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## Sexual Function, Anxiety, Depression and Coping After Myocardial Infarction: An Exploratory Study

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### Abstract

**Background:** Myocardial infarction (MI) may decrease sexual function and satisfaction in men and can be influenced by anxiety, depression, and sexual fear. However, few studies have examined short-term changes in sexual function over time in a post-MI population. This study aimed to longitudinally describe changes in sexual function and satisfaction in a sample of men post-MI.

**Methods:** Eighteen patients were recruited from a Midwestern hospital. Surveys were mailed two weeks and three months post discharge. Sexual function was measured with the Male Sexual Function Index. Other variables collected included sexual fear (Multidimensional Sexuality Questionnaire), anxiety and depressive symptoms (Patient-Reported Outcomes Measurement Information System Anxiety and Depression 4a), and use of coping strategies (Coping Strategy Indicator).

**Results:** Sexual function scores increased in the entire sample from 8.9 (SD 7.3) at two weeks to 14.6 (SD 8.9) at three months (18.8% improvement,  $p=0.04$ ). Men who were sexually active improved their scores by 27.3% ( $p=0.01$ ), while those who were not sexually active decreased their scores by 2.3% ( $p=0.5$ ). Depressive symptoms and anxiety scores were low and largely stable across timepoints, though there were some improvements among men who were sexually

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**Conflicts of interest/Competing interests** None.

**Ethics approval** This study was approved by the local institutional review board and was conducted in an ethical manner according to the declaration of Helsinki. Appropriate permissions were obtained for all instruments used in this study.

**Consent to participate** All patients signed informed consent before participating in this study.

**Consent for publication** All patients who participated in this study gave consent for publication.

**Availability of data and material** Data will be made available upon request.

**Code availability** Not applicable.

active compared to those who were not. Decreased utilization of avoidance coping strategies was reported in sexually active versus inactive men.

**Conclusion:** While sexual function improved within a short-time period post discharge among sexually active men post-MI, further research is needed with a larger sample to understand these changes across a longer period. Additional research is also warranted to examine any potential influence of psychosocial predictors.

### Keywords

Sexual health; sexual dysfunction; physiological; myocardial infarction; United States

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## Background

Myocardial infarction (MI) remains a notable acute exacerbation of chronic cardiovascular disease in the United States due to its high prevalence rates and negative effects on patient health. Approximately 470,000 men in the U.S. were hospitalized for either a new or recurrent MI between 2005 and 2014 [1]. These incidence rates have produced a substantial population of 5.1 million adult male survivors [1]. Both first time and recurrent MIs introduce new challenges for patients. The pathophysiological ramifications of MI increase activity intolerance, anxiety, depressive symptoms, and increase the probability of a recurrent MI [2,3]. Although improvements in medical management have reduced mortality and readmission rates, other issues like sexual dysfunction often remain unaddressed. [4–6]. Sexual function in men consists of four main phases including excitement, plateau, orgasm, and resolution [7]. Sexual dysfunction in men post-MI is therefore thought to be caused by decreased blood flow to sex organs following cardiac injury [3]. In addition to sexual function, sexual satisfaction pertains to an individual's appraisal of the contentedness of their sexual relationship including physical and emotional satisfaction [8].

Some cross-sectional research has evaluated sexual function post-MI [9, 10]. Symptoms in men include erectile and orgasmic dysfunction, decreased sexual desire, and decreased satisfaction with intercourse [11, 12]. While cross-sectional studies have measured sexual function post-MI, few studies provide a complete representation of sexual function and satisfaction longitudinally, particularly within a short-term period post discharge. A review of the literature using PubMed, CINAHL, PsycINFO, Scopus, and the Cochrane Database of Systematic Reviews from 2005 to 2020 using sexual function and MI terms found only one longitudinal study that focused primarily on sexual activity and presence of a functional problem, while dysfunctional severity and satisfaction were neglected [13]. While this previously published article described a landmark study measuring sexual function in this population, sexual function outcomes were only reported at 1-year post-MI, and was limited to adults age 18–55 years, which represents only 20% of all post-MI patients. As such, knowledge of short-term outcomes among adults aged greater than 55 years remains unknown.

