

## Using SAS® to test the Psychometric Properties of Computer-Based Prostate Cancer Screening Decision Aid Acceptance Scale among African-American Men

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### Abstract

Prostate cancer incidence and mortality rates among African-American men are 1.5 and 2.5 times greater than Whites, respectively, in the southeastern United States. Prostate cancer screening could result in early detection and potentially reduce cancer health disparities. This study tested the psychometric properties of the Computer-Based Prostate Cancer Screening Decision Aid and Acceptance Scale (PCDAA). We analyzed baseline data from a purposive sample of 352 African-American men aged 40 years and older who resided in South Carolina. Exploratory factor analysis (EFA) was conducted using maximum likelihood, squared multiple correlation, and Promax rotation. Internal consistency reliability was assessed using Cronbach's alpha. Pearson's correlation assessed the association between factors and subscale items. A Scree plot and item statistics assessed factor loadings. EFA revealed the optimal factor structure of the PCDAA among African American men was a 24-item, 3-factor model. Factor loadings ranged from 0.32 to 0.94 with 11 items loading on Factor 1, 8 items on Factor 2, and 5 items on Factor 3. A negative weak correlation between Factors 1 and 3, a strong positive correlation between Factors 1 and 2, and no correlation between Factors 2 and 3. A positive correlation between factors and the total subscale ranging from .32 to .85. Scale reliability in this study was examined by estimating the Cronbach's alpha. The reliability of each subscale ranged from 0.87 to 0.94 with a total scale reliability of 0.87. The PCDAA is a reliable measure of prostate knowledge, decision self-efficacy, and intention to make an informed decision among African American men.

**Keywords:** SAS, exploratory factor analysis, psychometrics

### Background

Prostate cancer incidence and mortality rates among African-American men are 1.5 and 2.5 times greater than Whites, respectively, in the southeastern United States.<sup>1</sup> Prostate cancer screening could result in early detection and potentially reduce cancer health disparities and mortality. According to the American Urological Association, it is important to make an informed decision about prostate screening.<sup>2</sup> Prior studies indicate that men participating in informed decision making interventions for prostate cancer screening have increased knowledge and higher decision self-efficacy.<sup>3</sup> Computer-based technologies are effective methods for disseminating prostate cancer information to diverse populations including African-American men.<sup>4</sup>

### Purpose

The purpose of this paper is to use SAS® to test the psychometric properties Computer-based Prostate Cancer Screening Decision Aid Acceptance Scale (PCBDAA)<sup>5</sup> among African-American men.

### Methodology

This study analyzed data from a purposive sample of 352 self-identified African-American men aged 40 years and older who were residents of South Carolina. Inclusion criteria were the ability to speak and comprehend English, no personal history of prostate cancer, and no self-reported history of cognitive decline. The PCBDAA was developed using the Unified Theory of Acceptance and Use of Technology.<sup>6</sup> The 24-item scale measures acceptance and use of a technology-based scale on multiple conditions (e.g., how easy is the technology to use). Participants responded using a 5-point Likert scale.

### Data Analysis

Exploratory factor analysis was conducted using squared multiple correlations as prior communality estimates. The maximum likelihood (ML) method was used to extract factors followed by Promax (oblique) rotation. Factor loadings were assessed by the Scree plot, eigenvalues, and proportion of eigenvalues. An eigenvalue greater than one determined if a factor was included in the factor structure. The next phase involved a series of factor rotations. Evaluation of the results of various rotation methods including varimax and promax rotations indicated an optimal structure of three factors. When interpreting the rotated factor pattern, an item was determined to load on a given factor if the factor loading was 0.40 or greater for that factor, and was less than 0.40 for other factors<sup>7</sup>. Internal consistency reliability was assessed using Cronbach's alpha for the total scale and each of three subscales. Pearson's correlation assessed the association between factors and subscale items. Proc Mean and Freq were used to conduct descriptive

statistics. Proc Corr and Factor were used to conduct exploratory factor analysis, compute Cronbach's alpha, and estimate correlations. All data analyses were performed using SAS/STAT® statistical software, version 9.4.<sup>8</sup>

## Results

Table1 displays the frequency distribution of item 1 for the PCBDAA, which indicates that about 93% of participants agree or strongly agree that the computer-based decision aid was useful.

