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ORIGINAL PAPER

Measuring Factors Associated with Colorectal Cancer Screening among Young Adult African American Men: A Psychometric Study

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Abstract The Male Role Norms, Knowledge, Attitudes, and Perceptions associated with Colorectal Cancer Screening (MKAP-CRCS) survey was developed to assess the attitudes, knowledge, male role norms, perceived barriers, and perceived subjective norms associated with screening for colorectal cancer (CRC) among young adult African American men. There is a critical need for exploring the complex factors that may shape attitudes towards CRC screening among men who are younger (i.e., ages 19–45) than those traditionally assessed by clinicians and health promotion researchers (age 50 and older). Psychometrically sound measures are crucial for eliciting valid and reliable data on these factors. The current study, therefore, assessed the psychometric properties of the MKAP-CRCS instrument using an online sample of young adult African American men ($N = 157$) across the United States. Exploratory principal component factor analyses revealed that the MKAP-CRCS measure yielded construct valid and reliable scores, suggesting that the scale holds promise as an appropriate tool for assessing factors associated with CRC screening among younger African American men. Strengths and limitations of this study, along with directions for future research are discussed, including the need for more research examining the relationship between masculinity and CRC screening among African American men.

Keywords African American · Colon cancer · Principal component analysis · Men · Psychometrics

Introduction

Despite the benefits of early detection and the availability of effective screening tests, colorectal cancer (CRC) remains the second leading cancer killer among African American men [1–3]. Although routine screening detects CRC at an earlier, more treatable stage, African American men are disproportionately burdened by CRC as their incidence and mortality rates are 27 and 52% higher, respectively, than white men [2]. To investigate factors associated with low CRC screening uptake among African American men possibly contributing to these disparities, Rogers and Goodson [4] assessed whether attitudes toward CRC and CRC screening were associated with male role norms and select concepts and constructs from the Theory of Planned Behavior (e.g., knowledge, attitudes, perceived subjective norms, and perceived barriers) [5].

While several measures have been developed in previous studies to assess the aforementioned constructs and concepts, none have explicitly examined CRC screening behaviors among young adult African American men and warrant discussion. One measure of male role norms comprises the 21 item Male Role Norms Inventory-Short Form (MRNI-SF) utilized among 1017 undergraduate students to examine if men and women interpreted traditional masculinity ideologies similarly [6]. Reported alphas of 0.92 and 0.94, respectively, suggest the MRNI-SF scores were internally consistent. In regards to the knowledge construct, a

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CRC Knowledge test created by Green and Kelly [7] consisted of 16 items assessing a nonrandom sample of 100 African Americans' knowledge on the incidence and mortality, truths and myths, warning signs and symptoms, participation and screening modalities for CRC. An analysis of the participants' scores for this particular scale resulted in high internal consistency via Kuder–Richardson 20 (K–R 20 = 0.810). To accompany this measure, a CRC Perceptions test, consisting of 35 items examining perceptions of severity, susceptibility, benefits, and CRC barriers, also indicated good internal consistency ($\alpha = 0.84$).

Despite increasing CRC incidence among those younger than the recommended screening age of 50 and some providers lowering their recommended screening age for African Americans to 45 [1, 8–10], neither of the aforesaid measures have been used with young adult African American men. Hence, a modified version of the scale by Green and Kelly [7] along with the MRNI-SF developed by Levant and colleagues [6]—the Male Role Norms, Knowledge, Attitudes, and Perceptions associated with Colorectal Cancer Screening (MKAP-CRCS) survey was employed by Rogers and Goodson [4] to examine factors contributing to CRC screening completion disparities amid African American men. The purpose of the current study was to psychometrically evaluate the MKAP-CRCS measure's reliability and validity when completed by young adult African American men (ages 19–45).

