

# Health Literacy: A Pathway to Better Oral Health

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Oral health status is inexorably linked with general health,<sup>1</sup> as evidenced by the association between poor oral health and chronic diseases, such as diabetes,<sup>2</sup> cardiovascular disease,<sup>3</sup> and respiratory disease.<sup>4</sup> Among US adults, the burden of oral disease falls heaviest on vulnerable population groups,<sup>5-7</sup> particularly those living in rural areas.<sup>8</sup> Although improving oral health is named as one of the top 5 health priorities in *Rural Healthy People 2010*,<sup>9</sup> little progress has been made in establishing public health programs to address this priority area. To achieve the goal of improved oral health, it is essential to study the risk factors associated with the oral health status of individuals residing in rural areas and to understand the relationships among these risk factors.

The association between low dental care utilization and poor oral health outcomes has been proposed as a partial explanation for urban-rural disparities in oral health status.<sup>10-13</sup> The rate of dental care utilization is lower among US rural than general populations, and dental visits tend to be problem—rather than prevention—oriented.<sup>14-17</sup> Low levels of financial security and a lack of dental providers in rural areas are cited as major reasons for the low utilization rates in rural populations.<sup>12,18,19</sup> However, evidence that individuals with dental insurance benefits choose to forgo regular preventive dental care suggests the presence of additional determinants in dental care utilization.<sup>20</sup>

Previous research showed that communication between dentists and their patients plays an important role in the use of dental services.<sup>21-24</sup> Effective patient-dentist communication increases utilization of dental services by lessening dental anxiety and, as a result, increasing patient perceptions of provider competence.<sup>25</sup> Conversely, deficient communication skills, on either side of the patient-provider equation, are likely to increase dental anxiety and overall dissatisfaction with care.

Health literacy deficits can interfere with effective patient-dentist communication. Individuals with low health literacy skills often have difficulty describing dental problems to

**Objectives.** We examined whether health literacy was associated with self-rated oral health status and whether the relationship was mediated by patient-dentist communication and dental care patterns.

**Methods.** We tested a path model with data collected from 2 waves of telephone surveys (baseline, 2009–2010; follow-up, 2011) of individuals residing in 36 rural census tracts in northern Florida (final sample size  $n = 1799$ ).

**Results.** Higher levels of health literacy were associated with better self-rated oral health status ( $B = 0.091$ ;  $P < .001$ ). In addition, higher levels of health literacy were associated with better patient-dentist communication, which in turn corresponded with patterns of regular dental care and better self-rated oral health ( $B = 0.003$ ;  $P = .01$ ).

**Conclusions.** Our study showed that, beyond the often-reported effects of gender, race, education, financial status, and access to dental care, it is also important to consider the influence of health literacy and quality of patient-dentist communication on oral health status. Improved patient-dentist communication is needed as an initial step in improving the population's oral health. (*Am J Public Health.* 2014;104:e85–e91. doi:10.2105/AJPH.2014.301930)

their dentist and understanding dental conditions described by the dentist.<sup>26</sup> Rozier et al. surveyed about 2000 dentists in the United States regarding the use of the 5 domains of communication techniques: interpersonal communication, teach-back method, patient-friendly materials and aids, assistance, and patient-friendly practice.<sup>27</sup> Findings revealed low routine use by dentists of each communication technique, including those thought to be most effective with patients who demonstrate low health literacy.

The association between low health literacy and poor health outcomes is well established.<sup>28-30</sup> However, in the context of oral health, the literature offers few studies identifying the relationship between health literacy and oral health outcomes. It has been suggested that those with low health literacy are at highest risk for oral diseases and problems<sup>31</sup> and that low health literacy may be associated with barriers to accessing care and with oral health behaviors such as seeking preventive care.<sup>32</sup> Furthermore, rural residents have lower health literacy skills than urban residents.<sup>33</sup> However, how health literacy is related to oral health status among rural populations remains an unanswered question.

Frequently acknowledged risk factors for poor oral health include gender (male), race (Black), educational attainment (low), financial status (low), and access to dental care (none). We controlled for these factors in an examination of the effects of health literacy, patient-dentist communication, and dental care patterns on self-rated oral health status. In addition, we tested mediational pathways between health literacy and self-rated oral health. We hypothesized that greater health literacy would be associated with better patient-dentist communication, and in turn, that better patient-dentist communication would be associated with an increased likelihood of seeking regular dental care, ultimately leading to better self-rated oral health.