**Table1. Frequency distribution of item1 for PCBDAA**

| PCompBasedfinduseful     |           |         |                      |                    |
|--------------------------|-----------|---------|----------------------|--------------------|
| PCBDAA1                  | Frequency | Percent | Cumulative Frequency | Cumulative Percent |
| <b>Strongly Disagree</b> | 3         | 0.85    | 3                    | 0.85               |
| <b>Disagree</b>          | 3         | 0.85    | 6                    | 1.70               |
| <b>Neither</b>           | 21        | 5.97    | 27                   | 7.67               |
| <b>Agree</b>             | 126       | 35.80   | 153                  | 43.47              |
| <b>Strongly Agree</b>    | 199       | 56.53   | 352                  | 100.00             |
| Frequency Missing = 2    |           |         |                      |                    |

Table 2 report means, standard deviation, minimum, and maximum of PCBDAA items. The results showed the average ranged from 2.2 (PCDBAA 23) to 4.54 (PCDBAA 9).

**Table 2: N, means, standard deviation, minimum, and maximum for PCBDAA items.**

| Variable | Label   | N   | Mean | SD   | Min  | Max  |
|----------|---|-----|------|------|------|------|
| PCBDAA1  | PCompBasedfinduseful                              | 352 | 4.46 | 0.72 | 1.00 | 5.00 |
| PCBDAA2  | PCompBasedinfoquickly                             | 349 | 4.38 | 0.78 | 1.00 | 5.00 |
| PCBDAA3  | PCompBasedincreaseslikelihoodfindinginfo          | 351 | 4.43 | 0.71 | 1.00 | 5.00 |
| PCBDAA4  | PCompBasedincreaseschanceslearningonPC            | 351 | 4.47 | 0.68 | 1.00 | 5.00 |
| PCBDAA5  | PCompBasedinteractionwithCBDAclear                | 351 | 4.45 | 0.69 | 1.00 | 5.00 |
| PCBDAA6  | PCompBasedEasytobeexpert                          | 351 | 4.14 | 0.87 | 1.00 | 5.00 |
| PCBDAA7  | PCompBasedCBDAeasytouse                           | 349 | 4.35 | 0.82 | 1.00 | 5.00 |
| PCBDAA8  | PCompBasedLearningtouseCBDAeasy                   | 349 | 4.35 | 0.85 | 1.00 | 5.00 |
| PCBDAA9  | PCompBasedUsingCBDAgoodidea                       | 351 | 4.54 | 0.67 | 1.00 | 5.00 |
| PCBDAA10 | PCompBasedCBDAPCinteresting                       | 350 | 4.49 | 0.69 | 1.00 | 5.00 |
| PCBDAA11 | PCompBasedCBDAfun                                 | 351 | 4.27 | 0.82 | 1.00 | 5.00 |
| PCBDAA12 | PCompBasedLikeusingCBDA                           | 350 | 4.41 | 0.75 | 1.00 | 5.00 |
| PCBDAA13 | PCompBasedpeoplesupportofuseCBDA                  | 350 | 4.41 | 0.73 | 1.00 | 5.00 |
| PCBDAA14 | PCompBasedknowledge necessary                     | 351 | 4.34 | 0.81 | 1.00 | 5.00 |
| PCBDAA15 | PCompBasedCBDAnotcompatiblewithother              | 349 | 3.31 | 1.30 | 1.00 | 5.00 |
| PCBDAA16 | PCompBasedcancompletewithoutpeoplearoundusingCBDA | 351 | 4.16 | 1.03 | 1.00 | 5.00 |
| PCBDAA17 | PCompBasedcompleteCBDAifIcallforhelp              | 352 | 4.29 | 0.87 | 1.00 | 5.00 |
| PCBDAA18 | PCompBasedcompleteCBDAwithalotof time             | 351 | 4.20 | 0.91 | 1.00 | 5.00 |
| PCBDAA19 | PCompBasedcompleteCBDAreviewinstructionsbyavatar  | 352 | 4.30 | 0.84 | 1.00 | 5.00 |
| PCBDAA20 | PCompBasedfeelnervousaboutusingCBDA               | 352 | 2.38 | 1.33 | 1.00 | 5.00 |
| PCBDAA21 | PCompBasedscarestmetohitwrongkey                  | 351 | 2.39 | 1.34 | 1.00 | 5.00 |
| PCBDAA22 | PCompBasedhesitateCBDA mistakecantcorrect         | 352 | 2.34 | 1.33 | 1.00 | 5.00 |
| PCBDAA23 | PCompBasedsomewhatintimidating                    | 352 | 2.20 | 1.33 | 1.00 | 5.00 |
| PCBDAA24 | PCompBasedIntenduseCBDAinfuture                   | 345 | 4.28 | 0.82 | 1.00 | 5.00 |

Table 3 reports eigenvalues for the PCDBAA scale. Three eigenvalues are above 1 and 93% of the variance was explained by these three factors.

