making improvements in the GPRA measure will help IHS and tribal organizations to better evaluate the impact of CRC prevention and control activities.

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**Figure 1.**

Map of Government Performance and Results Act (GPRA) validation study sites, 2008-2010.

**Table 1**

Patient demographics, clinical characteristics, and reasons for Government Performance and Results Act (GPRA) misclassification, 2008-2010

<b>Characteristic</b>	<b>No.</b>	<b>(%)</b>
Total	1071	(100)
Sex		
Male	461	(43.0)
Female	607	(56.7)
Age, y		
45-50	15	(1.4)
51-60	573	(54.1)
61-70	319	(30.1)
71-80	153	(14.4)
Region		
Southern Plains	150	(14.0)
Southwest	241	(22.5)
Pacific Coast	227	(21.2)
Alaska	453	(42.3)
Family history of CRC	29	(2.7)
Personal history of polyps	92	(8.6)
Personal history of CRC	40	(3.7)
GPRA misclassification	305	(56.0)
Refusal misclassification	12	(35.3)
Reasons for misclassification (n=328)		
Tested for non-screening purposes (diagnostic/surveillance)	219	(66.5)
Miscoding	59	(18.0)
Ordered but not done	25	(7.6)
Not captured by EHR	18	(5.5)
Done outside of facility/other	8	(2.4)
Screening indication captured by GPRA measure (n=458)		
DCBE	2	(11.8)
Colonoscopy	325	(35.1)
Flexible sigmoidoscopy	43	(76.7)
FOBT	88	(78.4)

CRC, colorectal cancer; EHR, electronic health record; DCBE, double contrast barium enema; FOBT, fecal occult blood test.

**Table 2**

Sensitivity and specificity of Government Performance and Results Act (GPRA) measure for detection of CRC screening

	No. (%)	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
Screening including refusals as screened	1071	93 (89 - 95)	62 (59 - 66)	44 (40 - 48)	96 (94 - 98)
Screening with refusals not counted as screened	1071	97 (93 - 99)	61 (58 - 65)	40 (36 - 44)	99 (97 - 99)

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