

1 *Factors Influencing Precision Medicine Knowledge and Attitudes*

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ABSTRACT (284 words)

Precision medicine holds great promise for improving health and reducing health disparities that can be most fully realized by advancing diversity and inclusion in research participants. Without engaging underrepresented groups, precision medicine could not only fail to achieve its promise but also further exacerbate the health disparities already burdening the most vulnerable. Yet underrepresentation by people of non-European ancestry continues in precision medicine research and there are disparities across racial groups in the uptake of precision medicine applications and services. Studies have explored possible explanations for population differences in precision medicine participation, but full appreciation of the factors involved is still developing. To better inform the potential for addressing health disparities through PM, we assessed the relationship of precision medicine knowledge and trust in biomedical research with sociodemographic variables. Using a series of linear regression models applied to survey data collected in a diverse sample, we analyzed variation in both precision medicine knowledge and trust in biomedical research with socioeconomic factors as a way to understand the range of precision medicine knowledge (PMK) in a broadly representative group and its relationship to trust in research and demographic characteristics. Our results demonstrate that identifying as Black, while significantly PMK, explains only 1.5% of the PMK variance in unadjusted models and 7% of overall variance in models adjusted for meaningful covariates such as age, marital status, employment, and education. We also found a positive association between PMK and trust in biomedical research. These results indicate that race is a factor affecting PMK, even after accounting for differences in sociodemographic variables. Additional work is needed, however, to identify other factors contributing to variation in PMK as we work to increase diversity and inclusion in precision medicine applications.

48 INTRODUCTION

49 Precision medicine (PM) is changing the one-size-fits-all healthcare paradigm for prevention and treatment of
50 diseases through incorporation of an individual's genetic makeup, environment, and lifestyle. (1,2) Advances in
51 genetics, genomics, and data science have contributed to the potential for PM to reduce disease burden and
52 mortality. At the same time, however, PM advances have the potential to widen racial and ethnic health
53 disparities in the United States. (3–7) People of non-European ancestry are underrepresented in genetic
54 databases, a sampling bias that can translate to clinical care bias and result in disparate outcomes or health
55 disparities. (8,9) Little progress has been made since Need and Goldstein reviewed GWAS studies in 2009 and
56 found that participants of European ancestry outnumbered other races 10:1. (10) As the PM initiative has
57 expanded, we have also seen inequity in uptake of PM applications and services across racial groups.(11–13)
58 Without significant improvement in diversity and inclusion in genomic research, any advancements from PM
59 applications addressing the disease burden can therefore be expected to accrue inequitably, favoring those of
60 European ancestry over those of African, Latin, and Asian ancestry. (14)

61 Understanding why people may be unaware of or choose not to participate in PM initiatives will be
62 critical to the success of PM. Several explanations have been suggested for population subgroup differences in
63 PM participation, including awareness of PM research and care options, attitudes toward PM and PM-related
64 research topics like genetics and biobanks, trust in medical research, and socioeconomic status. Specific and
65 accurate understanding of the factors driving the observed variation in PM knowledge and attitudes could
66 provide evidence for how best to reduce that variation and the resulting disparities. Additionally, studies suggest
67 that equitable PM knowledge could increase diversity among research participants. For example, in a study of
68 research participation in a glaucoma study, African American participants with positive attitudes towards DNA
69 donation were more likely to participate.(15) In a study of a childhood heart disease biorepository, discomfort
70 with genetic testing was a perceived barrier to participation.(16) In a separate study, perceived benefits and
71 positive attitudes were the most influential factors in expanding genetic cancer screening.(17) This study
72 assesses the relationship of precision medicine knowledge (PMK) and trust in biomedical research (TBR) with
73 sociodemographic variables using survey data collected in a large, diverse sample. The measure of PMK used
74 includes items related to both health literacy and attitudes, factors important in the larger concept of awareness.

