

7-1-2019

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10.1177/1557988319859706

Occhipinti, S., Laurie, K., Hyde, M. K., Martin, S., Oliffe, J., Wittert, G., & Chambers, S. K. (2019). Measuring masculinity in men with chronic disease. *American Journal of Men's Health*, 13(4), 1-7. Available [here](#)

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American Journal of Men's Health
July-August 2019: 1–7
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DOI: 10.1177/1557988319859706
journals.sagepub.com/home/jmh



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Abstract

The Masculinity in Chronic Disease Inventory (MCD-I) is a new measure of internalized masculine beliefs previously validated in the context of prostate cancer. The present study assessed the validity of the MCD-I in men with other chronic diseases to explore its potential for wider application. A cross-sectional survey of 633 men aged 47–93 years old ($M = 68$ years), of whom 68% reported ≥ 2 chronic conditions, was conducted. Measures included the MCD-I and Erectile Function. Exploratory and confirmatory factor analyses were performed followed by tests for discriminant validity. A five-factor structure was confirmed that explained 60% of the variance, with good to excellent reliabilities ($\alpha = 0.68\text{--}0.93$) for the domains of Optimistic Action, Sexual Importance/Priority, Family Responsibilities, Emotional Self-Reliance, and Strength/Fitness. The MCD-I is a valid measure of internalized masculine beliefs for men with chronic disease that appears sensitive to age and to sexual health. The tailoring of health services for men can be guided by MCD-I outcomes to ensure gender-sensitized men's health interventions.

Keywords

masculinity, chronic disease, men's health, sexual health

Received January 22, 2019; revised May 15, 2019; accepted May 18, 2019

Approaches to the measurement of masculinity encompass a range from the proposing prescriptive and proscriptive social norms that are distinct from gender identity (Thompson, Pleck, & Ferrera, 1992) to a normative perspective where cultural traditions and social practices are seen as shaping and shaped by socially constructed masculinities and gender ideals (Connell & Messerschmidt, 2005). Extending this narrative, Thompson and Bennett (2015) suggested that once internalized, these gender ideals become individualized belief systems about masculinity, that is masculine beliefs. The importance for men's health, then, is that these belief systems may help or hinder men's health-promoting practices, wherein accurately mapping men's health and illness behaviors with valid and responsive measurement is crucial (Luyt, 2015).

In terms of health, chronic disease in particular is known to be associated with masculinity, wherein societal constructions of masculinity can hinder health behaviors but in turn, chronic disease can impinge negatively on personal perceptions of masculinity (Zanchetta et al., 2017). Until the work of Chambers et al. (2016),

who developed the Masculinity in Chronic Disease Inventory (MCD-I), no validated measures existed that tapped into internalized masculine beliefs applicable to

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researching chronic diseases. Importantly, the MCD-I was derived from a specific qualitative examination of men's self-reported experiences of prostate cancer, thereby ensuring the items and constructs within the scale were relevant to the health, cultural, and social context of these men. Emergent scale domains included Strength, Sexual Importance/Priority, Emotional Self-Reliance, Optimistic Capacity, Family Responsibilities and Action Approach. Further, these domains fit well within the theoretical lens of socially constructed masculinities. In this germinal study, the MCD-I demonstrated good convergent, divergent, and discriminant validity, with excellent reliabilities.

However, as this instrument was developed and tested with a population of men who had been diagnosed with prostate cancer, it is important to broaden the scope of the measure to access conceptions of masculinity that are not tied to a single diagnostic group. For example, Chan and Corvin (2016) conducted a qualitative investigation finding links between masculinity, depression, and chronic diseases such as cardiovascular disease, diabetes, and hypertension, finding a complex interplay of contextual factors. Of particular interest in a broader chronic disease population is the role of sexual identity in masculinity. Sexual Importance/Priority emerged as a separate factor in the sample of Chambers et al. (2016), and this is consonant with the elevated potential for erectile dysfunction in prostate cancer treatment. Yet sexual difficulties and in particular erectile dysfunction are associated with a variety of chronic conditions in men (e.g., Sutsunbuloglu and Vural, 2018). Many different factors have been shown to affect men's conceptions of erectile dysfunction and also the role of sexual difficulties in constraining, or not, conceptions of masculinity (Thompson and Barnes, 2013; Wentzell, 2014). It is necessary to examine both the nature of sexual importance and its association with erectile dysfunction in contexts beyond that of prostate cancer.