Methods

Participants

We assessed the psychometric properties of the MKAP-CRCS instrument among a sample of 157 young adult African American men aged 19–45 years ($M = 29.78$, $SD = 5.871$). A convenience and snowball sampling plan was used to recruit these men nationally through various existing social networks such as social media (e.g., Facebook, Twitter), list-serves, predominantly African American-serving barbershops and mega-churches, among others. Most categorized themselves as straight/heterosexual (89.2%), 7.6% identified themselves as gay, and 2.5% as struggling with their sexual orientation. The median family/household income was $35,000–$49,000 with most of the participants (62%) working a full-time job and having health insurance (83%). Nearly half (47%) were single and 77% lived in the South. In terms of study enrollment: 48% learned about the study through their friends, a family member, or someone told them about it; 24% via Facebook or Twitter, and 22% by way of email or common interest list-serves [4].

Measures

Demographics

Participants were asked to indicate their (a) age, (b) current state of residence according to the four Census Bureau-designated areas (i.e., Midwest, Northeast, South, West), (c) education level, (d) health insurance, (e) marital status, (f) religiosity, (g) sexual orientation, and (h) work status, among other variables described elsewhere [4].

Male Role Norms

This 21-item MRNI-SF scale measures seven theoretically-derived norms of traditional masculinity ideology: Achievement/Status, Aggression, Avoidance of Femininity, Self-Reliance, Non-Relational Attitudes toward Sex, Restrictive Emotionality, and Fear and Hatred of Homosexuals [6]. A sample item from the Fear and Hatred of Homosexuals subscale is, "Homosexuals should never marry". For all scales, individual items were assessed on a 7-point Likert-type scale ranging from 1 (*strongly disagree) to* 7 (*strongly agree*). Higher scores indicated a greater degree of endorsement of masculine norms. The coefficient alpha (Cronbach) was 0.90 for this scale.

Knowledge about CRC and Early Detection Screening

Adapted from Green and Kelly [7], this section and scale consisted of 21 items measured as true/false regarding CRC screening modalities, truths and myths, screening participation, incidence and mortality, as well as symptoms and warning signs. Each item was assigned 1 point if correct and participants had to answer 11 of the 13 questions correctly to receive a passing score (85%). To improve the initial performance of this scale (yielding a coefficient alpha of 0.45), eight items were removed after exploratory principal component factor analysis identified the lowest-performing ones. The alpha for the re-defined scale increased to 0.54.

Beliefs and Values about CRC and Early Detection Screening

The next section of the survey, consisted of 54 items on a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). The reliability coefficients for each revised scale, originally developed by Green and Kelly [7], in the current study were as follows: 17 items making up the *Attitudes* scale (0.79), 4 items in the *Perceived Barriers* scale (0.71), and 10 items measuring *Perceived Subjective Norms* (0.87).

Procedure

The study, approved by the host university's IRB, consisted of an online survey housed by PsychData. Participants could complete the survey from any computer of their choice. In order to assure successful transfer of the participants' survey responses directly into the secure PsychData database, the survey was located at a website owned by the first author (CRR). The first page of the website reviewed the informed consent information and participants who consented clicked "yes" to be taken to the survey. The survey presented the measures in the following order: Demographics, Male Role Norms, Knowledge about CRC and Early Detection Screening, and Beliefs and Values about CRC and Early Detection Screening. Upon completing the survey, participants were given the choice to be entered into four drawings to win one of four electronic devices.

