

1 Research Letter

2 **The Ability of Gender-Related Variables to Predict Functional Capacity and Quality of**
3 **Life in Patients with Coronary Artery Disease at Cardiac Rehabilitation Entry**

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19 **Short Running Title:** Gender-related Variables in Patients Entering CR

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28 **INTRODUCTION**

29 Coronary artery disease (CAD) is a leading cause of death worldwide. There are known

30 differences in the clinical and sociodemographic characteristics of males and females with CAD,

31 such as higher mortality and poorer health-related quality of life (HR-QoL) following a
32 revascularization procedure in females.¹ Sex (i.e., males, females, intersex) is a biological
33 construct, while gender encompasses socially-constructed roles, behaviors and self-expressions.
34 When gender-related variables are included in analyses, post-revascularization sex-differences
35 are often attenuated.² Differences in health status and HR-QoL of patients with CAD may be
36 better explained by considering gender-related variables (e.g., gender-identity, education and
37 marital status) rather than biological sex alone.^{2,3,4}

38
39 At cardiac rehabilitation (CR) entry, patients with CAD who have undergone coronary
40 revascularization procedures frequently demonstrate low functional capacity, levels of physical
41 activity and HR-QoL.⁵ Existing CR research is limited in investigating the independent effects of
42 gender-related variables on functional capacity and HR-QoL. The purpose of this study was to
43 examine the associations between gender-related variables and health-status indicators (i.e.,
44 functional capacity and HR-QoL) at CR entry.

45

46 **MATERIALS AND METHODS**

47 This cross-sectional study presents secondary data analyses of baseline data from a larger trial at
48 the University of Ottawa Heart Institute.⁶ Patients with CAD who underwent a percutaneous
49 coronary intervention (PCI) or coronary artery bypass graft surgery (CABG) within the previous
50 18 weeks were included (REB #20160127-01H).

51

52 **Measures**

53 **Sociodemographic Information:** Age, sex and body mass index (BMI).

54 **Gender-Related Variables:** Marital status, education level, occupation status, ethnicity, and
55 personality traits. Gender-related personality traits were assessed by the Bem Sex-Role Inventory
56 (BSRI), which provides separate masculine and feminine scores.⁷ Participants were asked to
57 indicate the degree to which 60 personality traits described themselves on a 7-item Likert scale
58 (1-never or almost never true, 7-always or almost always true). BSRI masculinity and femininity
59 scores represent how strongly an individual identifies with personality traits that are traditionally
60 ascribed to a male or a female, respectively.

61 **Dependent Variables**

62 Functional capacity was assessed using an average of two 6-minute walk tests (6MWT)
63 measured on an indoor track, within one week, to account for a potential learning effect.

64

65 HR-QoL was measured using the Medical Outcomes Study Short Form-36 (SF-36) version 1.0.⁸
66 The SF-36 yields psychometrically-based Physical Component Summary (PCS) and Mental
67 Component Summary (MCS) scores.

68

69 **Statistical analyses**

70 Pearson's correlations were used to examine the correlation between the independent and
71 dependent variables. Variables with significant correlations ($P < .05$) were included in the linear
72 regression models. These models were used to examine the associations of BSRI masculinity and
73 femininity scores, marital status, education level, occupation status and ethnicity (as gender-
74 related variables), with 6MWT distance and PCS and MCS scores (as health-status indicators) at

75 CR entry. These models were adjusted for sex, revascularization procedure (PCI, CABG), age,
76 and BMI. The same analysis was repeated in males only, as males comprised 84% of the sample.

77

78 **RESULTS**

79 Of the 135 participants in the main trial, a total of 126 (93%) participants completed the BSRI
80 and were included in these secondary data analyses. The characteristics of these 126 participants
81 are presented in Table 1. Time between revascularization and CR entry was longer following
82 CABG than PCI (53 ± 15 vs. 32 ± 16 days, $P<.05$). There were sex-differences in BSRI
83 masculinity and MCS scores ($P<.05$); no other differences were observed. No significant
84 difference was found in the BSRI femininity scores between males and females.

85

86 BSRI femininity ($\beta=-0.229$, $P=.006$) and BMI ($\beta=-0.405$, $P<.001$) were negatively associated
87 with 6MWT distance ($R^2=0.209$). Higher BSRI masculinity ($\beta=0.191$, $P=.033$) values and age
88 ($\beta=0.200$, $P=.022$) predicted lower MCS scores ($R^2=0.148$). Higher BMI ($\beta=-0.214$, $P=-.016$)
89 and a CABG procedure ($\beta=-0.225$, $P=.011$) predicted lower PCS scores ($R^2=0.129$). No other
90 associations were found; sex was not significantly associated with 6MWT distance, PCS or MCS
91 scores.

92

93 In the males only analysis, BMI ($P<.001$, $\beta=-0.402$) and a CABG procedure ($P=.002$, $\beta=-0.281$)
94 were negatively associated with 6MWT distance ($R^2=0.221$). A CABG procedure predicted a
95 lower PCS score ($P=.018$, $\beta=-0.231$; $R^2=0.053$).

