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# The influence of patient-provider communication on cancer screenings differs among racial and ethnic groups

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ABSTRACT

Our study aimed to estimate how associations between adults' perceptions of specific domains of PPC quality and their likelihood of receiving cancer screenings differed by race and ethnicity. We analyzed 2011–2015 Medical Expenditure Panel Survey (MEPS) data. Samples included 7337 women ages 50–74 (breast), 13,276 women ages 21–65 (cervical), and 9792 adults ages ≥50 years (colorectal). To examine individual domains of PPC quality (independent variables), adults reported how often providers: listened; showed respect; spent enough time; explained things; gave specific instructions; and demonstrated health literate practices (gave clear instructions and asked them to "teach-back" how they will follow instructions). Dependent variables were breast, cervical, and colorectal cancer screenings. Multivariable logistic regression was used to evaluate the odds of receiving cancer screenings using a composite measure of PPC quality and separate domains. Hispanic and non-Hispanic black adults who reported their providers always demonstrated PPC quality had higher odds of receiving colorectal cancer screenings compared to those whose providers did not. Adults' perceptions of whether or not their provider gave them specific instructions increased their odds of receiving breast (Hispanics OR = 1.65, 95% CI = 1.09, 2.51; non-Hispanic blacks OR = 1.54, 95% CI = 1.06, 2.24) and colorectal (non-Hispanic whites OR = 1.37, 95% CI = 1.13, 1.66; Hispanics OR = 1.29, 95% CI = 1.01, 1.66; non-Hispanic blacks OR = 1.92, 95% CI = 1.39, 2.65) cancer screenings. Non-Hispanic Asian women who reported their health care providers demonstrated "teach-back" had higher odds (OR = 2.25; 95% CI = 1.10, 4.62) of receiving cervical cancer screenings. Efforts to improve cancer screenings should focus on training providers to demonstrate health literate practices to improve cancer screenings.

## 1. Introduction

While progress has been made towards meeting national goals for preventive cancer screenings, disparities continue to exist among racial and ethnic minority groups. The prevalence of up-to-date breast, cervical, and colorectal cancer screening estimates remain lowest among Hispanics and non-Hispanic Asians compared to non-Hispanic whites (National Center for Health Statistics, 2018). There have been substantial increases in the proportion of US adults with health insurance coverage over the past five years (Cohen et al., 2018). The Affordable Care Act legislation requires that health insurers cover a range of preventive services with no out-of-pocket costs, which includes preventive cancer screenings (Armstrong, 2015). Despite improvements in access and the elimination of costs, screening estimates remain low among Hispanics, non-Hispanic blacks and non-Hispanic Asians (Hong et al., 2017; Wyatt et al., 2017).

Limited knowledge of the benefits of preventive care, lack of trust, and lack of physician recommendation have been identified as barriers by Hispanics, non-Hispanic blacks and non-Hispanic Asians (Alexandraki and Mooradian, 2010; Berkowitz et al., 2008) and may

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contribute to low screening estimates. The evidence suggests that physician recommendation and improving the quality of communication between health care providers and their patients through behaviors such as shared decision-making contributes to more adults receiving breast, cervical and colorectal cancer screenings (Peterson et al., 2016). A growing number of studies have evaluated how specific domains of patient-provider communication (PPC) quality were associated with adults' likelihood of receiving cancer screenings and produced mixed results (Cairns and Viswanath, 2006; Carcaise-Edinboro and Bradley, 2008; Ho et al., 2011; Ling et al., 2006; Silk et al., 2008; Underhill and Kiviniemi, 2012; Villani and Mortensen, 2013). While these studies have used large nationally representative samples and made efforts to account for racial and ethnic differences, they were limited in their ability to provide specific estimates of the associations between domains of PPC quality and cancer screenings among racial and ethnic minority groups.

There remains a gap in our understanding of how the associations between domains of PPC quality and adults' receipt of cancer screenings differs among racial and ethnic minority groups. To address this gap, the aim of this study was to estimate how associations between adults' perceptions of specific domains of PPC quality and their likelihood of receiving cancer screenings differ by race and ethnicity.

## 2. Methods

### 2.1. Data source

We used cross-sectional data from the 2011–2015 Medical Expenditure Panel Survey (MEPS). Since 1996, the MEPS has collected information on sociodemographic factors, health care access, expenditures, and health insurance coverage from nationally representative samples of US adults using a survey panel design (Agency for Healthcare Research and Quality, 2016). From 2011 to 2015, households recruited for each panel were selected based on a subsample of households who participated in the previous year's NHIS. The panel design included five face-to-face interviews conducted over two years using a computer-assisted personal interview system and self-administered questionnaires (Agency for Healthcare Research and Quality, 2016). Further details of the MEPS design and data collection methods have been reported previously (Agency for Healthcare Research and Quality).