75 Awareness of PM research is significantly influenced by health literacy. Health literacy is known to
76 increase patient participation in their own care and improve health outcomes. (18) Similarly, genomic health
77 literacy, though less studied to date, is thought to play a role in how well a diverse and inclusive public can
78 engage with PM, from participating in research, to processing risk assessments and acting on PM-based medical

79 advice, to participating in policy discussions about data use and the role of PM in health care. (19) Furthermore,
80 differences in knowledge and attitudes toward PM were influenced by health literacy more than race and
81 ethnicity.(20,21) Researchers across disciplines have studied the contribution of the social construct of race to
82 observed differences in PM awareness and attitudes. Familiarity with PM in general continues to be low in non-
83 White populations in America. Awareness of the existence of genetic testing was low in African-Americans
84 (32.9%) and Hispanics (20.6%) compared to Whites (44.4%) in a number of studies.(22–24) Realizing equity in
85 PM knowledge and awareness should be part of a larger strategy to reduce the potential for PM to increase health
86 disparities, as this jeopardizes its success. (25–28)

87 Like awareness, attitudes towards PM also differ by racial group. Minorities are more hesitant to accept
88 PM approaches.(29) They are also less likely to support its promotion to the general public.(27) One study
89 demonstrated that, despite similar attitudes towards the benefits of PM, Blacks were significantly more likely
90 than Whites to be concerned about discrimination based on genetic results, use of genes and genetic information
91 without consent, and costs to receive PM.(30)

92 Medical mistrust is a significant influencer of attitudes towards genetic testing.(24) In a systematic
93 review of barriers to minority research participation, 77% of articles reviewed cited medical mistrust as a barrier
94 which held true across all four racial minorities studied (African Americans, Pacific Islander, Latino, Asian
95 American).(31) These differences are due to concerns that benefits will not be equitably distributed (32,33), fear
96 of being a “guinea pig,” (34,35) and lack of legal protection for research subjects (36).

97 Increasingly, research suggests that factors other than race itself could explain these observed
98 differences and therefore serve as potentially modifiable influencers of PM knowledge. Two studies reported that
99 some recognized social determinants of health, such as income, Internet access, and numeracy skills also
100 determined differences in PM awareness. (20,21) Preferred source of medical information may also play a key
101 role. Previous literature suggests that Hispanics are more likely to utilize the radio for medical information,
102 while Blacks more frequently pay attention to television.(37) Other authors have suggested that improving health
103 information delivery to minority populations has the potential to decrease disparities in care.(38) It is possible
104 that different racial groups have varying exposure to informative and accurate PM concepts based on their
105 preferred sources for health information.

106 Using data from the Mid-South Clinical Data Research Network (MS-CDRN) Consumer Interest and
107 Attitudes Survey, we determined the contribution of socioeconomic factors to differences in overall PM
108 knowledge and trust in biomedical research. Other data from this survey, published elsewhere, has compared the
109 Hall and Mainous trust scales(39) and to assessed the relationship between race, health literacy, and values

110 important when deciding about genetic testing.(20) This current work builds upon previous literature to describe
111 the relationship between race and overall PM knowledge. In this study, we apply validated trust scales to
112 explain the variation in precision medicine knowledge, which we have not seen in other studies. In addition, our
113 study creates a systematic measure of PM knowledge consisting of a calculated value for PM-related health
114 literacy plus the six foundational PM values. This metric can be replicated in future studies to quantitatively
115 deepen our understanding of the factors driving PM use. We hypothesized that, after controlling for age, marital
116 status, employment, and education, race itself would not be a predictor of PM knowledge, as the social construct
117 of race masks underlying factors contributing to disparities in PM knowledge which, unlike race, could be
118 addressed. The findings from this work may inform efforts to recruit minority participants into PM knowledge
119 initiatives, therefore, benefiting individual and public health.

120 **MATERIALS AND METHODS**

121 *Study Population*

122 This study was a cross-sectional survey of 3847 adult participants of the Mid-South Clinical Data
123 Research Network (MS-CDRN), one of 11 CDRNs funded by the Patient-Centered Outcomes Research Institute.
124 (40) The CDRN was established to facilitate involvement of patients in generating research questions and
125 participating in research studies in order to further patient-centered research. In the MS-CDRN, clinical data
126 from over 20 million patients are included from three large health systems encompassing 32 hospitals and
127 hundreds of ambulatory practices. The health settings include academic medical centers, community-based
128 hospitals, traditional outpatient clinics and federally-qualified health centers. Previous studies have included
129 surveys of parent willingness to participate in HPV vaccination clinical trials and the relationship between
130 depression and perceived health competence.(40) Our patient survey participants were recruited from June 2014
131 to June 2015 from this larger cohort. Informed consent was collected electronically prior to survey completion.
132 The research team identified priority populations consisting of racial/ethnic minorities, individuals with multiple
133 chronic conditions, low-income groups, rural and urban residents, and older adults. Anyone over the age of 18
134 with the capacity to consent was invited to participate. Recruitment strategies included in-person engagement at
135 community health centers, minority-owned barbershops, and community health fairs. In addition, online
136 recruitment was utilized specifically through the Vanderbilt patient portal and ResearchMatch, a volunteer
137 registry. Participants who completed the survey received a \$10 compensation. This study was approved by the
138 Vanderbilt Medical Center Institutional Review Board.