96

97 **DISCUSSION**

98 Gender-related variables are important determinants of cardiovascular health in patients with
99 CAD.^{4,5} This study examined the association of gender-related variables (gender-identity from
100 the BSRI, marital status, education, occupation and ethnicity) on functional capacity and HR-
101 QoL at CR entry.

102
103 Our findings demonstrate the importance of considering gender-related constructs, as they are
104 associated with functional capacity and HR-QoL in patients with CAD. The higher BSRI
105 femininity scores were associated with shorter 6MWT distances (i.e., every 1-unit increase in
106 BSRI femininity was associated with 33 meters less distance). This indicates that patients who
107 identify with more feminine personality traits may have a lower functional capacity at CR entry.
108 Such patients may require enhanced care; to address patient needs and allow for more
109 personalized programming, CR programs should be tailored based on patients' gender-identity at
110 CR entry.

111
112 We also showed that BSRI masculinity scores were positively associated with MCS values (i.e.,
113 for every 1-unit increase in BSRI masculinity, a 2.5-unit higher MCS value was observed).
114 Similar findings were reported by Radley et al. in patients post myocardial infarction,
115 demonstrating that BSRI masculinity scores, independent of sex, are associated with better
116 overall health status.³ Our results suggest that BSRI scores can be stronger indicators of the MCS
117 score of the SF-36 than sex, as sex was not significantly associated with functional capacity or
118 HR-QoL at CR entry.

119

120 We did not observe significant sex-differences in BSRI femininity, suggesting that males and
121 females had similar femininity at CR entry. Hunt et al demonstrated that males who identified
122 with feminine characteristics have a decreased risk of death from CAD.⁹ Gender-related
123 characteristics shape an individual; they interact with each other and sex, which can ultimately
124 affect the cardiovascular well-being of individuals.¹⁰

125
126 Limitations of this study include a small sample size and a small number of female participants,
127 but our participants' sociodemographic profile is characteristic and thus generalizable to other
128 cardiac rehabilitation populations.¹¹ Future studies should include patient engagement in the
129 design phase to enhance the diversity and generalizability of findings. Further research is needed
130 to explore the clinical value of considering gender-related variables in females enrolling in CR.
131 A more comprehensive gender measure, such as the GENESIS-PRAXY (which considers
132 variables such as socioeconomic status, household responsibilities and BSRI femininity score)¹⁰
133 may also provide stronger results. In conclusion, gender-related variables are more strongly
134 related to key health-status indicators than sex at CR entry. Consideration of such gender-related
135 variables in future research will improve our understanding of their role in the many sex-
136 differences within CAD – differences that remain insufficiently understood.

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170 Table 1: Participant Characteristics

	Males (n=106, 84.1%)	Females (n=20, 15.9%)	P Value
Age (yr)	61.0 ± 8.0	60.4 ± 9.7	0.837
BSRI masculinity	5.14 ± 0.83*	4.67 ± 0.77	0.020
BSRI femininity	4.84 ± 0.51	5.06 ± 0.64	0.085
Marital status	Single 12.3% Married/Common Law 80.2% Divorced 5.7% Widowed 0.9%	Single 10.0% Married/Common Law 70.0% Divorced 10.0% Widowed 10.0%	0.177
Education level	Grade 10 0.9% Grade 11 2.8% Grade 12/13 10.4% 1 Year U/C 7.5% 2 Years U/C 17.0% 3 Years U/C 15.1% 4 Years U/C 44.3%	Grade 11 10.0% Grade 12/13 10.0% 1 Year U/C 30.0% 3 Years U/C 25.0% 4 Years U/C 25.0%	0.616

Occupation	Unemployed 3.8% Not working with job to return to 10.4% Retired 34.0% Part-time 5.7% Full-Time 42.5% On Disability 2.8 %	Unemployed 5.0% Retired 40.0% Part-time 10.0% Full-Time 45.0%	0.793
Ethnicity	White 80.2% Black 0.9% Aboriginal 1.9% Asian 3.8 % Hispanic 0.9% Other 10.4%	White 90% Asian 5.0% Other 5.0%	0.394
Clinical Characteristics			
Body mass index (kg/m ²)	29.7 ± 5.5	27.4 ± 5.8	0.87
PCI (n)	90 (65.2%)	20 (100%)	<0.001
CABG (n)	35 (33.9%)	0 (0%)	
PCI & CABG (n)	1 (0.9%)	0 (0%)	

6MWT (m)	581.3 ± 73.5	548.8 ± 93.9	0.092
MCS	50.3 ± 10.8*	44.5 ± 10.7	0.032
PCS	41.7 ± 8.1	43.1 ± 9.5	0.514

171

172 ^aValues are presented as mean ± standard deviation for continuous variables and as frequency (proportions) for nominal variables. Abbreviations:
173 CABG, coronary artery bypass graft; MCS, mental component score; m, meters; PCI, percutaneous coronary intervention; PCS, physical
174 component score; U/C, University/College; 6MWT, six-minute walk test.

175 ^bIndependent samples t-test compared to females; **P*<.05 compared to females

176 ^cBSRI Masculinity scores ranged from 2.80 – 6.80 with a higher score denoting greater masculinity

177 ^dBSRI Femininity scores ranged from 3.40 – 6.82 with a higher score denoting greater femininity

178 ^eHigher MCS and PCS scores denote better QoL

179