### 2.2. Participants

Our sample included women ages 21 and older and men ages 50 and older who reported a primary health care visit in the last 12 months (n = 33,143). We further limited the sample by ages of recommended screenings (breast = 50–75 years; cervical = 21–65 years; colorectal = 50 years and older), sex (women for breast and cervical), and personal history of breast, cervical, and colorectal cancer for each screening outcome. We removed participants who were adherent with USPSTF recommendations. For breast cancer screenings, we removed women who received a mammogram between one and two years ago. For cervical cancer screenings, we removed women who received a pap test between one and three years ago. For colorectal cancer screenings, we removed adults who received a sigmoidoscopy between one and five years ago and colonoscopy between one and 10 years ago. Our final samples included 7337 women for breast cancer screenings, 13,276 women for cervical cancer screenings, and 9792 adults for colorectal cancer screenings.

### 2.3. Variables

#### 2.3.1. Independent variables

The independent variables were adults' perceptions of PPC quality. PPC quality was analyzed as a composite measure and separated by specific domains. Adults reported how often in the last 12 months doctors or other health professionals "listen carefully to you," "explain things in a way that was easy to understand," "show respect for what you had to say," and "spend enough time with you." In 2011, the MEPS included additional domains of PPC quality designed to measure health literate practices by health care providers (Agency for Healthcare Research and Quality). Adults reported whether a doctor or other health professional would "give instructions about what to do about a specific illness or health condition" and "ask you to describe how you were going to follow these instructions." Adults were also asked "how often were these instructions easy to understand" (Agency for Healthcare Research and Quality, 2016). Adults rated most domains of PPC quality on a four-point scale (never, sometimes, usually or always). Adults stated whether or not (yes or no) their health care provider gave them specific instructions. A dichotomous variable was created to compare providers who "always/yes" versus "not always/no" (usually, sometimes or other) exhibited each domain of PPC quality. This method has been used in previous studies evaluating the domains of PPC quality using MEPS public-use data (Carcaise-Edinboro and Bradley, 2008; Villani and Mortensen, 2013). A composite measure was created to identify adults who reported that their health care providers "always" exhibited all domains of PPC quality versus those who did "not always" (usually, sometimes, never) demonstrate all domains of PPC quality based on previous studies (Levine, Landon and Linder, 2019; Salzberg et al., 2016). Each domain of PPC quality was weighted equally.

#### 2.3.2. Dependent variables

The dependent variables were breast, cervical, and colorectal cancer screenings. For breast and cervical cancer screenings, women were asked a series of questions to determine 1) if they *ever* received a mammogram or pap test and if yes, 2) how long ago each test was received. We created two dichotomous variables (yes or no) to compare women who did and did not receive a mammogram or Pap test in the last 12 months. For colorectal cancer screenings, adults were asked three questions to determine when they received their most recent blood stool test, sigmoidoscopy and/or colonoscopy (within the past year, two years, three years, five years, ten years, > 10 years, or never). Responses were collapsed to create a dichotomous variable (yes or no) evaluating adults' receipt of any colorectal cancer screening in the last 12 months.

#### 2.3.3. Other covariates

We examined potential covariates based on previous studies (Carcaise-Edinboro and Bradley, 2008; Villani and Mortensen, 2013). Sociodemographic variables included age, sex (colorectal screenings only), nativity status (born in the US or not born in the US), language spoken at home (English, Spanish, other language) marital status (never married, married/living as married or divorced/widowed/separated), highest level of education (no degree, HS degree/GED, some college/Associates degree, or Bachelor's degree or higher), insurance coverage (any private, public, or uninsured), and perceived health status (excellent/very good/good or fair/poor).

### 2.4. Statistical analysis

Frequencies (unweighted) and percentages (weighted) were used to describe sociodemographic characteristics and adults' perceptions of each domain of PPC quality by receipt of cancer screenings. Chi-square tests were used to evaluate differences for all variables. Logistic regression was used to examine associations between the composite measure of PPC quality, separate domains of PPC quality (independent variables), and adults' likelihood of receiving cancer screenings before and after controlling for confounders. Purposeful selection methods were used for model building (Hosmer et al., 2013). Wald tests were used to determine variables to include in the adjusted models. Chi-square tests and Akaike information criterion (AIC) were used to assess

goodness-of-fit. Multivariable models with the lowest AIC were selected based on the purposeful selection model building approach (Agresti, 2007).

Data were analyzed using SAS 9.4. SAS survey procedures were used to account for primary sampling units, clustering and weighting in the sampling design. The influence of missing data was tested using chi-square and t-tests. We selected variables with the least amount of missing data (e.g. education instead of income). We compared each independent variable (individual domains of PPC quality and our composite) and our covariates with each of our dependent variables. If associations were not statistically significant ($p > .05$), no changes were made to the variables. If associations were statistically significant ($p < .05$), we compared our results to previous literature to determine whether these associations were expected. We found significant associations for education and marital status. Because this influence was expected based on previous studies (Reio, 2007; Mitchell, 2010), no changes were made the variables. The annual self-administered questionnaire weight was divided by five to account for combining five years of data. We conducted a sensitivity analysis for each domain of PPC quality by removing the "usually" category and comparing "always" to "sometimes/never" responses.