139 *Survey*

140 Patients were asked to respond to a series of demographic questions, including educational level,
141 household income, and race. To create racial groups of sufficient size for statistical comparison, participants
142 were asked to select one of nine racial categories. The racial groups included in this analysis were Asian, Black,
143 Hispanic, and white.

144 The survey was developed based on literature evidence of common concerns about PM. The first part
145 asked participants to rate their familiarity with PM terms on a five-point Likert scale (1=not at all familiar;
146 5=extremely familiar). The second part of the survey asked patients to rate the importance of certain factors in
147 guiding future research and healthcare on a five-point Likert scale (1=not at all important; 5=extremely
148 important). As no validated tools existed to measure these concepts at the time of this study, we developed new
149 instruments based on previous research conducted by the study team and a literature review of genetics
150 literacy.(41) Experts were asked to assess the relevance and clarity of each item to measure its content and face
151 validity. The third part of the survey was one of two different validated scales to measure trust in biomedical
152 research. Participants completed all 12 questions on the respective assigned validated scale. Half of the
153 participants selected at random received the Hall scale,(42) while the other half received the Mainous scale.(43)
154 This strategy was chosen to assess the consistency between the two surveys, and the results of this work are
155 published elsewhere. (39)

156 In addition, basic demographic information was also collected, including ethnicity, educational
157 attainment, and household income. Barriers to participation in research were collected using a modified, 14-item
158 scale developed by Mouton et al.(44) For the barriers section of the survey, items “Prefer study headed by Black
159 scientist” and “Prefer study headed by Latino scientist” were excluded due to previously observed participant
160 discomfort with these two items. Eleven of the remaining 12 items were measured using a 5-point Likert scale
161 based on agreement. The final item for measuring barriers to participation (“In my opinion, research in the
162 United States is...”) had three possible response options: “ethical,” “not ethical,” and “I don’t know.” To
163 preserve how this item loaded onto the overall score of the scale, the variable was scored such that “ethical” was
164 recoded to 2.54, “not ethical” was recoded as 0.83, and “I don’t know” was recoded as 1.69. The total score
165 across these 13 domains was calculated as a simple sum, with some items reversed scored so that higher scores
166 represented a lower perception of participation barrier. The complete survey is provided in the additional
167 supplemental material [Online Resources 1-4].

168 *Variables*

169 Precision medicine knowledge (PMK) is an outcome variable created as a sum score of 10 questions.
170 Four questions asked participants about their familiarity with PM vocabulary. The terms included genetic testing,

171 biological indicators/biomarkers, precision medicine, and pharmacogenetics. Participants were asked to state
172 their familiarity with the terms on a Likert Scale (1 = not at all familiar, 5 =extremely familiar). An additional six
173 questions asked participants about attitudes towards PM concepts. Examples of questions included: “My
174 healthcare is specific to me. No two cases are the same.”; “My genes can be used to determine the best treatment
175 for me.”; “My genes and other health information can be used to help prevent or treat health conditions in my
176 family.”; “My health information is kept private and secure.”; “I have access to my own health records and can
177 decide which health care providers and researchers have access to them.”; and “I can add information about my
178 health to my health records.” Participants were asked to rate importance on a Likert scale (1 = not at all
179 important, 5 = extremely important). A higher total PMK score indicated greater familiarity with terms and
180 benefits, with a maximum score of 50.

181 To create an overall trust in biomedical research (TBR) variable, each participant’s score from the Hall
182 survey (42) was standardized. Items 2, 4, 7, and 10 were reverse-coded prior to summation. This was repeated
183 for the Mainous (43) participants, with items 1-6 and 12 reverse coded prior to summation. Higher scores
184 demonstrate higher trust towards biomedical research, with a maximum score of 5. TBR scores were treated as
185 continuous outcome variables in the models.