## METHODS

We conducted 2 waves of telephone surveys with adults aged 25 years and older residing in 36 rural census tracts in 6 northern Florida counties.<sup>34-37</sup> To maximize participation of Black people, we oversampled census block groups with more than 30% Black residents. We used survey sampling weights in the data analysis to adjust for the oversampling. To

ensure stability in recontact, we limited sampling to homes with landlines.

Professional interviewers obtained informed consent from participants and administered computer-assisted telephone interviews. The baseline survey was conducted between November 2009 and March 2010; the follow-up survey was conducted between March and June of 2011. Participants received a \$15 Walmart gift card for each survey completed.

For the baseline survey, we purchased and dialed 16 000 discrete phone numbers. The top reasons for incomplete surveys were (1) ineligibility ( $n = 6420$ , which included fax lines, nonworking numbers, no eligible respondents, etc.), (2) household occupancy unknown ( $n = 3255$ , which included no answer, busy, technical phone problems, and answering machine), and (3) refusal ( $n = 3002$ ). The response rate, defined as the number of complete interviews with reporting units ( $n = 2605$ ) divided by the number of eligible reporting units in the sample ( $16\ 000 - 6420 = 9580$ ), was 27.2%. A year later, 1942 (75.1%) of the 2587 participants who agreed to be interviewed a second time completed the follow-up interview. Relative to those who were lost to follow-up, participants who completed both baseline and follow-up surveys were older (57.4 vs 52.9 years;  $P < .001$ ), were more likely to be female ( $\chi^2 = 7.63$ ;  $P = .006$ ), were more likely to be White ( $\chi^2 = 37.6$ ;  $P < .001$ ), and had higher levels of education ( $\chi^2 = 37.2$ ;  $P < .001$ ). After removing participants whose race was not White or Black ( $n = 91$ ) and those with incomplete data ( $n = 52$ ), we obtained a final sample of 1799 participants.

## Measures

*Self-rated oral health (follow-up survey).* The main outcome variable of interest was participants' self-rated oral health status. Previous studies have demonstrated self-rated oral health as a valid and reliable indicator of actual overall oral health status.<sup>38,39</sup> In the follow-up survey, we assessed perceived oral health with a single question: "How would you describe the condition of your mouth?" (1 = excellent, 2 = very good, 3 = good, 4 = fair, 5 = poor). We reverse-coded this variable so that larger values indicated better self-rated oral health.

*Dental care patterns (follow-up survey).* We divided participants into 2 groups according to

their dental care patterns: regular versus problem-oriented dental care seekers (the latter were the reference group). We defined the groups by asking, "Which of the following best describes your approach to dental care?" (1 = I never go to a dentist; 2 = I go to a dentist when I have a problem or when I know that I need to get something fixed; 3 = I go to a dentist occasionally, whether or not I have a problem; 4 = I go to a dentist regularly). Regular dental care seekers reported going to a dentist occasionally or regularly, whether or not there was a problem. Problem-oriented dental care seekers reported only going to a dentist when they had a problem.

*Patient–dentist communication (follow-up survey).* Four questions assessed patient–dentist communication: (1) "When you visit a dentist, how often does the dentist explain things in a way that is easy to understand?" (2) "When you visit a dentist, how often does the dentist listen carefully to you?" (3) "When you visit a dentist, how often does the dentist treat you with courtesy and respect?" and (4) "When you visit a dentist, how often does the dentist spend enough time with you?" (1 = never, 2 = sometimes, 3 = usually, 4 = always). We recoded response options to range from 0 to 3 and calculated a communication score as the average score of answered questions.

*Health literacy (baseline survey).* The main independent variable of interest was health literacy score (range = 0–3, with 3 indicating highest level of health literacy). We derived the score from 3 validated screening questions for assessing health literacy<sup>40</sup>: (1) "How often do you have a problem understanding the written materials about your medical condition?" (2) "How often do you have a problem understanding what is told to you about your medical condition?" and (3) "How often do you have a problem filling out medical forms by yourself?" (1 = rarely or none of the time, 2 = some or a little of the time, 3 = occasionally or a moderate amount of time, 4 = all of the time). We recoded responses to range from 0 to 3 and calculated a literacy score as the average score of answered questions. Because we assumed that medical and dental forms would pose equal challenges to those with low health literacy, we chose to leave the item referencing completion of medical forms unchanged.