The University of Texas Health Science Center at Houston's Committee for the Protection of Human Subjects deemed this study exempt from human subjects review.

## 3. Results

Sociodemographic characteristics of adults by receipt of each cancer screening are presented in Table 1. Adults who received cancer screenings were more likely to be non-Hispanic white, born in the US, married, have some form of college education, have any private insurance coverage, speak English at home, and self-report being excellent, very good or good health (p's $< .05$). Fewer men (47.6%) received a colorectal cancer screening compared to women (52.4%) ($p = .0003$).

### 3.1. Logistic regression results

Crude and adjusted logistic regression results for the composite measure of PPC quality among non-Hispanic whites, Hispanics, non-Hispanic blacks, and non-Hispanic Asians are presented in Table 2. In adjusted models, Hispanic (OR = 1.51; 95% CI = 1.10, 2.08) and non-Hispanic black (OR = 1.31; 95% CI = 1.03, 1.68) adults who reported their providers always demonstrated PPC quality had higher odds of receiving colorectal cancer screenings compared to those whose providers did not.

Crude and adjusted logistic regression results for each domain of PPC quality among non-Hispanic whites, Hispanics, non-Hispanic blacks, and non-Hispanic Asians are presented in Table 3.

#### 3.1.1. Non-Hispanic whites

In adjusted models, non-Hispanic white women who reported that their health care provider always explained so they understood (OR = 1.32; 95% CI = 1.07, 1.63) and showed respect (OR = 1.46; 95% CI = 1.19, 1.80) for what they had to say had higher odds of receiving breast cancer screenings than those whose providers did not. No statistically significant associations were observed between individual domains of PPC quality and cervical cancer screening among Non-Hispanic white women. Non-Hispanic white adults who reported that their health care provider always gave them specific instructions (OR = 1.37; 95% CI = 1.13, 1.66) and those instructions were easy to understand (OR = 1.17; 95% = 1.02, 1.34) had higher odds of receiving colorectal cancer screenings than those whose provider did not.

#### 3.1.2. Hispanics

In adjusted models, Hispanic women who reported that their health care provider always gave them specific instructions (OR = 1.65; 95% CI = 1.09, 2.51), asked them to "teach-back" how they will follow instructions (OR = 1.71; 95% CI = 1.03, 2.82), and who thought their instructions were easy to understand (OR = 1.67; 95% CI = 1.11, 2.53) had higher odds of receiving breast cancer screenings than those whose provider did not. No statistically significant associations were observed between individual domains of PPC quality and cervical cancer screening among Hispanic women. Hispanic adults who reported that their health care providers always listened to them (OR = 1.41; 95% CI = 1.07, 1.85), gave them specific instructions (OR = 1.29; 95% CI = 1.01, 1.66), asked them to "teach-back" how they will follow instructions (OR = 1.49; 95% CI = 1.14, 1.95) and thought those instructions were easy to understand (OR = 1.33; 95% CI = 1.05, 1.68) had higher odds of receiving colorectal cancer screenings than those whose providers did not demonstrate these domains of PPC quality.

#### 3.1.3. Non-Hispanic blacks

In adjusted models, non-Hispanic black women who reported that their health care providers always listened to them (OR = 1.58; 95% CI = 1.14, 2.19), showed them respect (OR = 1.66; 95% CI = 1.19, 2.32), spend enough time with them (OR = 1.49; 95% CI = 1.12, 1.97), gave them specific instructions (OR = 1.54; 95% CI = 1.06, 2.24), and who thought those instructions were easy to understand (OR = 1.45; 95% CI = 1.04, 2.00) had higher odds of receiving breast cancer screenings than those who did not report their providers demonstrated these domains of PPC quality. No statistically significant associations were observed between qualities of PPC and cervical cancer screening among Non-Hispanic black women. Non-Hispanic black adults who reported that their health care providers always explained so they could understand (OR = 1.42; 95% CI = 1.14, 1.78), showed them respect (OR = 1.45; 95% CI = 1.13, 1.86), spent enough time with them (OR = 1.38; 95% CI = 1.07, 1.76), gave them specific instructions (OR = 1.52; 95% CI = 1.16, 1.99), asked them to "teach-back" how they will follow instructions (OR = 1.39; 95% CI = 1.07, 1.81), and who thought those instructions that were easy to understand (OR = 1.57; 95% CI = 1.24, 1.98) had higher odds of receiving colorectal cancer screenings.