**Table3 Part of Eigenvalues for PCBDAA**

| Preliminary Eigenvalues: Total = 66.7070721<br>Average = 2.77946134 |            |            |            |            |
|---|------------|------------|------------|------------|
|   | Eigenvalue | Difference | Proportion | Cumulative |
| 1   | 41.2324089 | 25.0127050 | 0.6181     | 0.6181     |
| 2   | 16.2197038 | 11.7620409 | 0.2431     | 0.8613     |
| 3   | 4.4576629  | 1.1695876  | 0.0668     | 0.9281     |
| 4   | 3.2880753  | 1.0535851  | 0.0493     | 0.9774     |
| 5   | 2.2344903  | 1.2329772  | 0.0335     | 1.0109     |
| 6   | 1.0015130  | 0.3789205  | 0.0150     | 1.0259     |
| 7   | 0.6225925  | 0.2495025  | 0.0093     | 1.0352     |
| 8   | 0.3730900  | 0.0229063  | 0.0056     | 1.0408     |

Figure 1 displays the scree plot of eigenvalues for the PCDBAA scale, which revealed that two or three factors are meaningful for the PCDBAA scale.

Figure1: Scree Plot of Eigenvalues for PCDBAA Scale

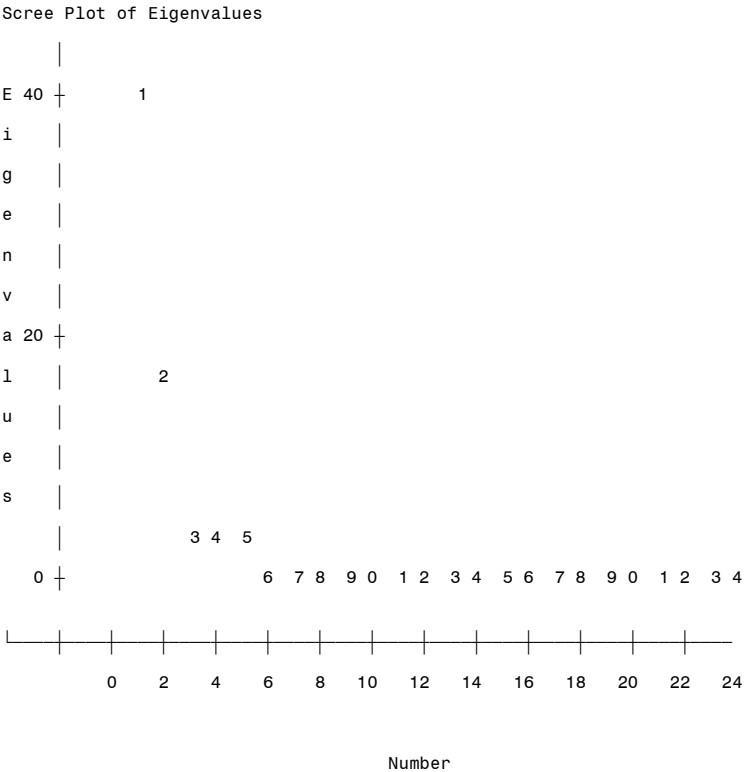


Table 4 reports the Rotated Factor Pattern (Standardized Regression Coefficients) for the PCBDAA. A Scree plot, eigenvalues, and the proportion of variance explained by each factor suggested three meaningful factors for the 24-item scale. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is 0.93 which is acceptable. The residuals are all small and the overall RMSR is 0.049, indicating that the factor structure explains most of the correlations<sup>9</sup>. All 24 items loaded positively on three different factors at 0.32 or above with factor loadings ranging from 0.32 to 0.94. Eleven items loaded for Factor 1, eight on Factor 2, and five on Factor 3.

Table 4. Rotated Factor Pattern (Standardized Regression Coefficients) for the PCBDAA