*Sample characteristics (baseline survey).* Socio-demographic characteristics collected were age, gender (women were the reference group), race (Blacks were the reference group), education, financial security, and having a regular dentist. We dichotomized education: completed high school (or had a general equivalency diploma) or less (reference group) and had more than a high school education. We derived a financial security score (continuous, range = 0–2, with 2 indicating greatest financial security) from 2 questions<sup>37,41</sup>: "Which of these statements best describes your present financial status?" (1 = I really can't make ends meet, 2 = I manage to get by, 3 = I have enough to manage plus some extra, 4 = money is not a problem, I can buy about whatever I want) and "If you were faced with an unexpected \$500 medical bill that was not covered by insurance, how would you best describe your situation?" (1 = not able to pay the bill; 2 = able to pay, but with difficulty; and 3 = able to pay comfortably). We then calculated a continuous financial security score as the weighted average of the 2 items. We also asked participants whether they had a regular dentist: "A regular dentist is one that a person usually goes to for check-ups and cleanings or when they have a cavity or tooth pain. Do you have a regular dentist?" (yes, no, don't know, or refused).

## Data Analysis

We managed data and calculated descriptive statistics with SAS version 9.3 (SAS Institute, Cary NC). We performed comparisons with survey sampling weighted  $\chi^2$  and  $t$  tests. To better present sample characteristics, we dichotomized self-rated oral health status into fair or poor versus good, very good, or excellent in Table 1.<sup>42</sup> We used the original 5-level self-rated oral health scale in all the other analyses.

We tested the proposed path model with Mplus version 7 (Muthén & Muthén, Los Angeles, CA). Path models are used to test the significance of hypothesized causal relationships between sets of variables and to estimate the magnitude of the relationships. Path coefficients (denoted as  $B$ ) are standardized parameter estimates that measure the magnitude of the relationships between variables or sets of variables. Path coefficients can be compared with the relative effects of the variables within the path model.

**TABLE 1—Characteristics of Rural Participants by Self-Rated Oral Health Status: Florida, 2009–2011**

Characteristic	Self-Rated Oral Health		P
	Fair or Poor (n = 284), Weighted Mean (SD) or %	Good, Very Good, or Excellent (n = 1515), Weighted Mean (SD) or %	
Age, y	56.1 (14.7)	56.8 (14.7)	.428
Gender			.402
Women	53.4	56.2	
Men	46.6	43.8	
Race			.048
Black	34.0	28.0	
White	66.0	72.0	
Education			< .001
≤ high school or GED	53.0	27.4	
> high school	47.0	72.6	
Financial security <sup>a</sup>	0.78 (0.62)	1.24 (0.59)	< .001
Having a regular dentist			< .001
Yes	28.8	64.6	
No	71.2	35.4	
Dental care pattern			< .001
Regular	34.5	76.8	
Problem oriented	65.5	23.2	
Patient–dentist communication <sup>b</sup>			< .001
0.0–1.0	10.3	2.5	
1.1–2.0	23.0	15.2	
2.1–3.0	66.7	82.3	
Health literacy <sup>b</sup>			< .001
0.0–1.0	17.6	6.6	
1.1–2.0	29.1	21.6	
2.1–3.0	53.3	71.8	

Note. GED = general equivalency diploma. All percentages were survey sampling weighted.

<sup>a</sup>Range = 0–2.

<sup>b</sup>Range = 0–3, with 3 highest.

To assess the direct and indirect effects of health literacy on self-rated oral health, we constructed 3 regression models in a structured way for the endogenous variables self-rated oral health, dental care patterns, and patient–dentist communication. We entered health literacy into the regression models as the exogenous variable. Control variables were age, gender, race, education, financial security, and having a regular dentist or not. Mplus supports combinations of continuous and categorical variables. We used STRATIFICATION and WEIGHT options with TYPE = COMPLEX to account for the complex survey design. We performed parameter estimation with the WLSMV estimator in Mplus.