In addition to the pathophysiologic effects of MI, depressive symptoms and anxiety are often associated with decreased sexual function and satisfaction. Chest pain during sexual activity can increase sexual fear and decrease overall desire for intercourse [14–16]. This fear of

sexual activity combined with anxiety and depression - commonly observed in patients after MI - can negatively influence sexual function and satisfaction [2]. A previous cross-sectional cohort study of 493 patients found that depressive symptoms significantly influenced the relationship between sexual function and quality of life [3]. In another cohort study of 64 patients, sexual satisfaction was negatively related to anxiety, and sexual satisfaction accounted for 42% of the variance in anxiety scores [17]. These negative psychological symptoms can ultimately cause patients to adapt additional coping strategies. A previous study of 121 men post-MI found a mediating effect of emotion-focused coping on negative emotions and general well-being, which may also be linked to issues of sexual function and health related quality of life [18].

### Significance

Focusing only on sexual activity and presence of dysfunction at one year post-event without also exploring short-term changes limits effective prescription of the support patients need to improve sexual function (sexual aids) and overall sexual confidence (counseling). Comprehensive descriptive studies in other chronic conditions, including diabetes and cancer, suggest the need for additional longitudinal research examining short-term sexual dysfunction and satisfaction changes in post-MI patients [19, 20]. Therefore, the purpose of this study was to examine changes in sexual function and satisfaction as well as anxiety, depressive symptoms, sexual fear, and utilization of coping strategies over time in a cohort of men post-MI, and to also compare changes in sexual function by sexual activity status.

### Methods

An observational cohort design was used to achieve study aims. Two weeks and three months post discharge for MI were selected to build a comprehensive and multidimensional short-term trajectory of dysfunctional symptoms. This study was approved by the local Institutional Review Board (IRB) at the health system of recruitment. All patients completed informed consent before participation in the study. Once consented, patients were mailed questionnaires the day following discharge from the hospital. A follow up phone call was made with participants before two weeks and three months to remind them of study requirements and answer potential questions.

### Sample

Ninety-nine of 395-screened men and women were approached while hospitalized for an MI at one Midwestern university hospital. This study details the results of the men recruited from this sample of 99, as there were not enough women to analyze longitudinally ( $n=3$ ). The inclusion criteria were patients admitted to the hospital with an MI who could read and write English. Diagnosis of MI was confirmed using chart review in addition to a troponin T value exceeding the 99<sup>th</sup> percentile of a normal reference population ( $>18$  ng/mL) [21]. The exclusion criteria were pertinent comorbidities potentially impacting sexual health (prostate cancer, COPD, or HIV infection), patients being treated for suicidal ideation or acute alcohol withdrawal, or those with a life expectancy of less than one year.

## Measures

The dependent variables of sexual function and satisfaction were evaluated using a well-validated self-report instrument, the Male Sexual Function Index (MSFI) [22]. The MSFI was derived from the Female Sexual Function Index [23], which is considered the gold standard in sexual function measurement. The subscales of this measure include desire, arousal, erection, orgasm, and satisfaction. The Cronbach's alphas for each subscale are 0.85, 0.82, 0.76, 0.66 and 0.82, respectively [24]. The total score range for the MSFI is 2–30, with higher scores indicating better sexual function. While being sexually active was not a requirement to participate in this study, a participant's sexual activity status does influence scoring on the arousal, erection, and orgasm subscales (i.e. patients are scored a 0 for no activity).