Accordingly, to further assess the utility of the MCD-I, the present study addresses the validity of the instrument in a large sample of men with a wide range of chronic diseases. Although it could be expected that a similar factor structure would emerge as for the original prostate sample, the present study included both exploratory and confirmatory analyses to allow the most appropriate structure for the broader population. With this approach, the MCD-I items were not constrained to the structure determined by previous empirical analyses but rather the factor structure was determined directly by initial analyses with the present population. Validation techniques were included to mitigate against overfitting and sample-specific associations. In view of the centrality of erectile dysfunction, the ability of the instrument to discriminate with respect to this variable was assessed.

Method

Participants and Procedure

Data for the present study were drawn from the Florey Adelaide Male Ageing Study (FAMAS), a prospective cohort of randomly-selected, community-dwelling middle-aged to elderly men, extensively characterized, including information on chronic disease status. Details of the broader study are reported elsewhere (Martin, Haren, Middleton, & Wittert, 2007). Written informed consent was obtained by all participants. Ethical approval for the study was obtained from the Royal Adelaide Hospital Research Ethics committee and, where appropriate, the Aboriginal Health Research Ethics Committee of South Australia (protocol number 020305). The project is currently funded by NHMRC project grants (#1122342; #627227), with previous funding from the South Australian Premier's Science and Research Fund and The University of Adelaide's Florey Foundation. Data collected through the 2015 annual follow-up survey for 633 men were utilized (response rate: 68.7% of eligible participants).

Measures

MCD-I. The 22-item MCD-I was administered to all participants. Participants indicated on a 5-point Likert type scale how true each of the statements were for them, from 1 = *not true at all* to 5 = *very true*. The scale included six subscales representing different aspects of masculinity: Strength (five items), Sexual Importance/Priority (four items), Family Responsibilities (four items), Emotional Self-Reliance (two items), Optimistic Capacity (four items), and Action Approach (three items). Higher subscales scores and total scores indicated stronger respondent endorsement of these masculine ideals.

Erectile function. Erectile function was measured with a single self-report item: "Impotence means being unable to get and keep an erection that is rigid enough for satisfactory sexual activity. How would you describe yourself?" Participants answered on a scale of 1 to 5, from 1 = *always able to get and keep an erection good enough for sexual intercourse* to 4 = *never able to get and keep an erection good enough for sexual intercourse* (men who preferred not to answer could respond with 5 = *refused to answer*).

Covariate data. Men reported their age, relationship and family status, sexuality, education, employment status, and presence of chronic disease. Chronic disease status was collected as the patient's recall of having ever been diagnosed by a physician (i.e., Have you ever been told

by a doctor that you have any of the following conditions?) with any of the conditions presented in a list. Body mass index (BMI) was collected through a previous clinic visit.

Statistical Analysis

The structure of the MCDI was examined using a two-part strategy. As the model was to be assessed in a new population to that in which it was developed, the sample was split randomly into two equal subsamples. Model development was conducted on one subsample and then assessed via confirmatory techniques in the other. First, exploratory factor analysis (EFA) via a minimum residual approach with promax rotation was used to examine the possible factor structure in one half of the sample. The potential number of factors was examined with Velicer's Minimum Average Partial (MAP; Velicer, 1976). Second, confirmatory factor analysis (CFA) was used to test the fit of the suggested covariance structure in the second, hold-out sample. Estimation was by robust maximum likelihood in order to reduce the effects of the severe skew present in the data. As recommended by contemporary methodologists (Hu & Bentler, 1999; Kline, 2015), fit was assessed with the robust variants of chi-square, root mean square error of approximation (RMSEA), comparative fit index (CFI), and standardized root mean square residual (SRMR). EFA was conducted using tools in the psych package (Revelle, 2018) and CFA analyses were conducted using the lavaan package (Rosseel, 2012).

Internal consistency reliability for each scale was assessed with Cronbach's α . Discriminant validity was assessed using Pearson's r . Of the 633 men whose responses were available, 11 had missed all 22 items of the MCD-I and were dropped from further analyses. The EFA was conducted with the 278 men in the first subsample who had completed all MCD-I items. The CFAs were conducted with the 311 men in the second subsample who had provided some responses on the MCD-I. For erectile function, refusal to answer was treated as a missing response. All correlation analyses were conducted with all available participants. All analyses were conducted with R 3.5.1. Statistical significance was taken as $\alpha = 0.05$.