#### 3.1.4. Non-Hispanic Asians

In adjusted models, non-Hispanic Asian women who reported their provider gave them instructions that were easy to understand had 2.25 times increased odds (95% CI = 1.10, 4.62) of receiving a cervical cancer screening compared to women whose provider did not demonstrate this domain of PPC quality. No statistically significant associations were observed between qualities of PPC and breast or colorectal cancer screenings among non-Hispanic Asians.

#### 3.1.5. Sensitivity analysis

Results from our sensitivity analysis removing "usually" responses for each domain of PPC quality are provided in Supplemental Table 1. All results overlapped with our initial findings.

## 4. Discussion

Our purpose was to determine racial and ethnic disparities in how adults' perceptions of PPC quality were associated with receiving cancer screenings. Our study is innovative because it is one of the first studies to include domains of PPC quality that address health literate practices by health care providers within our composite measure (giving specific instructions, asking patients to "teach-back" instructions, and providing instructions that were easy to understand) and providing estimates of individual domains of PPC quality. Furthermore, our results are disaggregated by race and ethnicity, allowing for culturally specific estimates to be used for designing health interventions at the community, clinical practice, and systems levels. In the following paragraphs, we discuss two important findings.

**Table 1**
Selected characteristics[a] by cancer screening in the last 12 months in the United States, MEPS 2011–2015.*

| | Breast Cancer Screening (n = 7337) | | Cervical Cancer Screening (n = 13,276) | | Colorectal Cancer Screening (n = 9792) | |
|---|---|---|---|---|---|---|
| | No (n = 1589) | Yes (n = 5748) | No (n = 2315) | Yes (n = 10,961) | No (n = 6045) | Yes (n = 3747) |
| *Age* | | | | | | |
| 21–29 | – | – | 376 (15.9) | 2220 (21.2) | – | – |
| 30–39 | – | – | 234 (8.4) | 2715 (23.3) | – | – |
| 40–49 | – | – | 406 (17.0) | 2505 (21.9) | – | – |
| 50–59 | 780 (47.6) | 2755 (46.3) | 750 (33.1) | 2410 (22.7) | 3085 (49.9) | 1489 (37.8) |
| 60–69 *(60–65 for cervical)* | 587 (37.3) | 2292 (40.2) | 549 (25.6) | 1111 (10.9) | 1524 (25.1) | 1312 (35.2) |
| ≥70 years *(70–74 for breast)* | 222 (15.1) | 701 (13.5) | – | – | 1436 (24.9) | 946 (27.0) |
| *Race/Ethnicity* | | | | | | |
| NH White | 835 (73.9) | 3013 (74.3) | 1184 (70.8) | 4585 (65.2) | 3128 (73.3) | 1900 (73.0) |
| Hispanic | 278 (8.8) | 1,028 (9.2) | 471 (10.8) | 2,729 (13.6) | 1,242 (10.8) | 711 (10.0) |
| NH Black | 317 (9.7) | 1,237 (10.7) | 420 (9.3) | 2,713 (14.1) | 1,070 (8.5) | 814 (11.1) |
| NH Asian | 105 (4.6) | 345 (3.9) | 165 (6.0) | 663 (4.8) | 460 (5.2) | 248 (4.0) |
| NH Other | 54 (3.0) | 125 (1.9) | 75 (3.1) | 271 (2.3) | 145 (2.2) | 74 (1.9) |
| *Nativity Status* | | | | | | |
| Foreign-born | 350 (13.7) | 1240 (13.1) | 475 (14.0) | 2577 (15.0) | 1559 (16.1) | 869 (13.9) |
| US-born | 1238 (86.3) | 4506 (86.9) | 1839 (86.0) | 8377 (85.0) | 4481 (83.9) | 2876 (86.1) |
| *Language Spoken at Home* | | | | | | |
| English | 1272 (88.3) | 4626 (88.8) | 964 (89.2) | 8411 (86.1) | 4606 (86.0) | 2933 (87.5) |
| Spanish | 211 (6.5) | 802 (6.8) | 136 (5.4) | 1953 (9.2) | 986 (8.1) | 584 (8.0) |
| Other language | 104 (5.2) | 317 (4.4) | 66 (5.4) | 588 (4.7) | 449 (5.9) | 230 (4.5) |
| *Marital Status* | | | | | | |
| Never married | 202 (10.1) | 562 (7.0) | 656 (24.9) | 3158 (24.4) | 685 (9.0) | 382 (8.2) |
| Married/Live with partner | 689 (51.1) | 3204 (64.4) | 969 (48.9) | 5601 (59.9) | 3161 (58.0) | 2176 (65.6) |
| Divorce/Widow/Separated | 688 (38.8) | 1942 (28.6) | 673 (26.2) | 2039 (15.7) | 2151 (32.9) | 1160 (26.1) |
| *Education* | | | | | | |
| Less than HS graduate | 374 (16.0) | 835 (9.1) | 389 (10.8) | 1396 (7.6) | 1488 (17.7) | 724 (13.9) |
| HS graduate | 489 (33.9) | 1642 (30.6) | 750 (31.6) | 2764 (24.7) | 1933 (35.6) | 1060 (31.6) |
| Some college | 430 (34.0) | 1642 (36.9) | 736 (39.9) | 3355 (37.0) | 1370 (28.6) | 934 (31.7) |
| Bachelor's degree/higher | 184 (16.2) | 945 (23.4) | 309 (17.7) | 2180 (30.7) | 787 (18.0) | 595 (22.8) |
| *Health Insurance* | | | | | | |
| Any Private | 749 (57.6) | 3817 (75.9) | 1271 (65.6) | 7414 (80.0) | 3241 (63.3) | 2277 (70.2) |
| Public Only | 607 (30.9) | 1634 (20.5) | 647 (21.1) | 2514 (13.8) | 2105 (28.2) | 1318 (26.8) |
| Uninsured | 233 (11.5) | 297 (3.6) | 397 (13.3) | 1033 (6.3) | 699 (8.5) | 152 (3.0) |
| *Perceived Health Status* | | | | | | |
| Poor/Fair | 518 (27.6) | 1248 (15.9) | 648 (23.7) | 1654 (11.2) | 1572 (21.4) | 980 (21.0) |
| Good/Very/Excellent | 1071 (72.4) | 4498 (84.1) | 1667 (76.3) | 9307 (88.8) | 4471 (78.6) | 2767 (79.0) |