Results

The data were thoroughly screened before conducting statistical analyses to eliminate random responses, missing data, and data entry errors. Data cleaning specifics were previously reported by Rogers and Goodson [4]. In the current study, principal component analysis (PCA) with Varimax rotation for each of the scales was implemented using SPSS Version 20.0. First, these analyses assessed the underlying structure of the 21 items in the *Male Role Norms* scale. Seven factors were expected, based on the original model proposed and reported by Levant et al. [6]: (1) Avoidance of Femininity, (2) Negativity toward Sexual Minorities, (3) Self-reliance through Mechanical Skills, (4) Toughness, (5) Dominance, (6) Importance of Sex, and (7) Restrictive Emotionality. Upon analysis, this study's sample yielded 6 scales/factors instead of the 7 put forth by Levant and colleagues [6]. After rotation, the first factor accounted for 15.85% of the variance ($M = 3.33$, $SD = 1.49$) and the sixth factor accounted for 9.05% ($M = 4.55$, $SD = 1.36$). Table 4 displays the items alongside the factor loadings for the rotated factors and each factor's reliability coefficient (Cronbach's alpha), with loadings less than 0.50 omitted to improve clarity. The item *"All homosexual bars should be closed down"* had its highest loading on the second factor, but had a cross-loading over 0.5 on the first factor. Since the item is conceptually closer to the other items in the first factor (assessing *Negativity toward Sexual Minorities*), and based on the analysis put forth by Levant et al. [6], we opted to keep this item in the first factor.

We employed the same techniques (PCA with Varimax rotation) to assess the underlying structure of the 21 items for the *Knowledge about CRC and Early Detection Screening (EDS)* scale. Initially, 10 factors were obtained after rotation, where the first factor accounted for 7.61% ($M = 0.69$, $SD = 0.40$) of the variance and the tenth factor accounted for 5.99% ($M = 0.34$, $SD = 0.22$). Because preliminary analyses indicated the possibility of a two-factor model, we forced the analyses into a two-factor solution. After rotation, the first factor accounted for 11.25% of the variance and the second factor accounted for 7.78%. Furthermore, the first and second factor had weak loadings (<0.30) for 8 of the items. Thus, these 8 items were removed in an attempt to improve the reliability and validity of the *Knowledge about CRC and EDS* scores. Without these items, and after rotation, the first factor accounted for 17.13% of the variance and the second factor accounted for 11.78%. Table 1 displays the items and factor loadings for the rotated factors in the final *Knowledge about CRC and EDS* scale, with loadings <0.30 omitted to improve clarity.

We also assessed the underlying structure of the 16 items forming the *Attitudes* scale. Initially, 4 factors were obtained after rotation where the first factor accounted for 19.35% of the variance and the fourth factor accounted for 10.42%. Because we wished to have a single attitude variable for the multivariate analyses, we examined if a forced, one-factor solution was reasonable. Upon analysis, we found the single, forced factor accounted for 19.42% of the variance after rotation. After removing the 5 items with loadings <0.30, the single factor accounted for 32.16% of the variance. One more attempt to improve the scale's validity involved omitting the one item that loaded with a coefficient lower than 0.40, *"Having CRC screening will decrease my chances of dying from CRC."* After removing this item, the first factor accounted for 34.83% of the variance after rotation. Table 2 displays the items and factor loadings for the rotated factors for the final *Attitudes* scale, with loadings <0.40 omitted to improve clarity.

In the same manner, we also assessed the underlying structure of the 10 items in the *Perceived Subjective Norms* scale. Because preliminary analyses indicated the possibility of a three-factor model, we forced the analyses into this model. Three factors were obtained after rotation, where the first factor accounted for 25.68% of the variance and the third factor accounted for 20.96%. To confirm this was the best decision before moving forward with multivariate analyses, we examined if a forced, one-factor solution was reasonable for these items. In the forced extraction, after rotation, the first factor accounted for 46.4% of the variance. Table 3 displays the items and factor loadings for this single factor in the retained *Perceived Subjective Norms* scale, with loadings <0.40 omitted to improve clarity.

Finally, we assessed the underlying structure of the 4 items in the *Perceived Barriers* scale. The analysis yielded a structure of a single factor, accounting for 56.12% of the variance. Table 4 displays the items and factor loadings, with loadings less than 0.30 omitted for clarity.