Several key variables related to sexual function were measured using validated instruments including sexual fear, anxiety, depressive symptoms, and coping strategies. Sexual fear - defined as “fear of engaging sexually with an individual” - was measured using the sexual fear subscale of the Multidimensional Sexuality Questionnaire (MSQ) [25]. The sexual fear subscale ranges from 0–20, with higher scores indicating more sexual fear. The Cronbach's alpha of the sexual fear subscale is 0.82 [25]. Anxiety and depressive symptoms were measured with the Patient-Reported Outcomes Measurement Information System (PROMIS) - Anxiety and Depression Short Form 4a [26]. Both measurements range from 0–20, with higher scores indicating worse anxiety or worse depressive symptoms. The Cronbach's alpha is 0.89 for the Anxiety Short Form and 0.93 for the Depression Short Form [26]. Lastly, utilization of coping strategies was measured with the Coping Strategy Indicator (CSI). The CSI consists of three subscales: two representing positive coping strategies (seeking support, problem solving), and one representing negative coping strategies (avoidance) [27]. Each subscale is scored from 11–33, with a higher score indicating an increased use of that coping strategy. The Cronbach's alphas for these subscales range from 0.84 to 0.93 [27].

Demographic variables including employment, marital status, cardiac rehabilitation status, and education were collected using a demographic survey. Left ventricular ejection fraction (LVEF) percentages were used to determine basic cardiac function. Type of MI (occlusion vs. demand ischemia), ST or non-ST segment elevated (STEMI/NSTEMI), and troponin T levels were collected to assess for MI severity. These clinical variables were obtained from the medical record.

## Statistical Analyses

All analyses in this study were performed using SAS version 9.4 (SAS Institute, Cary, NC). MSFI scores were summarized as frequencies, means (SD), and ranges at each timepoint. The continuous subscales of desire, arousal, erection, orgasm, and satisfaction scores on the MSFI were compared from two weeks to three months. Univariate statistics were applied to check the normality of the data. Scores were not normally distributed at the first timepoint, so Wilcoxon signed rank tests were used. Depressive symptoms, anxiety, use of coping strategies, and sexual fear were normally distributed allowing use of t-tests to examine mean changes. Some data were missing among the satisfaction subscales for four participants for

questions pertaining to partnered sexual activity, so the satisfaction subscale and total score changes were calculated with these participants removed. Given that these missing data were from unpartnered individuals and therefore less likely to be missing at random, multiple imputation was not conducted [28].

Subgroup analyses were conducted to assess for differences among those who were sexually inactive at three months compared to those who either became or were always active. Individual MSFI item responses were also examined to assess for clinical significance by determining what percentage of patients reported slight, moderate, or no difficulties with a particular aspect of sexual function. T-score transformation of the PROMIS measurements were also calculated to assess for clinical significance. These t-scores were based on established cut points among a sample of adults with a mean age of 59.3 years [29]. Percent changes were calculated as a change of the total possible score of a measurement or subscale, rather than the change over the first timepoint. A statistical significance level of 0.05 was adopted.

## Results

While 52 men consented, only 18 returned all survey materials (final completion rate=34.6%). Primary reasons for attrition were a loss to follow up (55.7%), while 7.7% withdrew, and 3.8% were either ineligible or deceased. The study sample ( $N=18$ ) included 17 White men and 1 Native American man. The mean age of the sample was  $60.5 \pm 13.6$  years. Participants were primarily married (61.1%), employed (50%), and at minimum college educated (50%). Cardiac function was below a normal LVEF (48.5%) compared to a normal range of 55–70%. Primary diagnosis was NSTEMI (61.1%) and average peak troponin T was 1081.9 ng/mL. Additional clinical and sociodemographic characteristics are presented in table 1.

Average sexual function scores at two weeks increased from 8.9 (SD 7.3, median 5.35, range 3.6–26.2) to 14.6 (SD 8.9, median 12.45, range 3.8–30) at three months. Sexual function scores improved in two thirds of the sample, with an average improvement of 18.8% (range 1–68%,  $p=0.04$ ). The largest percent change among the subscales were erection (27.8%,  $p=0.01$ ), and orgasm (25.9%,  $p=0.04$ ). In contrast, desire only improved by 8.9% ( $p=0.06$ ). At three months, 50% of the sample reported at least moderate sexual desire (improved from 38.9%), 38.9% reported at least moderate sexual arousal (improved from 22%), 50% reported either slight or no difficulties with erection or orgasm (improved from 16.7%), and 38.9% were at least equally satisfied and dissatisfied with their overall sex life (improved from 33.3%). Table 2 presents the total and subscale scores of the MSFI and covariates among the entire sample, and these are visualized in figure 1.