## RESULTS

Sample characteristics stratified by self-rated oral health status are summarized in Table 1. Respondents in the fair or poor group did not differ significantly from those in the good, very good, or excellent group in age ( $P = .428$ ) or gender ( $P = .402$ ). However, a significantly higher percentage of Blacks (34.0% vs 28.0%;  $P = .048$ ), individuals with a high school diploma or less (53.0% vs 27.4%;  $P < .001$ ), individuals without a regular dentist (71.2% vs 35.4%;  $P < .001$ ), and problem-oriented dental care seekers (65.5% vs 23.2%;  $P < .001$ ) were in the fair or poor oral health group than in the good, very good, or excellent group. In

addition, respondents in the fair or poor group had less financial security ( $P < .001$ ), poorer patient–dentist communication ( $P < .001$ ), and lower health literacy skills ( $P < .001$ ) than those in the good, very good, or excellent group.

## Preliminary Analyses

Table 2 presents zero-order correlations among the variables of interest. Better oral health was associated with higher levels of health literacy ( $r = 0.21$ ;  $P < .001$ ), better patient–dentist communication ( $r = 0.24$ ;  $P < .001$ ), and regular dental care ( $r = 0.38$ ;  $P < .001$ ). In addition, a higher level of health literacy was associated with better patient–dentist communication ( $r = 0.12$ ,  $P < .001$ ).

Better patient–dentist communication was associated with regular dental care ( $r = 0.24$ ;  $P < .001$ ). Overall, the observed zero-order correlations among the variables of interest supported our proposed mediational model.

## Path Model

Figure 1 presents the tested path model with standardized path coefficients. The overall model fit was good ( $\chi^2 = 0.432$ ;  $P = .51$ ; comparative fit index = 0.99; root mean square error of approximation = 0.01). A statistically significant direct path connected health literacy with self-rated oral health ( $B = 0.091$ ;  $P < .001$ ), indicating better self-rated oral health among respondents with higher levels of health literacy.

Two indirect paths connected health literacy and self-rated oral health. First, higher health literacy levels were associated with better patient–dentist communication. In turn, better patient–dentist communication corresponded with better self-rated oral health. The indirect effect estimate for this path was  $B = 0.008$  ( $P = .009$ ). In the second indirect path, higher health literacy levels corresponded with better patient–dentist communication. Better patient–dentist communication corresponded with being a regular (rather than problem-oriented) dental care seeker, which in turn corresponded with better self-rated oral health. The indirect effect estimate for this path was  $B = 0.003$  ( $P = .01$ ).

In addition to the primary findings regarding health literacy and patient–dentist communication and their relationship to dental care

**TABLE 2—Correlations Among Factors Affecting Self-Rated Oral Health Among Rural Participants: Florida, 2009–2011**

Variable	Self-Rated Oral Health, <i>r</i>	Age, <i>r</i>	Gender, <i>r</i>	Race, <i>r</i>	Education, <i>r</i>	Financial Security, <i>r</i>	Having a Dentist, <i>r</i>	Dental Care Patterns, <i>r</i>	Patient–Dentist Communication, <i>r</i>
Age	0.03	1.00							
Gender	-0.06**	-0.01	1.00						
Race	0.14***	0.12***	-0.04	1.00					
Education	0.23***	-0.09***	-0.02	0.15***	1.00				
Financial security	0.33***	0.15***	0.11***	0.23***	0.29***	1.00			
Having a dentist	0.30***	0.03	-0.06*	0.20***	0.30***	0.36***	1.00		
Dental care patterns	0.38***	0.03	-0.06*	0.13***	0.26***	0.38***	0.54***	1.00	
Communication	0.24***	0.08***	-0.01	0.01	0.04	0.18***	0.20***	0.24***	1.00
Health literacy	0.21***	-0.12***	-0.01	0.09***	0.32***	0.28***	0.17***	0.18***	0.12***

\**P* < .05; \*\**P* < .01; \*\*\**P* < .001.

patterns and self-rated oral health status, our path analysis revealed several important findings regarding the demographic variables. The standardized path coefficients for the control variables from the path model are summarized in Table 3. First, Blacks' disadvantage in self-rated oral health disappeared when we controlled for education, financial security, having a dentist, health literacy, patient–dentist communication, and dental care patterns (*B* = 0.044; *P* > .05). Second, a higher level of financial security was associated with better self-rated oral health (*B* = 0.124; *P* < .001), being a regular dental care seeker (*B* = 0.242; *P* < .001), and better patient–dentist communication (*B* = 0.110; *P* < .001). Third, a comparison of education levels showed that

respondents with more than a high school education had better self-rated oral health (*B* = 0.065; *P* < .05) and were more likely to seek regular dental care (*B* = 0.070; *P* < .05). However, they did not report better patient–dentist communication.