Table 1 Factor loadings for the rotated factors for the Knowledge about CRC and early detection screening scale of the MKAP-CRCS survey—forced-factor extraction (2 factors only) after deletion of select items ($N = 157$)

Items[a]	Factor loading		
	1	2	Communality
58. Men and women should begin screening…	0.68		1.0
44. CRC is the third most common cancer…	0.55		1.0
59. African-American men should begin…	0.61		1.0
54. There are several screening tests for CRC	0.47		1.0
57. A colonoscopy is an appropriate test to…	0.41		1.0
45. The risk of developing CRC is greater as…	0.43		1.0
41. CRC is a cancer of the colon or rectum	0.37		1.0
49. Bleeding from the rectum, blood in your stool	0.33		1.0
42. CRC is the leading cause of cancer death…		0.63	1.0
56. A sigmoidoscopy is an appropriate test…		0.53	1.0
51. You should see your doctor if you have…		0.48	1.0
55. A FOBT is an appropriate test to…		0.47	1.0
43. CRC is a disease that affects only older, white…		0.39	1.0
Eigenvalues	2.22	1.53	
% of variance	17.13	11.78	Total α
Cronbach's Alpha	0.57	0.38	0.54

Loadings <0.30 are omitted

Varimax rotation

[a]Item numbering corresponds to order in the survey

Table 2 Factor loadings for the rotated factors for the attitudes scale of the MKAP-CRCS survey—forced-factor extraction (1 factor solution) after deletion of select items ($N = 157$)

Items[a]	Factor loading	
	1	Communality
67. I am afraid to even think about CRC	0.75	0.56
64. When I think of CRC my heart beats faster	0.64	0.41
70. If I got CRC, my whole life would change	0.63	0.40
77. I am afraid to find out there is something…	0.61	0.37
63. If I had CRC, my career/life would be over	0.61	0.37
78. I am afraid to have CRCS because I don't…	0.59	0.35
66. My feelings about myself would change if…	0.59	0.35
68. My financial security would be endangered..	0.58	0.34
62. The thought of getting CRC scares me	0.54	0.29
76. CRCS is embarrassing to me	0.48	0.23
81. CRCS exams would be painful	0.40	0.16
Eigenvalues	3.83	
% of variance	34.83	Total α
Cronbach's alpha	0.81	0.81

Loadings <0.40 are omitted

Varimax rotation

[a]Item numbering corresponds to order in the survey

Discussion

The goal of the current study was to evaluate the psychometric properties of the MKAP-CRCS measure among a sample of African American men across the U.S.—a group that is ranked last among all racial/ethnic groups for age-adjusted CRC mortality rates and 5-year survival rates [1, 2]. Results suggested that the measures yielded reliable scores, thus providing a brief and appropriate means for assessing the complex, poorly understood factors contributing to CRC screening and treatment outcome disparities among African American men. To the authors' knowledge, this is the first psychometrics-focused study of its kind centered on CRC and young adult African American men (specifically, ages 19–45).

The current research supports the psychometric soundness of the MKAP-CRCS measure among young adult African American men, but further research on these men's beliefs regarding male role norms is sorely needed. As Rogers and Goodson [4] reported, numerous participants withdrew from the study after reaching the *Negativity toward Sexual Minorities* questions, suggesting potential for more conservative perceptions of traditional male role norms, not captured by the *Male Role Norms* scale. On average, our sample tended to disagree slightly with traditional masculinity ideology (see Rogers and Goodson [4] for details on this sample's mean scores); however, those who withdrew may have felt uncomfortable sharing personal beliefs about the roles expected of men or, conversely, may have found

Table 3 Factor loadings for the rotated factors for the perceived subjective norms scale of the MKAP-CRCS Survey—forced-factor extraction (1 factor solution) ($N = 157$)