[a] Note: Sample frequencies (unweighted) and weighted percentages reported. Abbreviations: HS = high school; NH = non-Hispanic.
* All p's < .05 except for age, race/ethnicity, nativity status, language for breast cancer screening and perceived health status for colorectal cancer screening.

**Table 2**
Crude and adjusted[a,b] logistic regression models by race and ethnicity for composite measure of patient-provider communication quality in the United States, MEPS 2011–2015.

| | Breast Cancer Screening *Ages 50–74 years* *No mammogram in past 1–2 years* | | Cervical Cancer Screening *Ages 21–65 years* *No pap test in past 1–3 years* | | Colorectal Cancer Screening *Ages 50–75 years* *No colonoscopy in past 1–10 years* *No sigmoidoscopy in past 1–5 years* | |
|---|---|---|---|---|---|---|
| Models *OR (95% CI)* | Crude | Adjusted | Crude | Adjusted | Crude | Adjusted |
| *PPC quality* | | | | | | |
| Not Always/No (Ref) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Always | | | | | | |
| Non-Hispanic Whites[a] | 0.98 (0.78, 1.23) | 1.03 (0.80, 1.33) | 0.81 (0.66, 1.00) | 0.87 (0.70, 1.07) | 1.14 (0.97, 1.34) | 1.17 (0.99, 1.40) |
| Hispanics[b] | 1.63 (1.01, 2.63) | 1.55 (0.91, 2.63) | 1.08 (0.76, 1.52) | 0.83 (0.46, 1.48) | 1.53 (1.12, 2.09) | 1.51 (1.10, 2.08) |
| Non-Hispanic Blacks[a] | 1.11 (0.77, 1.60) | 1.14 (0.76, 1.69) | 1.13 (0.84, 1.51) | 1.15 (0.83, 1.58) | 1.26 (0.99, 1.60) | 1.31 (1.03, 1.68) |
| Non-Hispanic Asians[b] | 0.61 (0.30, 1.23) | 0.65 (0.30, 1.38) | 1.65 (0.84, 3.27) | 1.82 (0.70, 4.74) | 1.13 (0.70, 1.83) | 1.19 (0.69, 2.05) |

[a] Adjusted models accounted for age, marital status, highest level of education, health insurance coverage and perceived health status.
[b] Adjusted models accounted for age, nativity status, language spoken at home, marital status, highest level of education, health insurance coverage and perceived health status.

**Table 3**
Crude and adjusted[a,b] logistic regression models by race and ethnicity for all domains of patient-provider communication quality in the United States, MEPS 2011–2015.