Results

Participants

Participants ages ranged from 47 to 93 years old ($M = 68$, $SD = 10$). The majority of the participants were exclusively heterosexual ($n = 501$, 81%), married or in a de facto relationship ($n = 498$, 80%), and had children ($n = 480$, 77%). Most of the men had a high school

education, apprentice or university qualifications ($n = 427$, 69%) and indicated they were retired at the time of the questionnaire ($n = 314$, 51%; see Table 1). A large proportion of the participants were overweight ($n = 267$, 43%) or obese ($n = 199$, 32%; class 1–3). Most men had comorbid chronic conditions, with 68% ($n = 422$) indicating they had two or more chronic conditions, the most commonly reported being: hypertension ($n = 301$, 48%), hypercholesterolemia ($n = 250$, 40%), osteoarthritis ($n = 171$, 28%), enlarged prostate/benign prostatic hyperplasia ($n = 118$, 19%), and diabetes ($n = 97$, 16%). Twenty-three percent of participants indicated they had been diagnosed with one or more cancers, the most common diagnoses were skin cancer or melanoma ($n = 111$, 18%) and prostate cancer ($n = 47$, 8%; see Table 2).

Exploratory Factor Analysis

Inspection of the MAP plots suggested that between four and five factors may have been present in the data. Although these were fewer than the six factors observed by Chambers et al. (2016), both solutions were examined further. The five-factor solution (see Table 3) accounted for 57% of the variance. The factors were named Optimistic Action, Sexual Importance/Priority, Family Responsibilities, Emotional Self-Reliance, and Strength/Fitness. The five-factor solution was identical to the four-factor solution except for the Strength/Fitness factor that was composed of three items that were the only ones that did not load on any factors in the four-factor solution. This solution is similar to that reported by Chambers et al. (2016) in that the Sexual Importance/Priority, Family Responsibilities, and Emotional Self-Reliance factors are composed of the same items in each analysis, and Strength/Fitness included three of the items from the previous Strength factor. The novel Optimistic Action factor was composed of highest loading items such as: "I am a positive person" (item 12); "I have a forward thinking mindset" (item 16); and "My approach is to get on with things" (item 21). As presented in Table 3, the items on this factor consist equally of items indicating both an optimistic stance and an orientation towards action. The five factors were correlated with each other but not excessively so, with correlations ranging from 0.1 to 0.53 (see Table 4).

Confirmatory Factor Analysis

The five-factor model was submitted to a CFA on the responses of the 311 men in the second, holdout subsample. Initial inspection of fit indices suggested the model did not fit according to conventional criteria (Hu & Bentler, 1999; Kline, 2015). $\chi^2(199) = 520.63$, $p < .001$; robust RMSEA = .08 (LO90 = 0.070; HI90 = 0.087); robust CFI = .90; robust SRMR = .06. Inspection of

Table 1. Sociodemographic Characteristics of Participants (N = 622).

Characteristic	n (%)
Age (years)	
M (SD)	67.35 (10.05)
Range	47–93
Education	
Formal schooling not completed	13 (2.1%)
Completed primary school	146 (23.5%)
Completed high school	71 (11.4%)
Trade or technical certificate or diploma	267 (42.9%)
University degree	89 (14.3%)
Other	22 (3.5%)
Missing	14 (2.3%)
Employment	
Employed full-time or self-employed	227 (36.5%)
Employed part-time or casual	48 (7.7%)
Full-time home duties or home career	6 (1%)
Unemployed or looking for work	3 (.5%)
Retired	314 (50.5%)
Student or volunteering	8 (1.3%)
Permanently ill/disabled/unable to work	4 (.6%)
Other	9 (1.4%)
Missing	3 (.5%)
Income	
<\$20,000	61 (9.8%)
\$20,000–less than \$40,000	149 (24%)
\$40,000–less than \$60,000	99 (15.9%)
\$60,000–less than \$80,000	76 (12.2%)
\$80,000+	163 (26.2%)
Don't know	26 (4.2%)
Marital status	
Married or de facto	498 (80.1%)
Divorced or separated	58 (9.3%)
Widowed	25 (4.0%)
Never married	24 (3.9%)
Missing	17 (2.7%)
Children	
One or more children	480 (77.2%)
No children	79 (12.7%)
Sexual orientation	
Heterosexual	501 (80.5%)
Homosexual	5 (.8%)
Bisexual	9 (1.4%)
Rather not say	12 (1.9%)
Missing	57 (9.2%)
Ethnicity	
Caucasian	533 (85.7%)
Asian	3 (.5%)
European	3 (.5%)
Aboriginal	1 (.2%)
Anglo-Indian	2 (.3%)
Missing	9 (1.4%)

Table 2. Medical Characteristics of Participants (N = 622).