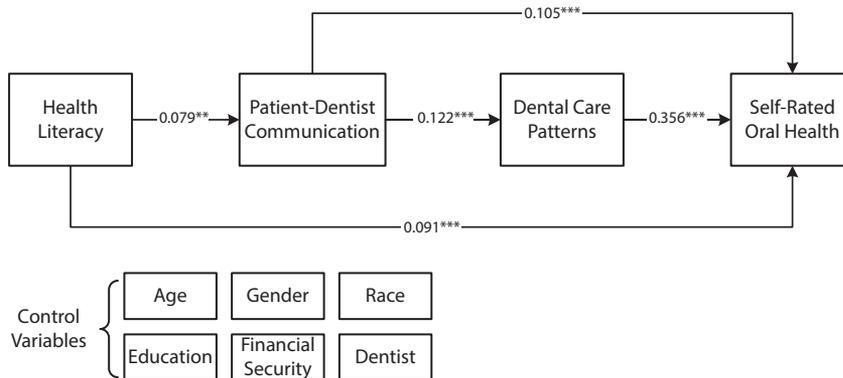
**DISCUSSION**

Our findings were consistent with those of previous reports, specifically that men reported poorer oral health status than women and that Blacks reported poorer oral health status than Whites.<sup>43</sup> In addition, higher levels of financial security and educational attainment were significantly associated with better oral health status.<sup>43</sup> Beyond these acknowledged relationships, we

found important new patterns associated with health literacy and oral health. We identified a direct relationship between health literacy and oral health status as well as an indirect relationship between the 2 via patient–dentist communication and dental care patterns. In the direct relationship, higher levels of health literacy were associated with better oral health status. In the indirect relationship, higher levels of health literacy corresponded with better patient–dentist communication, which in turn corresponded with being a regular dental care seeker. Being a regular dental care seeker then corresponded with better self-rated oral health.

**Path Model**

We found an association between greater health literacy and better patient–dentist communication, which in turn corresponded with patterns of regular dental care and higher levels of self-rated oral health. We measured health literacy by asking respondents how well they understood written or verbal information about their medical conditions and how well they felt they could fill out medical forms. It is important to note that this health literacy measure references individuals' ability to locate, comprehend, evaluate, and use health information. It requires comprehending what their doctor tells them, which includes asking questions for both information and clarification. People who are more health literate are less likely to have difficulty accessing care and communicating the required information to providers.



Note. Numbers represent standardized path coefficients. \**P* < .05; \*\**P* < .01; \*\*\**P* < .001.

**FIGURE 1—Path model for influence of health literacy on self-rated oral health status among rural Floridians, 2009–2011.**

**TABLE 3—Relationship Between Endogenous and Control Variables Affecting Self-Rated Oral Health Among Rural Participants: Florida, 2009–2011**

Control Variable	Self-Rated Oral Health, <i>r</i>	Dental Care Patterns, <i>r</i>	Patient–Dentist Communication, <i>r</i>
Age	0.011	-0.014	0.059*
Gender	-0.047	-0.079**	-0.011
Race	0.044	-0.006	-0.067**
Education	0.065*	0.070*	-0.021
Financial security	0.124***	0.242***	0.110***
Having a dentist	-0.021	0.474***	0.147***

Note. Values are standardized coefficients in the path model for the control variables.

\* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$ .

Many factors are associated with missed dental visits. Improving health literacy and patient–dentist communication could help address factors that influence missed dental appointments. This includes helping people understand the benefits of preventive dental care and the importance of regular care. Lack of preventive dental care often results in more expensive oral treatments, such as restorative, endodontic, and surgical procedures or the loss of teeth altogether.<sup>44</sup> In the long run, a pattern of regular dental care may save money, because more costly dental procedures are often avoided.<sup>45</sup> Individuals with greater health literacy are more likely to understand the benefits of seeking regular preventive dental care.