186 *Statistical Analysis*

187 Descriptive statistics were used to calculate demographic characteristics. For each outcome (PMK and
188 TBR), we created a linear regression model to compare the racial group of interest and the contribution of race to
189 the outcome. Predictive mean matching was used to account for missing data. Covariates (marital status,
190 employment status, education, age, and gender) were selected *a posteriori*, based upon a review of relevant
191 literature. Due to the association of race with health literacy and education, these were assessed as additional
192 interaction variables in the model, with education coded as a continuous variable. Analysis was conducted in R
193 (version 3.4.3).

194 **RESULTS**

195 Of the 3847 participants, 83% identified as White and 15% identified as Black. The mean age was 48
196 (standard deviation: ± 16) years, 69% percent of the population identified as female, and 61% of participants had
197 a college degree. Table 1 contains additional demographic information.

198 *Precision Medicine Knowledge (PMK)*

199 The average PMK score was 38.20 out of a total of 50 for the 1142 participants who fully answered the
200 questions. Average PMK by race was 36.16 (Black), 38.36 (White), 38.87 (Asian), and 38.31 (Hispanic). Self-
201 identification as Black was negatively correlated with PMK when compared to all other participants. This

202 relationship describes about 1.5% of the total variation in PMK ($p < 0.001$). Self-identification as Asian or
203 Hispanic was not strongly correlated with PMK. The remaining three racial categories (Middle Eastern, Native
204 American, and Native Hawaiian) could not be compared due to small sample size. When adjusting for covariates
205 such as age, marital status, employment, and education, self-identification as Black was still negatively
206 correlated with PMK, with the model explaining 6.7% of overall variance ($p = 0.0026$). There was no evidence
207 that race modified the effect of education on PMK when including race and education as interaction terms in the
208 model ($p = 0.2681$).

209 *Trust in Biomedical Research (TBR)*

210 Based on previous research using this database comparing results between the Hall and Mainous
211 scales,(39) we were able to compare overall TBR scores for participants, regardless of which survey they took.
212 We standardized each score distribution by subtracting its mean and dividing by its standard deviation. Self-
213 identification as Black was negatively correlated with TBR when compared to White participants ($p < 0.001$).
214 This relationship describes about 5.5% of the total variation in TBR. Self-identification as Hispanic or Asian was
215 also negatively correlated with TBR, each explaining 0.1% of the variation. When adjusting for covariates such
216 as age, marital status, employment, and education, self-identification as White was still positively correlated with
217 TBR, and explained 6.8% of the overall variance.

218 Given that the analyzed covariates did not explain much of the variance in trust or PMK, we theorized
219 that there may be a relationship between the two outcome variables and found a positive association between
220 PMK and TBR ($\beta = 0.1516$, $SE = 0.0512$, $p = 0.003$).

221 *Preferred Health Information Source*

222 As our initially analyzed covariates did not explain the variance in trust or PMK, we explored the
223 theory that information source preferences could differ widely within our population and could contribute to
224 disparities in PMK that were not addressed by the previous models. The frequency results are displayed in Table
225 5. When asked about preferences for health information sources, the most popular answer was internet, with
226 approximately 32% of respondents selecting this choice. Other popular sources included doctors (31%), family
227 (15%), or friends (10%). Among racial subgroups, the rank order for information source preference remained the
228 same. Of the participants who answered the question and identified as White, the most frequently preferred
229 source of information was family (30%), followed by the internet (27%), and then doctors (26%).

230 **DISCUSSION**

231 Identifying strategies to address disparities in PM research and applications is imperative to the
232 successful adoption of PM strategies. Results from the MS-CDRN Participant Survey, designed to collect data

233 on stakeholder opinions about participation in that research network, have allowed us to identify gaps between
234 race, socioeconomic barriers, and perceived mistrust on overall PMK. Black participants have significantly
235 lower PMK and TBR, even after controlling for meaningful covariates. This is also true of Asian and Hispanic
236 participants for TBR models. However, as the models explain less than 7% in the overall variation in PMK, even
237 after adjusting for meaningful covariates included in this survey, indicating that the survey data are an
238 incomplete measure of factors related to PMK and TBR. Moreover, there is a significant association between
239 PMK and TBR. The magnitude of these differences appears to be greater for Black participants compared to
240 Hispanic or Asian participants. Additionally, the most popular health information sources (family, internet, and
241 doctors) were consistent, regardless of race, and therefore are unlikely to contribute to the differences observed.