| | Breast Cancer Screening<br>*Ages 50–74 years*<br>*No mammogram in past 1–2 years* | | Cervical Cancer Screening<br>*Ages 21–65 years*<br>*No pap test in past 1–3 years* | | Colorectal Cancer Screening<br>*Ages 50–75 years*<br>*No colonoscopy in past 1–10 years*<br>*No sigmoidoscopy in past 1–5 years* | |
|---|---|---|---|---|---|---|
| Models *OR (95% CI)* | Crude | Adjusted | Crude | Adjusted | Crude | Adjusted |
| *Not Always/No (Ref)* | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| **In past 12 months, health care provider always:** | | | | | | |
| *Non-Hispanic Whites*[a] | | | | | | |
| Listened to you | 1.23 (1.02, 1.49) | 1.21 (0.97, 1.50) | 0.96 (0.82, 1.13) | 0.89 (0.75, 1.07) | 1.11 (0.96, 1.29) | 1.07 (0.91, 1.26) |
| Explained so understand | 1.34 (1.10, 1.63) | 1.32 (1.07, 1.63) | 0.94 (0.81, 1.10) | 0.82 (0.69, 0.98) | 1.07 (0.93, 1.22) | 0.99 (0.85, 1.16) |
| Showed respect | 1.51 (1.25, 1.82) | 1.46 (1.19, 1.80) | 1.12 (0.96, 1.30) | 0.98 (0.82, 1.17) | 1.06 (0.92, 1.22) | 1.01 (0.85, 1.19) |
| Spent enough time with you | 1.18 (0.98, 1.43) | 1.21 (1.00, 1.47) | 0.95 (0.83, 1.09) | 0.88 (0.75, 1.03) | 0.98 (0.87, 1.11) | 1.00 (0.86, 1.16) |
| Gave specific instructions | 0.99 (0.79, 1.23) | 1.05 (0.84, 1.32) | 0.88 (0.74, 1.04) | 1.10 (0.90, 1.36) | 1.45 (1.22, 1.73) | 1.37 (1.13, 1.66) |
| Asked to describe instructions | 0.86 (0.71, 1.04) | 0.92 (0.75, 1.14) | 0.83 (0.67, 1.02) | 0.91 (0.73, 1.14) | 1.06, 0.91, 1.24) | 1.11 (0.94, 1.30) |
| Instructions easy to understand | 1.08 (0.91, 1.28) | 1.04 (0.87, 1.26) | 0.90 (0.77, 1.06) | 0.88 (0.74, 1.05) | 1.20 (1.05, 1.37) | 1.17 (1.02, 1.34) |
| *Hispanics*[b] | | | | | | |
| Listened to you | 1.09 (0.79, 1.49) | 1.03 (0.74, 1.43) | 1.20 (0.95, 1.52) | 1.16 (0.74, 1.80) | 1.38 (1.05, 1.81) | 1.41 (1.07, 1.85) |
| Explained so understand | 1.03 (0.74, 1.43) | 0.92 (0.65, 1.30) | 1.18 (0.95, 1.47) | 0.99 (0.66, 1.48) | 1.17 (0.90, 1.52) | 1.19 (0.92, 1.54) |
| Showed respect | 1.06 (0.77, 1.48) | 0.90 (0.63, 1.29) | 1.03 (0.83, 1.29) | 0.84 (0.55, 1.29) | 1.23 (0.96, 1.57) | 1.17 (0.91, 1.51) |
| Spent enough time with you | 0.92 (0.67, 1.26) | 0.84 (0.59, 1.19) | 1.08 (0.86, 1.35) | 0.87 (0.59, 1.29) | 1.27 (0.99, 1.63) | 1.25 (0.96, 1.61) |
| Gave specific instructions | 1.69 (1.17, 2.44) | 1.65 (1.09, 2.51) | 0.83 (0.62, 1.11) | 0.83 (0.51, 1.35) | 1.38 (1.08, 1.77) | 1.29 (1.01, 1.66) |
| Asked to describe instructions | 1.74 (1.11, 2.75) | 1.71 (1.03, 2.82) | 0.95 (0.71, 1.28) | 0.76 (0.48, 1.21) | 1.46 (1.12, 1.91) | 1.49 (1.14, 1.95) |
| Instructions easy to understand | 1.80 (1.24, 2.60) | 1.67 (1.11, 2.53) | 1.05 (0.83, 1.32) | 0.95 (0.59, 1.52) | 1.45 (1.13, 1.85) | 1.33 (1.05, 1.68) |
| *Non-Hispanic Blacks*[a] | | | | | | |
| Listened to you | 1.49 (1.10, 2.02) | 1.58 (1.14, 2.19) | 1.21 (0.91, 1.61) | 1.27 (0.94, 1.72) | 1.29 (0.99, 1.69) | 1.26 (0.95, 1.67) |
| Explained so understand | 1.28 (0.95, 1.73) | 1.30 (0.95, 1.77) | 1.09 (0.84, 1.42) | 1.13 (0.85, 1.49) | 1.41 (1.13, 1.77) | 1.42 (1.14, 1.78) |
| Showed respect | 1.62 (1.17, 2.24) | 1.66 (1.19, 2.32) | 1.24 (0.95, 1.63) | 1.89 (0.89, 1.59) | 1.44 (1.12, 1.85) | 1.45 (1.13, 1.86) |
| Spent enough time with you | 1.45 (1.13, 1.87) | 1.49 (1.12, 1.97) | 1.26 (0.99, 1.60) | 1.27 (0.99, 1.64) | 1.40 (1.12, 1.76) | 1.38 (1.07, 1.76) |
| Gave specific instructions | 1.42 (0.99, 2.02) | 1.54 (1.06, 2.24) | 0.76 (0.56, 1.04) | 0.87 (0.61, 1.24) | 1.85 (1.39, 2.46) | 1.92 (1.39, 2.65) |
| Asked to describe instructions | 1.01 (0.73, 1.38) | 1.11 (0.79, 1.56) | 0.89 (0.67, 1.20) | 1.02 (0.76, 1.38) | 1.27 (1.01, 1.60) | 1.39 (1.07, 1.81) |
| Instructions easy to understand | 1.42 (1.05, 1.92) | 1.45 (1.04, 2.00) | 0.87 (0.67, 1.12) | 0.89 (0.67, 1.17) | 1.53 (1.24, 1.90) | 1.57 (1.24, 1.98) |
| *Non-Hispanic Asians*[b] | | | | | | |
| Listened to you | 0.95 (0.52, 1.73) | 0.78 (0.41, 1.49) | 1.21 (0.83, 1.76) | 0.70 (0.32, 1.51) | 1.07 (0.76, 1.53) | 1.27 (0.87, 1.86) |
| Explained so understand | 1.30 (0.72, 2.35) | 1.21 (0.62, 2.34) | 1.17 (0.72, 1.89) | 0.76 (0.38, 1.51) | 1.16 (0.83, 1.62) | 1.28 (0.85, 1.92) |
| Showed respect | 1.11 (0.63, 1.94) | 1.09 (0.60, 1.96) | 1.42 (0.88, 2.27) | 0.96 (0.48, 1.91) | 0.96 (0.64, 1.45) | 1.07 (0.70, 1.64) |
| Spent enough time with you | 0.81 (0.45, 1.47) | 0.82 (0.44, 1.53) | 1.32 (0.86, 2.03) | 1.26 (0.63, 2.53) | 0.97 (0.69, 1.36) | 0.88 (0.62, 1.26) |
| Gave specific instructions | 1.73 (0.93, 3.20) | 1.67 (0.84, 3.30) | 1.33 (0.85, 2.07) | 1.09 (0.55, 2.17) | 1.56 (1.01, 2.40) | 1.48 (0.87, 2.50) |
| Asked to describe instructions | 0.74 (0.38, 1.44) | 0.68 (0.32, 1.45) | 1.24 (0.72, 2.14) | 1.17 (0.48, 2.85) | 1.16 (0.76, 1.78) | 1.19 (0.74, 1.90) |
| Instructions easy to understand | 1.31 (0.74, 2.31) | 1.36 (0.76, 2.43) | 1.72 (1.08, 2.74) | 2.25 (1.10, 4.62) | 1.09 (0.74, 1.63) | 1.03 (0.64, 1.66) |