| Items   | Label   | Factor 1 | Factor 2 | Factor 3 |
|---------|---|----------|----------|----------|
| PCBDA4  | PCompBasedincreaseschanceslearningonPC            | 86       | 3        | 5        |
| PCBDA1  | PCompBasedfinduseful                              | 84       | -1       | -2       |
| PCBDA3  | PCompBasedincreaseslikelihoodfindinginfo          | 80       | 8        | 5        |
| PCBDA2  | PCompBasedinfoquickly                             | 79       | 1        | 5        |
| PCBDA7  | PCompBasedCBDAeasytouse                           | 79       | 9        | -7       |
| PCBDA8  | PCompBasedLearningtouseCBDAeasy                   | 78       | 8        | -10      |
| PCBDA5  | PCompBasedinteractionwithCBDAclear                | 70       | 20       | -1       |
| PCBDA6  | PCompBasedEasytobeexpert                          | 63       | 13       | 2        |
| PCBDA14 | PCompBasedknowledgenecessary                      | 46       | 37       | -8       |
| PCBDA16 | PCompBasedcancompletewithoutpeoplearoundusingCBDA | 41       | 22       | -1       |
| PCBDA19 | PCompBasedcompleteCBDAreviewinstructionsbyavatar  | 32       | 27       | -2       |
| PCBDA11 | PCompBasedCBDAfun                                 | -5       | 89       | 0        |
| PCBDA10 | PCompBasedCBDAPCinteresting                       | -2       | 84       | -6       |
| PCBDA9  | PCompBasedUsingCBDAgoodidea                       | 16       | 65       | -10      |
| PCBDA12 | PCompBasedLikeusingCBDA                           | 31       | 65       | 3        |
| PCBDA13 | PCompBasedpeoplesupportofuseCBDA                  | 28       | 55       | 5        |
| PCBDA18 | PCompBasedcompleteCBDAwithalotoftime              | 16       | 41       | 12       |
| PCBDA24 | PCompBasedIntenduseCBDAinfuture                   | 26       | 40       | 13       |
| PCBDA17 | PCompBasedcompleteCBDAiflcallforhelp              | 24       | 38       | 8        |
| PCBDA22 | PCompBasedhesitateCBDAmistakecantcorrect          | -3       | 3        | 94       |
| PCBDA21 | PCompBasedscaresmetohitwrongkey                   | 3        | -3       | 93       |
| PCBDA23 | PCompBasedsomewhatintimidating                    | -1       | -2       | 92       |
| PCBDA20 | PCompBasedfeelnervousaboutusingCBDA               | -7       | 3        | 86       |
| PCBDA15 | PCompBasedCBDAnotcompatiblewithother              | 19       | 18       | 44       |

Note: Root Mean Square Residual (RMSR) = 0.049 and Kaiser's Measure of Sampling Adequacy = 0.93

Table 5 report means, standard deviation, minimum, and maximum of total scale and subscales of the PCBDAA. The results showed the average of the total scale and each subscale were 94.90, 47.64, 34.68, and 12.58, respectively.

**Table 5: N, Mean, and SD for total scale and subscales of PCDBAA**

| Variable | Label  | N   | Mean  | Std Dev | Min   | Max    |
|----------|--|-----|-------|---------|-------|--------|
| mcbdaf1  | total Computer based decision aid (CBDA) scale/post/ ML/factor 1 | 352 | 47.64 | 7.28    | 11.00 | 55.00  |
| mcbdaf2  | total Computer based decision aid (CBDA) scale/post/ ML/factor 2 | 352 | 34.68 | 5.09    | 6.00  | 40.00  |
| mcbdaf3  | total Computer based decision aid (CBDA) scale/post/ ML/factor 3 | 352 | 12.58 | 5.57    | 4.00  | 25.00  |
| ptcbda   | total Computer based decision aid (CBDA) scale/post              | 352 | 94.90 | 12.24   | 23.00 | 120.00 |

Table 6 reports Pearson correlations for the total scale and three subscales of the PCBDAA. Results indicated a negative weak correlation between Factors 1 and 3, a strong positive correlation between Factors 1 and 2, and no correlation between Factors 2 and 3. Results also revealed a positive correlation between factors and the total subscale ranging from .32 to .85. Scale reliability in this study was examined by estimating the Cronbach's alpha. The reliability of each subscale ranged from 0.87 to 0.94 with a total scale reliability of 0.87.

**Table 6: Pearson correlation for total scale and subscales PCDBAA**

| Pearson Correlation Coefficients, N = 352<br>Prob >  r  under H0: Rho=0            |             |                   |                    |                   |
|--|-------------|-------------------|--------------------|-------------------|
|  | mcbdaf<br>1 | mcbdaf<br>2       | mcbdaf<br>3        | ptcbda            |
| <b>mcbdaf1</b><br>total Computer based decision aid (CBDA) scale/post/ ML/factor 1 | 1.00000     | 0.78496<br><.0001 | -0.16966<br>0.0014 | 0.84398<br><.0001 |
| <b>mcbdaf2</b><br>total Computer based decision aid (CBDA) scale/post/ ML/factor 2 |             | 1.00000           | -0.07995<br>0.1344 | 0.84622<br><.0001 |
| <b>mcbdaf3</b><br>total Computer based decision aid (CBDA) scale/post/ MLfactor 3  |             |                   | 1.00000            | 0.32108<br><.0001 |
| <b>ptcbda</b><br>total Computer based decision aid (CBDA) scale/post               |             |                   |                    | 1.00000           |