242 These results refuted our original hypothesis that the effects of race would be null after accounting for
243 sociodemographic variables of education, income, employment, and marital status and confirms previous
244 research citing race as a barrier for participation in biomedical research. The results from the models created in
245 this study suggest that we still have an incomplete picture of factors influencing PMK. Until we have an
246 understanding of why participants choose to not participate in PM initiatives or have not yet accepted the
247 potential benefits, disparities in PM acceptance will grow. These factors could include previous interactions with
248 the healthcare system,(43) self-efficacy,(45) and health literacy, specifically genetics literacy.(46) While our
249 survey captures many social determinants of health, it is possible that additional drivers such as food insecurity,
250 housing instability, or neighborhood safety issues may limit the benefits of PM in certain populations.

251 PM participation is modifiable, and early adopters have consistent personality traits, regardless of
252 minority status.(47) Meaningful interventions, such as better representation of socioeconomic diversity in
253 research leadership, tailored health education materials of appropriate literacy, and improved genetics education
254 of the public, are all potential methods to decrease disparities in PM knowledge and attitudes which, in turn,
255 could decrease differences in participation.(14) Furthermore, interventions that address logistical barriers, such
256 as the complexity of payer coverage for genetic testing,(48) the value of negative or unknown results to
257 patients,(49,50) or the burden on primary care providers,(51) is sorely needed to increase potential benefits of
258 PM.

259 Previous research also supports these findings. A qualitative study found that African American focus
260 group participants recommended a reduction in technical detail for genetics communication aids.(52) Both
261 providers(53) and patients(54) recognize the need for increased genetics education to alleviate disparities in
262 knowledge and attitudes towards PM. Culturally-tailored material and engagement of local stakeholders has been
263 successful in improving recruitment of underrepresented groups in research.(55) Among Asian Americans,

264 opportunities for improving participation include providing linguistically appropriate materials on genetic
265 testing.(56) In addition, more granular details including specific countries of origin and length of time in the US
266 could help researchers better understand differences within the Asian population as a whole.(57)

267 In response to these and other studies, there is significant ongoing work to specifically address
268 disparities in PM. One such example is the All of Us Research Program, which aims to increase genetic
269 biodiversity by creating a national database.(58) This organization offers materials in a variety of different
270 languages, has partnered with trustworthy community organizations to engage and retain participants, utilized a
271 patient advisory board early to advise development.(59) Meanwhile, The Personalized Medicine Research
272 Project consulted patient participants in the design of the protocol to include changes such as newsletters to
273 disseminate information to study participants, external advisory boards, and focus groups.(60) We believe that
274 engaging participants in these novel ways can mitigate differences in PMK and TBR though the results of these
275 initiatives are still being studied.

276 A strength of the current study is that the demographic distribution is similar to the MS-CDRN
277 population as a whole. Special efforts were made to recruit underrepresented groups to participate in this MS-
278 CDRN Survey through recruitment at federally-qualified health centers and community settings (i.e. barber
279 shops). The population's median age was reported to be 56.3. 84.1% were White, 9.9% were Black, 1.8% were
280 Hispanic, and Asian was not reported in the results. A predominance of females was also seen in the study
281 population as a whole (64%).(61) The surveys were comprehensive, including information on several variables
282 impacting participation in PM, such as attitude, awareness, and trust in medical research, as well as several other
283 confounding variables including age, marital status, employment, and education, which were successfully
284 incorporated into statistical models. Increasing the length of the survey to explore additional topics such as use
285 of genetic testing by law enforcement or access to direct-to-consumer testing were not directly measured by the
286 validated tools used in this study.