[a] Adjusted models accounted for age, marital status, highest level of education, health insurance coverage and perceived health status.
[b] Adjusted models accounted for age, nativity status, language spoken at home, marital status, highest level of education, health insurance coverage and perceived health status.

*First,* we found that PPC quality, measured as a composite, was associated with colorectal cancer screenings among Hispanic and non-Hispanic black adults. Previous studies examining this association have produced mixed results. Nationally representative studies have been conducted with composite measures of PPC quality using the Health Information National Trends Survey (HINTS). Our results are similar to Underhill and Kivieni's (2012) and Ho and colleagues' (2011) studies, who found that improved PPC quality increased adults' likelihood of receiving a cancer screening compared to adults who reported poor PPC quality. Our results differ from Cairns and Visawanath's (2006), who found no association between PPC quality and colorectal cancer screenings. While these studies provide national estimates, they do not account for differences by race and ethnicity. Statewide studies using probability-based samples and local studies using convenience samples have shown that improved PPC quality increases Hispanic and non-Hispanic black adults' likelihood of receiving colorectal cancer screenings. Using data from the California Health Interview Survey (CHIS), Modiri and colleagues (2013) found that Hispanic adults who had a hard time understanding their provider were less likely to be screened. Focus groups with Hispanic adults in Texas and Michigan showed that the greatest barrier to colorectal cancer screening was lack of provider recommendation (Byrd et al., 2019; Gonzalez et al., 2019). Similar results were found for non-Hispanic black adults. Focus groups with non-Hispanic black church members in North Carolina found that adults who rated their providers' general PPC quality as "good" were more likely to receive a colorectal cancer screening than those who rated PPC quality as "poor" (Katz et al., 2004). Among Maryland residents, non-Hispanic black adults were less likely to report ever receiving a recommendation for a colorectal cancer screening than non-Hispanic whites (May et al., 2015). We were unable to include physician recommendation for screening as a part of our PPC quality composite since this cancer-specific domain of PPC quality is not measured by MEPS. Other studies have found that patient-provider language discordance is a barrier to cancer screenings among Hispanic adults (Villani and Mortensen, 2014). We included language spoken at home in our multivariable models to account for language barriers with the provider and the association between PPC quality and colorectal cancer screening remained significant regardless of language preference among Hispanic adults.