The proportion of men who were active at two weeks and three months were calculated. Only 5 men were sexually active at two weeks post-discharge. Among the 13 who were sexually inactive at two weeks, 8 became sexually active by the second timepoint. The remaining 5 men were not active at either timepoint. Participants who were sexually active were not statistically different compared to those who were inactive in terms of age, (active: 60.2 years, inactive: 61.2 years,  $p=0.91$ ), LVEF (active: 46.3%, inactive: 54.8%,  $p=0.35$ ), or

marital status ( $p=0.59$ ). Those who were sexually active had higher troponin levels, though the difference was not statistically significant (active: 1285.5 ng/mL, inactive: 471.3 ng/mL,  $p=0.91$ ). Interestingly, a larger proportion of men who were sexually active were diagnosed with an ST-segment elevated MI (STEMI) ( $p=0.03$ ).

Score changes on the MSFI were also examined by sexual status. Men post-MI who were sexually active at three months improved their total scores by 27.3% ( $p=0.01$ ), while those who were not sexually active decreased their total scores by 2.3% ( $p=0.5$ ). All men who became sexually active at three months had higher total scores on the MSFI over time, with the largest improvement being 68%. The largest changes among those who were sexually active were erection (38.8%,  $p=0.003$ ) and orgasm (35.9%,  $p=0.04$ ), followed by arousal (27.9%,  $p=0.04$ ), satisfaction (15.3%,  $p=0.18$ ) then desire (12.3%,  $p=0.06$ ). Subscale scores in participants who were not sexually active only averaged a 2% net change. Among inactive men, the arousal subscale scores were the same across both timepoints (1.9, possible score 0–6). Unsurprisingly, orgasm scores were zero across both data points. Table 3 shows sexual function scores by sexual activity status.

Scores on the PROMIS measurements indicated a lack of anxiety and depressive symptoms in this sample. Despite the low overall scores, some changes were observed among the t-score transformations. At two weeks, t-scores for 50% of participants were within normal limits for depressive symptoms, while 38.9% were in the mild range, and 11.1% were in the moderate range. The percentage of participants with depressive symptoms t-scores within normal limits increased to 55.6% at three months, while t-scores for those with mild symptoms decreased to 22.2%, and t-scores for those with moderate symptoms increased to 22.2%. When examining anxiety t-scores at two weeks, 44.4% were within normal limits, while 27.8% were in the mild range, and 27.8% were in the moderate range. The percentage of participants within normal limits remained unchanged at three months, while the percentage of participants with mild anxiety increased to 44.4%, and the percentage of those with moderate anxiety decreased to 11.1%. Participants had slightly improved fear scores, but still scored low at both timepoints (8.3 to 7.2, possible score 0–20). There were no statistically significant changes in utilization of coping strategies over time. Utilization of coping strategies decreased by less than 2% in all subscales over time in the entire sample. Interestingly, those who were sexually active employed a higher number of both positive and negative coping strategies compared to those who were sexually inactive.

## Discussion

This exploratory study described changes in sexual function, anxiety, depressive symptoms, use of coping strategies, and sexual fear in men post-MI from two weeks to three months. Changes in sexual function scores fell across a broad range, with some drastically improving over three months while others remained stable or improved only minimally. In addition, physical components of function (arousal, erection, orgasm) improved more than psychosocial components (desire, satisfaction) over three months. To our knowledge, this is the first study that evaluated sexual function and satisfaction from an acute-MI phase (two weeks post event) to a recovery phase (three months post event). One large longitudinal cohort study reported development of functional deficits one-year post-MI,

but did not report severity of dysfunction, and was conducted in a younger sample aged 18–55 [13]. Our findings indicate that sexual function and satisfaction can decrease or increase dramatically within a short time post-discharge, as much as 38% in this sample. Previous studies have found a potential protective effect of sexual activity on cardiac risk in older patients, and so exploration of short term-changes in function over time is crucial to promote enjoyable sexual activity at an early stage [30]. This study also provides a more comprehensive characterization of sexual function, as previous cross-sectional studies have primarily focused on erectile quality [31].