**Note: Cronbach's alpha for total scale = 0.87, Factor 1 = 0.94, Factor 2 = 0.88, and Factor 3 = 0.89.**

## Conclusion

We used SAS® to examine the psychometric properties of the PCBDAA among African-American men. EFA revealed a 24-item, 3-factor structure as the optimal factor solution. All 24 items loaded positively on three factors at 0.35 or above with factor loadings ranging from 0.32 to 0.94. Eleven items loaded on Factor 1, eight on Factor 2, and five on Factor 3. There was a negative weak correlation between Factors 1 and 3, a strong positive correlation between Factors 1 and 2, and no correlation between Factors 2 and 3. Results also revealed a positive correlation between factors and the total subscale ranging from .32 to .85. Scale reliability in this study was examined by estimating the Cronbach's alpha. The reliability of each subscale ranged from 0.87 to 0.94 with a total scale reliability of 0.87. The PCDAA is a reliable measure of prostate knowledge, decision self-efficacy, and intention to make an informed decision among African American men.

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## SAS Syntax

### Part of Data steps:

```
data one;
set psa.psadat17;

if maritr=1 then martgb=1;
else if maritr=2 then martgb=2;
else if maritr=3 or maritr=4 or maritr=5 then martgb=2;

label
  martgb ="MArital status"
run;

data two;
set one;
ptcbda = sum (of pcbdaa1 - pcbdaa24);
mcbdaf1 = sum (of pcbda1 pcbda2 pcbda3 pcbda4 pcbda5 pcbda6 pcbda7 pcbda8 pcbda14 pcbda16 pcbda19);
mcbdaf2 = sum (of pcbda9 pcbda10 pcbda11 pcbda12 pcbda13 pcbda17 pcbda18 pcbda24 );
mcbdaf3 = sum (of pcbda15 pcbda20 pcbda21 pcbda22 pcbda23 );
label
ptcbda = " total Computer based decision aid (CBDAA) scale/post"
cbdaf1 = " total Computer based decision aid (CBDAA) scale/post/factor 1"
cbdaf2 = " total Computer based decision aid (CBDAA) scale/post/ factor 2"
cbdaf3 = " total Computer based decision aid (CBDAA) scale/post/ factor 3"
;
run;
```

### Procedures:

```
ods rtf; ods listing close;
proc freq data =one;
tables pcbdaa1 - pcbdaa24
title ' Frequency tables / ' ; title2 ' PSA Study '; run;

%macro avg (q,t);
proc means data=two maxdec=2;
var &q
TITLE 'means / ' &t; title2 ' PSA Study ';run;
%mend avg;
%avg (pcbdaa1-pcbdaa24 , post);
%avg (mcbdaf1 mcbdaf2 mcbdaf3 ptcbda);
run;
ods rtf close; ods listing; quit; run;
```

```
ods rtf; ods listing close;
proc corr data=two;
  var mcbdaf1 mcbdaf2 mcbdaf3 ptcbda;
  title 'correlation coefficient'; title2 'PSA Study '; run;
ods rtf close; ods listing; quit; run;

ods rtf; ods listing close;
%macro corr (q);
proc corr nocorr alpha nomiss data=two; var &q;;
  title 'Reliability coefficient'; title2 'PSA Study ';
%mend corr;
%corr ( pcbda1 - pcbda24);
%corr ( pcbda1 pcbda2 pcbda3 pcbda4 pcbda5 pcbda6 pcbda7 pcbda8 pcbda14 pcbda16 pcbda19);
%corr ( pcbda9 pcbda10 pcbda11 pcbda12 pcbda13 pcbda17 pcbda18 pcbda24 );
%corr ( pcbda15 pcbda20 pcbda21 pcbda22 pcbda23 );run;
ods rtf close; ods listing; quit; run;

ods rtf; ods listing close;
%macro fact (q,n,t);
proc factor data=two method=ml priors=smc scree rotate=promax reorder residual
  flag=.35 nfact=&n msa ;
  var &q ;
  title 'factor analysis ' &t; title2 'PSA Study ';
%mend fact;
%fact (pcbdaa1 - pcbdaa24,3, Computer based decision aid );
run;
ods rtf close; ods listing; quit; run;
```