We also observed a direct effect of health literacy on self-rated oral health status. This effect was the portion of the total effect of health literacy on self-rated oral health that was not explained by patient–dentist communication and dental care patterns. One interpretation of the direct effect is that individuals with higher levels of health literacy are more likely to follow recommended guidelines for regular dental examinations and self-care, such as daily brushing with fluoride toothpaste and flossing. Because most oral health promotion materials are estimated to require an eighth-grade reading level, it may be difficult for individuals with low literacy to comprehend behaviors necessary for maintaining oral health. Furthermore, in general, higher levels of health literacy influence a spectrum of positive health behaviors, resulting in positive effects on both oral and general health. Individuals with high health literacy can most likely identify and consume the foods recommended for

a balanced diet. By contrast, those with low health literacy may be less likely to adopt healthy dietary patterns or to understand the pros and cons of engaging in healthy behaviors.

### Public Health Implications

Our findings demonstrate the influence of health literacy on oral health status, particularly the role of health literacy in patient–dentist communication and patterns of individual dental care seeking. The relationships among these key variables represented in the path model have important public health implications.

First, oral health education materials should address oral health from the patient's standpoint, not the provider's. It is our and others' experience that literacy level is often too high in patient education materials, including oral health materials.<sup>46</sup> Critical attention must be given to ensuring that information is presented at a reading level appropriate for the audience.<sup>47–49</sup> For example, written information aimed at a general audience should not exceed a sixth-grade reading level.<sup>50</sup> A public health educator's review and redesign of educational brochures to accommodate topic relevance, reading level, and cultural appropriateness are critical if oral health information and dental care guidelines are to be communicated appropriately and received by the target audience. Population groups that lack access to regular dental care are in need of readable materials listing community oral health care resources. This is particularly important in light of the findings of Cohen et al. that patients seeking acute dental care in hospital emergency departments receive only palliative care along with a dental referral for definitive care.<sup>51</sup>

Because of the strong relationship between health literacy and health, it is reasonable to consider the accommodation of low health literacy as the initial behavioral strategy in improving both oral and general health status among individuals and communities.

It is also important to improve the ways dentists communicate health information to vulnerable populations with low health literacy. Dentists often do not use the communication techniques thought to be most effective with patients with low literacy skills. To increase comprehension, dentists need to communicate critical oral health information in nontechnical language. In addition, patient-friendly materials designed to increase oral health knowledge and communicate recommended care guidelines can be made available in the clinic, in a format patients can take and keep for future reference.

Finally, another way to improve oral health is by providing navigators or guides in dental offices. A patient navigator could assist in filling out forms; getting information on oral health conditions, signs, and symptoms; and fully explaining diagnostic information and guidelines to follow for dental patients' self-care. Dental patients could also have their questions regarding oral health answered by a navigator. With navigators, critical health information could be smoothly delivered to patients. At the same time, patients could improve their knowledge through better communication with the health care system.

### Limitations

To address concerns regarding a low recontact rate among participants at follow-up, we limited our sample to persons with landlines. This strategy likely resulted in sampling bias, because individuals who could only be contacted by mobile phone were excluded from the study. However, the average age of the respondents was 56.7 years, and mobile phone usage is lower among older adults. The use of self-reported data collected by telephone surveys introduces issues of recall bias, response bias, and inability to capture the absolute level of the variables of interest. To minimize the associated biases, we used only validated self-report measures.

Finally, our recommendations are somewhat speculative. However, speculation is necessary

because dental health literacy research is in its infancy. Ours was among the first studies to explore the relationship between health literacy and oral health status. More research is needed to inform interventions targeting improved oral health.

## Conclusions

We proposed and tested a potential mechanism through which health literacy affects oral health status. We established that this effect is mediated by patient–dentist communication and dental care utilization patterns. In addition to the often-reported effects of gender, race, education, financial security, and access to dental care,<sup>52</sup> it is important to consider the influence of health literacy and the quality of patient–dentist communication on oral health. ■

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## Contributors

Y. Guo conducted the analysis and led the writing of the article. H. L. Logan, V. J. Dodd, J. G. Marks, and J. L. Riley III guided the study design and assisted with analysis, interpretation, and writing. K. E. Muller guided the study design and statistical model selection.

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## Human Participant Protection

This study was approved by the institutional review board of the University of Florida.

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