Men who were sexually active had higher sexual function scores over time than those who were not sexually active. The improvement in sexual activity rates from 33.3% to 72% might explain the observed improvements in sexual function, though this could also be due to a better relationship with their partner or generally increased motivation or interest. To our understanding, prior studies have not stratified sexual function based on sexual activity statuses post-MI. This provides a unique contribution by characterizing the challenges that sexually inactive men experience regarding sexual desire and satisfaction. Our findings suggest that patients who are inactive still feel sexual desire and can still feel satisfied in their relationship with their partner. As a result, pre-discharge education that provides information on managing sexual difficulties and returning to safe sexual activity according to patient desires may improve care in this population [32].

Previous research has reported that depressive symptoms and anxiety are often associated with decreased sexual function and satisfaction [16–18]. In this study, scores on anxiety and depressive symptoms were largely stable over time. Half of depressive symptom scores and almost half of anxiety scores remained within normal limits at both time points with very few mild and moderate cases, and no severe cases. However, those who were sexually active post-MI reported lower anxiety and depressive symptoms scores compared to those who were not sexually active. This could either be because depressive symptoms and anxiety precipitate decreased sexual desire, or because low sexual function produces more depression and anxiety. However, the observed changes in depressive symptoms and anxiety across timepoints were considerably small, and so further research is needed to explore these potential hypotheses.

Patients post-MI often face new challenges to their quality of life, and subsequently seek assistance with developing coping strategies for anxiety and depression [33]. A recent review found that common positive coping strategies among those with chronic conditions involved both religious coping and utilization of social support [34]. In the MI literature specifically, reduced social support was associated with lower overall coping scores and decreased use of positive coping strategies, which may have led to higher utilization of a passive coping style [35]. As such, it may be that men who are sexually active were able to cope better with MI compared to those who were not active. However, these findings are preliminary and should be explored further given the small effect size observed in this study.

Although not statistically significant, men who were sexually inactive had more sexual fear than active men. This is an expected finding, given that some may hesitate to engage sexually for fear of causing additional cardiac complications. However, both active and

inactive men decreased fear scores over time, which was unexpected. This study also found relatively low prevalence rates of sexual fear. Our findings are contrary to previous literature, which have reported prevalence rates for sexual fear in post-MI samples as high as 88.4% [10]. Among those in our study who were not sexually active, low functional scores may have been interacting with low sexual fear. While these previous studies have identified potential associations; no study has determined whether fear can directly predict changes in sexual function [10, 16].

The results of this study can be used to inform healthcare professionals about possible short-term changes to sexual function and its trajectory over the first three months post-MI. Previous studies have found that only 39.1% of sexually active men and 17.9% of sexually active women discuss sexual health with their physician [11]. As such, questions regarding the quality of sexual health education post-MI exist. A combination of lack of knowledge, discomfort, and lack of resources to address sexual concerns all contribute to this disparity [5, 33, 36]. These results, along with additional descriptive research, can assist healthcare professionals with determining patient needs for sexual health education. Additional research is also needed to explore whether the observed trends in sexual function will continue to improve beyond three months. Future studies should measure sexual function in patients with a diverse set of sexual and dyadic preferences (i.e. non-monogamy, sexual orientation), and obtain more data from unpartnered individuals, all of which are critically understudied populations [13]. Furthermore, qualitative research could provide an opportunity for a more personal open-ended discussion on the many nuances and intricacies of sexuality. This approach could also broaden our understanding of sexuality in this population beyond physical function by exploring intimacy, body image, and role engagement, and could also be utilized to explore patient perceptions of their sex lives both before and after an MI.