287 *Limitations*

288 There are several limitations to this study. First, it relied on self-reported data and not objective
289 measurements of PM knowledge. As no validated tools exist, the authors relied on methods that have been
290 utilized in other genetics literature. Second, the sample was limited to those who electively participated in a
291 survey about research attitudes. This resulted in a participant cohort with above average levels of education and
292 income that was majority female. In addition, this nonresponse bias may have led to higher participation rates
293 among people with higher TBR scores compared to the general population. For these reasons, these conclusions
294 may not be generalizable to the whole population. Unfortunately, this study was not powered to address the

295 nuances within race and can only draw conclusions generally about those who identify broadly as White, African
296 American, Asian, and Hispanic. These categories do not fully represent the spectrum of racial diversity.

297 **CONCLUSIONS**

298 As the field of PM grows, we must be cautious about growing disparities in its understanding and
299 dissemination. While statistical models are able to capture individual factors such as education, income, and race
300 it is clear that PM knowledge represents the end result of a complex, longitudinal interaction between providers,
301 patients, the scientific community, society, and the environment. Future statistical models must incorporate
302 additional factors to better understand variations in PM knowledge/awareness. Efforts must be made to address
303 sociocultural barriers as well as logistical barriers to accessing genomic testing. Equitable distribution of PM
304 interventions and their benefits requires deepening our genomic knowledge in addition to our sociocultural
305 knowledge.

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Characteristic	n (%)
Total	3847 (100)
Race	
Asian	84 (2.2)
Black, African American, African, or Afro-Caribbean	594 (14.4)
Hispanic, Latino, or Spanish origin	120 (3.1)
Middle Eastern/North African	16 (0.4)
Native American, American Indian, or Alaskan Native	71 (1.8)
Native Hawaiian, Guamanian, or Chamorro	8 (0.2)
White	3192 (83.0)
More than one race	124 (3.2)
Other	22 (0.6)
Missing	29 (0.8)
Sex	
Male	1203 (30.2)
Female	2744 (69)
Other	3 (0.1)
Prefer not to answer	7 (0.2)
Missing	20 (0.5)
Marital Status	
Now married	2196 (55.2)
Separated	62 (1.6)
Divorced	501 (12.6)
Widowed	137 (3.7)
Never married	771 (19.4)
Living with a partner or significant other	258 (6.5)
Prefer not to answer	33 (0.8)
Missing	19 (0.5)
Highest degree or level of school	
8th grade or less	26 (0.7)
Some high school, but did not graduate	91 (2.3)
High school graduate or GED	402 (10.1)
Some college or 2-year degree	1042 (26.2)
College graduate	1135 (28.5)
More than a college degree	1242 (31.2)
Prefer not to answer	21 (0.5)
Missing	18 (0.5)
Employment Status	
Employed Full Time	2012 (50.6)
Employed Part Time	352 (8.9)
Unemployed	217 (5.5)
Volunteer	34 (0.9)
Stay-at-home parent	177 (4.5)
Retired	665 (16.7)
Receiving Disability	279 (7)
Other	223 (5.6)
Missing	18 (0.5)

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Table 1: Patient Demographics

Table 2: Variables: Survey questions, items, and response modes

Variable	Questions Asked	Response
Demographics	Age	Year of birth
	Race/Ethnicity	7 Choices + Other
	Sex	Male/Female/Other
	Marital Status	5 Choices
	Employment Status	6 Choices + Other
	Household Size	Free-text
	Number of comorbidities	6 Choices + Other and None
	Household Income	7 Choices
	Health Insurance	6 Choices + Other
Precision Medicine Vocabulary	How familiar are you with the following words or phrases? <ul style="list-style-type: none"> • Genetic testing • Biological indicators/biomarkers • Precision medicine • Pharmacogenetics 	5-point Likert Scale
Precision Medicine Attitudes	My healthcare is specific to me. No two cases are the same.	5-point Likert Scale
	My genes can be used to determine the best treatment for me.	5-point Likert Scale
	My genes and other health information can be used to help prevent or treat health conditions in my family.	5-point Likert Scale
	My health information is kept private and secure.	5-point Likert Scale
	I have access to my own health records and can decide which health care providers and researchers have access to them.	5-point Likert Scale
	I can add information about my health to my records.	5-point Likert Scale
Sources of Medical Information	How much do you trust information about health or medical topics from each of the following?	9 Choices, each rated on a 5-point Likert Scale