*Second,* we found that domains of PPC quality describing health literate practices by providers were associated with increased odds of cancer screenings across all racial and ethnic groups. Receiving instructions that were easy to understand increased the odds of receiving breast cancer screenings among Hispanic and non-Hispanic white

women, cervical cancer screenings among non-Hispanic Asian women, and colorectal cancer screenings among non-Hispanic white, Hispanic, and non-Hispanic black adults. Being asked to "teach-back" how you will follow instructions increased the odds of receiving breast cancer screenings among Hispanic women and colorectal cancer screenings among Hispanic and non-Hispanic black adults. Few studies have examined health literate practices by providers using nationally representative samples. Liang and Brach (2017) found that 70% of US adults reported their provider gave them clear instructions while only 29% were asked to "teach-back" how they will follow instructions. This is particularly concerning since racial and ethnic minority groups are more likely to have limited health literacy and adults with limited health literacy may be less likely to receive recommended cancer screenings (Oldach and Katz, 2014). Other studies using convenience samples have found that providers are more likely to demonstrate health literate practices with patient groups where limited health literacy is more common. Jager and Wynia (2012) found that non-Hispanic black adults and patients whose language preference was not English were more likely to report that their provider demonstrated "teach-back" compared to non-Hispanic whites. Studies have shown that patients with ambulatory sensitive conditions (e.g. hypertension, type 2 diabetes) who reported receiving health literate practices from their providers were more likely to hospitalized or experience hospital readmissions (Hong et al., 2019). To our knowledge, no studies have evaluated associations between these health literate practices and cancer screenings using national data sources.

### 4.1. Strengths and limitations

Among the strengths of this study was the use of nationally representative samples to evaluate associations between PPC quality and adults' likelihood of receiving common cancer screenings. Using the MEPS allowed us to evaluate many domains of PPC quality while adjusting for confounders in our multivariable regression models. Our results differed from previous studies examining PPC quality and adults' receipt of cancer screenings (Carcaise-Edinboro and Bradley, 2008; Villani and Mortensen, 2013). These differences may be due to more stringent restrictions of our inclusion criteria. A strength of our study was our ability to examine cancer screening outcomes to the last 12 months, which limited potential temporal biases that may be present in previous studies which used adherent or ever screening outcomes (e.g., last three years for cervical cancer screenings). In previous studies, the outcome may have occurred before their report of PPC in the last 12 months. Due to the cross-sectional nature of our data, we are unable to determine whether the adults' report of PPC quality occurred before the cancer screening. Other limitations of this study were the use of self-reported measures for PPC quality and cancer screening outcomes. Significant associations were found when examining the influence of missing data for: 1) education and breast cancer screening and 2) education and marital status for cervical cancer screening. We expected that education would cause biased estimates (Reio, 2007). We chose education instead of income level or employment status as a proxy for socioeconomic status because there were fewer missing responses than other comparable variables. Our results are similar to Mitchell's study which found that both marital status and the highest level of education were related to survey nonresponse and response errors on self-administered questionnaires (Mitchell, 2010). This potential bias should be considered when interpreting our results. Potential overestimates of adults' reports of cancer screenings should also be considered with our findings (Allgood et al., 2014; Rauscher et al., 2008). Even so, our study sheds light on the importance of quality communication between providers and patients to potentially improve compliance with recommended preventive services.

### 4.2. Conclusions

Our study revealed that domains of PPC quality which measure health literate practices by providers showed the greatest increases in adults' likelihood of cancer screenings. This was observed for non-Hispanic whites, non-Hispanic blacks, and Hispanics. Our results highlight the importance of training health care providers how to demonstrate PPC quality through the use of health literate practices to account for potential language barriers and limited health literacy. Interventions have been developed to train health care providers to demonstrate health literate practices (Pagels et al., 2015). However, there is a need to evaluate the impact of these interventions on health services outcomes at local, state and national levels. Further studies should be conducted to further explore how PPC is associated with cancer screening outcomes among racial and ethnic subgroups to identify important qualities for health care providers to exhibit during patient interactions about screenings.

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No financial support received for this work.

## CRediT authorship contribution statement

**Tiffany B. Kindratt:** Conceptualization, Methodology, Software, Formal analysis, Investigation, Data curation, Writing - original draft, Visualization, Project administration. **Florence J. Dallo:** Conceptualization, Methodology, Writing - review & editing. **Marlyn Allicock:** Conceptualization, Methodology, Writing - review & editing. **Folefac Atem:** Conceptualization, Software, Validation, Writing - review & editing. **Bijal A. Balasubramanian:** Conceptualization, Methodology, Investigation, Writing - review & editing, Visualization, Supervision.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2020.101086.

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