Despite promising preliminary results, some limitations exist. The small sample of only men reduces the generalizability of these findings to sexual function changes in women, although previous studies have measured sexual function in women post-MI using the FSFI at three months [10]. Our sample was also primarily White, which also limits generalizability, though we collected data from a diverse sample of patients of varying education levels, partner status, and education status. Future research should aim for a representative sample of race, age, and culture, to capture the many ways that sexuality is experienced in these diverse populations. A criticism of the FSFI - from which the MSFI was developed - is its coding of patients without sexual activity, which may bias results towards more dysfunction [37]. However, the purpose of this study was to understand trends in sexual function related to the return to sexual activity over time, and therefore being sexually active was not a part of our eligibility criteria. Without pre-MI sexuality data, it is difficult to determine the level of sexual function loss that was solely due to the MI. However, retrospectively collecting pre-MI sexual function data after discharge could result in recall bias, making findings unreliable. Collecting data on the number of sexual partners and frequency of sexual activity in our sample could have provided additional clarity to function scores, particularly given that almost 40% of our sample was unmarried. Lastly, while this study explored several covariates, the limited sample size prevented controlling for these variables in statistical analyses.

## Conclusion

This exploratory study demonstrated statistically significant improvements in total MSFI scores from two weeks to three months in men post-MI. Descriptive analysis of sexually active men compared to those who were inactive helped to contextually explain positive changes over time. The results from this study suggest that early information and guidance from clinicians may improve sexual health for men post-MI who are struggling with sexual dysfunction. Sexual function and interest should be assessed regularly in patients with heart disease so that if an MI occurs, baseline sexual health information would already have been provided. Future longitudinal studies with larger sample sizes should be conducted to confirm whether these observed changes in sexual function can be replicated. Additional research should also examine psychosocial variables including anxiety, depressive symptoms, utilization of coping strategies, and sexual fear concurrently to better understand their association and mutual influence.

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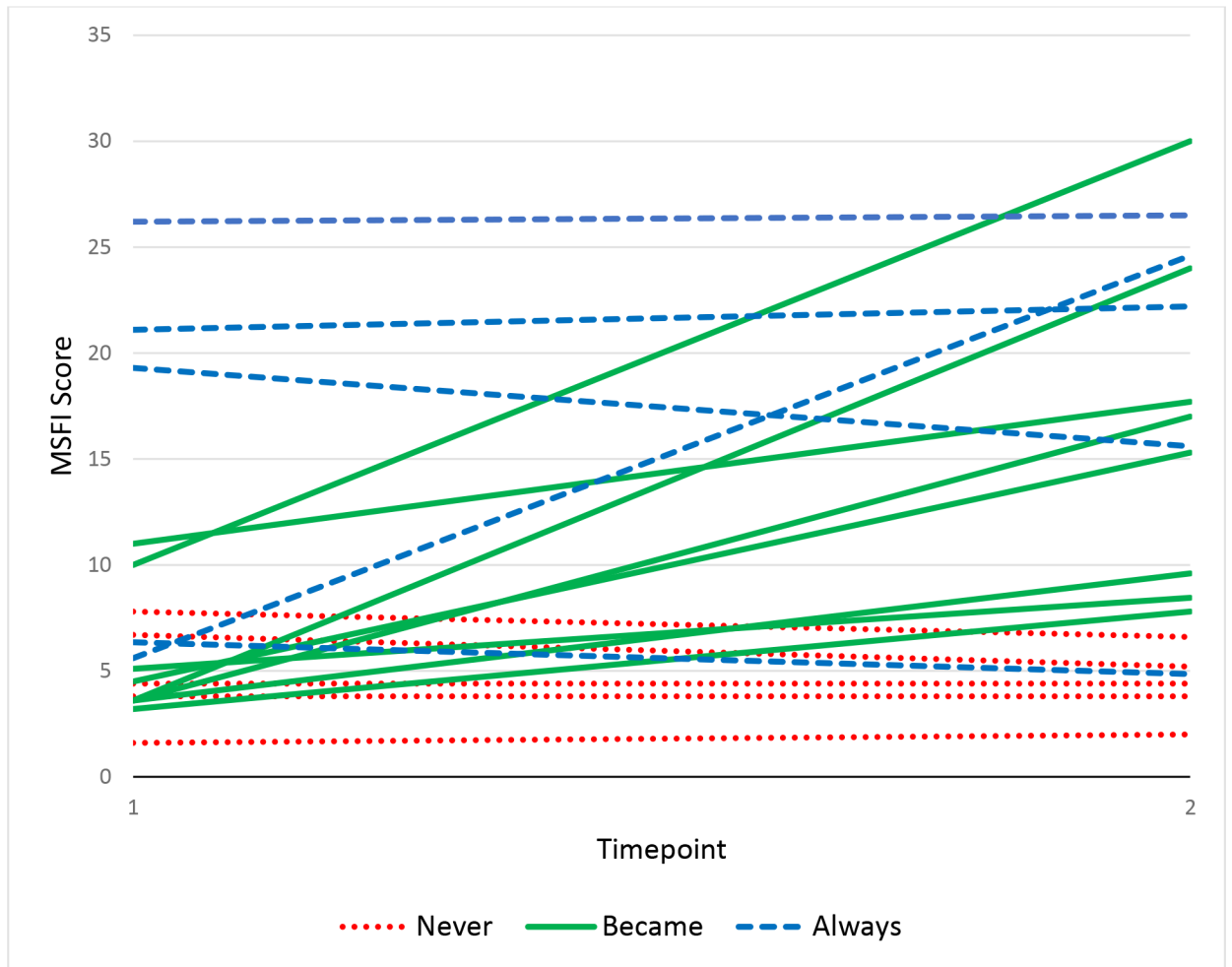
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## References