Characteristic	n (%)
Weight Class ^a	
Underweight	1 (.2%)
Normal weight	90 (14.5%)
Overweight	267 (42.9%)
Class 1 obesity	144 (23.2%)
Class 2 obesity	44 (7.1%)
Class 3 obesity	11 (1.8%)
Missing	65 (10.5%)
Comorbidity	
One condition	169 (27.2%)
Two or more	422 (67.8%)
Cancer	
Skin cancer	78 (12.5%)
Melanoma	33 (5.3%)
Bladder cancer	10 (1.6%)
Prostate cancer	47 (7.6%)
Bowel cancer	16 (2.6%)
Kidney cancer	4 (.6%)
Lung cancer	4 (.6%)
Non-Hodgkin's lymphoma	3 (.5%)
Pancreatic cancer	1 (.2%)
Other	15 (2.4%)
Health condition	
Heart attack	57 (9.2%)
Stroke	19 (3.1%)
Angina	54 (8.7%)
Transient ischemic attack	15 (2.4%)
Atrial fibrillation	40 (6.4%)
Kidney disease	23 (3.7%)
Hypertension	301 (48.4%)
Hypercholesterolemia	250 (40.2%)
Smoking-related lung condition	27 (4.3%)
Parkinson's disease	6 (1%)
Asthma	78 (12.5%)
Enlarged prostate/benign prostatic hyperplasia	118 (19%)
Diabetes	97 (15.6%)
Hyper/hypothyroidism	14 (2.2%)
Osteoarthritis	171 (27.5%)
Osteoporosis	27 (4.3%)
Gout	85 (13.7%)
Anxiety	41 (6.6%)
Depression	42 (6.8%)
Insomnia	18 (2.9%)
A stress-related condition	36 (5.8%)
None of the above	27 (4.3%)
Don't know	6 (1%)

Note. ^aClassified by BMI: underweight, below 18.49; normal weight, 18.5–24.9; overweight, 25–29.9; Class 1 obesity, 30–34.9; Class 2 obesity, 35–39.9; Class 3 obesity, 40 or above.

residuals and modification indices suggested that the model did not account for a large number of associations

Table 3. Five-Factor Solution for MCD-I EFA ($N = 278$) and CFA ($N = 311$).

Item (Item#)	α	EFA factor loadings	CFA factor loadings
Optimistic Action	0.88		
I am a positive person (12)		0.88	0.72
I have a forward thinking mind-set (16)		0.73	0.81
My approach is to get on with things (21)		0.73	0.78
I am optimistic about the future (19)		0.69	0.71
If I want to achieve something I can (10)		0.69	0.71
I like to take action in the face of problems (6)		0.63	0.63
I always look for the good in situations (3)		0.53	0.54
I am a fighter (9)		0.50	0.60
I am a competitive person (20)		0.45	0.57
Sexual Priority/Importance	0.93		
Being able to have an erection is important to me (5)		0.96	0.92
Being physically able to have sex is important to me (2)		0.89	0.89
I like to know I am capable of having sex (11)		0.88	0.93
Being able to have sex is like being able to run (17)		0.69	0.82
Family Responsibilities	0.89		
It's up to me to protect my partner or family (22)		0.86	0.89
Being able to provide for my partner or family is important to me (18)		0.88	0.85
I need to provide financial security for my partner or family (14)		0.81	0.84
I like to know I am looking after my partner or family (7)		0.62	0.77
Emotional Self-Reliance	0.68		
I keep my feelings to myself (4)		0.75	0.51
I tend not to talk about my worries (13)		0.83	0.84
Strength/Fitness	0.74		
Having a good level of fitness is important to me (8)		0.85	0.78
Being an active person is important to me (15)		0.60	0.85
Being physically strong is important to me (1)		0.54	0.56

Note. MCD-I = Masculinity in Chronic Disease Inventory, EFA = exploratory factor analysis, CFA = confirmatory factor analysis.

Table 4. Correlations Between MCD-I Subscales and Total Scale ($N = 622$).