Coefficient	ADJUSTED				UNADJUSTED			
	Estimate	Std. Error	t value	Pr(> t)	Estimate	Std. Error	t value	Pr(> t)
Race								
Asian	0.0272	0.1586	0.1717	0.8637	0.8400	1.5500	0.5400	0.6000
Black	-0.1765	0.0584	-3.0222	0.0026 *	-2.3100	0.5600	-4.4149	0.0000 *
Hispanic	0.0429	0.1484	0.2891	0.7726	0.4300	1.5500	0.2800	0.8000
Education	0.1002	0.0181	5.5360	0.0000 *				
Age	-0.0001	0.0017	-0.0654	0.9479				
Female	0.0007	0.0414	0.0178	0.9858				
Marital Status								
Separated	0.2597	0.1703	1.5251	0.1275				
Divorced	0.0551	0.0531	1.0387	0.2992				
Widowed	0.0796	0.1133	0.7028	0.4823				
Never Married	-0.1001	0.0559	-1.7904	0.0737				
Living with Partner/Significant Other	-0.0077	0.0880	-0.0873	0.9304				
Employment Status								
Employed Part Time	0.1202	0.0717	1.6779	0.0937				
Unemployed	-0.0454	0.0969	-0.4681	0.6398				
Volunteer	0.0273	0.2227	0.1226	0.9024				
Stay-at-home Parent	-0.0032	0.0993	-0.0319	0.9746				
Retired	0.0123	0.0593	0.2074	0.8357				
Receiving Disability	-0.0243	0.0681	-0.3567	0.7214				
Other	0.0202	0.0830	0.2430	0.8080				

Table 3: Precision Medicine Knowledge Regression Model Results

Coefficient	ADJUSTED				UNADJUSTED			
	Estimate	Std. Error	t value	Pr(> t)	Estimate	Std. Error	t value	Pr(> t)
	0.0561	0.0880	0.6369	0.5242				
Race					(0.3000)	0.1300	2.2000	0.0200 *
Asian	(0.3146)	0.1372	(2.2930)	0.0219	(0.6600)	0.0440	14.9000	- *
Black	(0.6074)	0.0494	(12.2893)	- *	(0.2800)	0.1300	2.2000	0.0270 *
Hispanic	(0.4458)	0.1185	(3.7610)	0.0002 *				
Education	0.0204	0.0159	1.2859	0.1986				
Age	0.0009	0.0015	0.6182	0.5365				
Female	0.0288	0.0377	0.7628	0.4456				
Marital Status								
Separated	0.0811	0.1330	0.6100	0.5419				
Divorced	0.0820	0.0532	1.5416	0.1233				
Widowed	0.0511	0.0936	0.5459	0.5851				
Never Married	(0.1104)	0.0504	(2.1897)	0.0286 *				
Living with Partner/Significant Other	0.1345	0.0702	1.9156	0.0555				
Employment Status								
Employed Part Time	0.0297	0.0603	0.4919	0.6228				
Unemployed	(0.1016)	0.0774	(1.3125)	0.1895				
Volunteer	(0.2475)	0.1839	(1.3457)	0.1785				
Stay-at-home Parent	(0.0362)	0.0848	(0.4267)	0.6697				
Retired	(0.1469)	0.0570	(2.5800)	0.0099 *				
Receiving Disability	0.0488	0.0691	0.7061	0.4802				
Other	(0.0300)	0.0751	(0.3998)	0.6894				
Table 4: Trust Regression Models								

Table 5: Information Source by Race

	Family	Friend	Doctor	Internet	Radio, Newspaper, Magazines	Telephone	Alternative Provider	Other	Total*
Asian	29%	10%	22%	27%	5%	2%	3%	2%	292
Black, African American, African, or Afro-Caribbean	34%	9%	23%	23%	6%	2%	2%	2%	1765
Hispanic, Latino, or Spanish origin	32%	7%	23%	26%	4%	2%	3%	3%	379
Middle Eastern/North African	25%	14%	22%	22%	5%	3%	5%	6%	65
Native American, American Indian, or Alaskan Native	28%	7%	24%	26%	4%	3%	5%	3%	254
Native Hawaiian, Guamanian, or Chamorro	32%	8%	28%	24%	0%	4%	4%	0%	25
White	30%	8%	26%	27%	4%	1%	3%	1%	10754
Other	40%	4%	20%	29%	2%	0%	2%	4%	55

*Respondents can select more than one information source