Items[a]	Factor loading	
	1	Communality
92. It is important for me to comply…siblings…	0.78	0.60
91. My siblings believe CRCS is an appropriate…	0.77	0.60
94. It is important for me to comply…close..	0.76	0.58
90. It is important for me to comply…"significant"…	0.72	0.51
89. My "significant other" believes CRCS is…	0.70	0.70
87. My parents believe CRCS is an appropriate…	0.68	0.46
88. It is important for me to do what my parents…	0.62	0.38
86. It important for me to do what important…	0.59	0.35
85. The important people in my life believe CRCS…	0.49	0.24
Eigenvalues	4.64	
% of variance	46.40	Total α
Cronbach's alpha	0.87	0.87

Loadings <0.40 are omitted

Varimax rotation

[a]Item numbering corresponds to order in the survey

Table 4 Factor loadings for the rotated factors for the perceived barriers scale of the MKAP CRCS survey ($N = 157$)

Items[a]	Factor loading	
	1	Communality
79. I don't know how to go about scheduling…	0.35	0.60
82. Having CRCS would expose me to too…	0.35	0.62
84. Having CRCS costs too much money	0.33	0.55
80. Having CRCS could take too much time	0.31	0.48
Eigenvalues	2.25	
% of variance	56.12	Total α
Cronbach's Alpha	0.73	0.73

Loadings <0.30 are omitted

Varimax rotation

[a]Item numbering corresponds to order in the survey

the norms proposed in the measures offensive or taboo. It may be beneficial for future researchers to control for participants' level of discomfort with sexuality-specific survey items when implementing the measure, to better determine the mechanisms underlying any missing data and/or prevent premature survey termination.

The development of the masculinity scale used in Rogers and Goodson's study [4] poses a limitation regarding its inclusion of the MRNI-SF. The original Male Role Norms Inventory scale was amended prior to the 1960s to better quantify respondents agreement with existing cultural norms of manhood characteristics of the U.S. and Western societies [6, 11–13]. Since masculinity varies across different demographics, such as age and race, its operationalization is complex. This is evident in its fixed interpretations of scale items on the MRNI-SF, which assumes all questions are applicable across contexts, geographies, and generations [13]. Although Rogers and Goodson [4] found the sample, on average, disagreed slightly with traditional masculine ideology, it may be beneficial for future researchers to develop a culturally appropriate measure of masculinity that explicitly considers masculinity's influence on CRC screening behaviors among African American men. Furthermore, additional research investigating cultural masculine ideals is needed as very few studies have examined the association between masculinity perceptions among African American men and CRC screening uptake [14].

Likewise, this psychometric analysis has several limitations to consider. The small sample size prevents generalizability to all African American males and the recruitment strategies precluded random sampling. It is also important to consider the self-reported nature of the data, with its potential inaccuracies and idiosyncrasies. The research team, however, placed concerted effort in recruiting a large sample and purging the dataset of obvious problems such as missing data, extreme outliers and inconsistent information.

Another limitation of our study involves the generalizability of the findings, given we were not able to carry out a random selection of our sample. For this reason, almost half of our respondents had a Master's or advanced degree. This is neither characteristic of the general nor African American populations in the U.S. However, when examining the various education levels in our sample, we found no significant differences in CRC and early detection screening knowledge across the levels.

In conclusion, the current study supports the psychometric soundness of the MKAP-CRCS measure for young adult

African American men. Research further investigating the masculine ideals among African American men is warranted, given the paucity of research and the importance of further understanding the relationship between masculinity and early detection screening uptake for CRC among these men [14, 15]. The current findings suggest that the MKAP-CRCS instrument can be used to generate valid and reliable measures within an African American context. However, more psychometric assessments employing more arduous techniques (e.g., exploratory factor analysis, structural equation modeling) are needed.

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Compliance with Ethical Standards

Conflict of interest Dr. Charles Rogers declares he has no conflict of interest. Dr. Patricia Goodson declares she has no conflict of interest. Lastly, Ms. O. Jessica Obidike also declares she has no conflict of interest.

Ethical Approval All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. As aforementioned in the Procedure section, informed consent was obtained from each participant prior to completing the survey.

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