Subscales	1	2	3	4	5	M	SD
Optimistic Action	–					3.71	0.74
Sexual Importance/Priority	0.30***	–				3.37	1.24
Family Responsibilities	0.51***	0.27***	–			4.25	0.91
Emotional Self-Reliance	0.22***	0.10*	0.18***	–		3.47	1.00
Strength/Fitness	0.53***	0.44***	0.42***	0.13**	–	3.71	0.86
Total Scale	0.84***	0.67***	0.69***	0.33***	0.72***	3.74	0.62

Note. MCD-I = Masculinity in Chronic Disease Inventory.

*** $p < .001$. ** $p < .01$. * $p < .05$.

between items within factors. It was deemed that such residuals represented method variance shared between items tapping into similar domains. Error correlations were unconstrained only between within-factor item pairs with large residuals. These were between items: 18 and 14; 7 and 22; 7 and 14; 18 and 22; 12 and 3; 21 and 3; 12 and 19; 10 and 9; 19 and 9 (see Table 3). The resulting model showed excellent fit: $\chi^2(190) = 326.27$; robust RMSEA = .052 (LO90 = 0.042; HI90 = 0.061); robust

CFI = .96; robust SRMR = 0.05. Standardized loadings for this analysis are also presented in Table 3.

Discriminant Validity

Correlation analysis showed that the five-factor model discriminated between men on the basis of erectile dysfunction and age. Optimistic Action ($r = -.16, p < .001$), Sexual Importance/Priority ($r = -.52, p < .001$), and

Strength/Fitness ($r = -.18, p < .001$) all discriminated between men with increasing levels of self-reported erectile dysfunction. Similarly, Sexual Importance/Priority ($r = -.46, p < .001$), and Strength/Fitness ($r = -.10, p = .012$) both discriminated between older and younger men. Older men and men with self-reported erectile dysfunction had lower masculinity scores on the MCD-I.

Discussion

The present study demonstrates the efficacy and relevance of the MCD-I as an important measure of masculinity for men with chronic disease. The close similarity between the factor structure identified in this study compared to that reported previously by Chambers et al. (2016) shows how sexual well-being, family relationships, physical strength and activity, and an active and optimistic approach to life appear central to masculine identity for men experiencing chronic disease. From this, it can be concluded that this measure is suitable for wider application applying the revised five-factor model. In line with recommendations by Thompson and Bennett (2015), the MCD-I offers a validated tool by which to collect empirical evidence about the connections between masculinities and chronic disease. As Oliffe et al. (2019) affirmed, consistent use of validated end-user informed masculinity measures is key to bridging qualitative and quantitative approaches as well as transitioning descriptive study findings to inform the design and formal evaluation of gender-sensitized men's interventions and services. Further, in light of men's increasing life expectancy in Western countries, and the likelihood of men's chronic disease rates growing in step with this trend, there is an ever-pressing need to describe and attend to the gendered dimensions of men's illness (and health).

Limitations of this research include the cross-sectional study design; however the diverse participant population in terms of chronic disease is a strength. There remains a need to examine and compare the measurement of masculinity in young men who experience chronic disease (i.e., hemophilia, Crohn's, epilepsy) as well as sexual minority men (i.e., gay, bisexual) to gain clarity around what aspects of masculinity intersect with chronic disease in these subgroups. In addition, an important area of future research is to examine how masculinity, as measured by the MCD-I, relates to health outcomes and health-promoting practices as a means to informing the design and evaluation of gender-sensitized interventions targeting men in the context of chronic disease. For example, an instrument such as the MCD-I that assesses masculinity as a multidimensional construct can allow researchers to assess the role of masculinity in moderating the effectiveness of interventions with men a priori

and on a sound theoretical basis, rather than addressing post-hoc justifications for unexpected results. This would be consistent with the work of Thompson and Barnes (2013) who reported marked differences in conceptions of sexual performance between men with and without erectile dysfunction. In addition, a clearer understanding of masculinity scores could aid in targeting important health messages, such as those endorsing self-care behaviors, to men with chronic illness. Men reporting high Emotional Self-Reliance and men reporting high Family Responsibilities scores might respond more positively to differently framed persuasive health messages.

In conclusion, the MCD-I is a valid measure of internalized masculine beliefs for men with chronic disease that is sensitive to age and to sexual health. The tailoring of health services for men in connection to these masculine beliefs is a priority.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The research described in this article received support from NHMRC project grant #627227 to Gary Wittert.

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