1. Virani SS, Alonso A, Benjamin EJ, et al. Heart disease and stroke statistics-2020 update: a report from the American Heart Association. *Circulation*. 2020;141(9):e139–e596. doi:10.1161/CIR.0000000000000757 [PubMed: 31992061]
2. Daniel M, Agewall S, Berglund F, et al. Prevalence of anxiety and depression symptoms in patients with myocardial infarction with non-obstructive coronary arteries. *Am J Med*. 2018;131(9):1118–1124. doi:10.1016/j.amjmed.2018.04.040 [PubMed: 29859805]
3. Kriston L, Günzler C, Agyemang A, Bengel J, Berner MM. Effect of sexual function on health-related quality of life mediated by depressive symptoms in cardiac rehabilitation. Findings of the SPARK project in 493 patients. *J Sex Med*. 2010;7(6):2044–2055. doi:10.1111/j.1743-6109.2010.01761.x [PubMed: 20345735]
4. Dunlay SM, Pack QR, Thomas RJ, Killian JM, Roger VL. Participation in cardiac rehabilitation, readmissions, and death after acute myocardial infarction. *Am J Med*. 2014;127(6):538–546. doi:10.1016/j.amjmed.2014.02.008 [PubMed: 24556195]
5. Byrne M, Doherty S, McGee HM, Murphy AW. General practitioner views about discussing sexual issues with patients with coronary heart disease: a national survey in Ireland. *BMC Fam Pract*. 2010;11:40. doi:10.1186/1471-2296-11-40 [PubMed: 20500836]
6. Puchalski B, Szymanski F, Kowalik R, Filipiak KJ. Sexual dysfunction in men in the first 9 months after myocardial infarction. *Psychiatr Pol*. 2013;47(5):811–826. [PubMed: 25011229]
7. Masters WH, Johnson VE. *Human Sexual Response*. Bantam; 1980
8. Ashdown BK, Hackathorn J, Clark EM. In and out of the bedroom: sexual satisfaction in the marital relationship. *Journal of Integrated Social Sciences*. 2011;2(1):40–57.
9. Thylén I, Brännström M. Intimate relationships and sexual function in partnered patients in the year before and one year after a myocardial infarction: A longitudinal study. *Eur J Cardiovasc Nurs*. 2015;14(6):468–477. doi:10.1177/1474515115571061 [PubMed: 25652073]
10. Oskay U, Can G, Camcı G. Effect of myocardial infarction on female sexual function in women. *Arch Gynecol Obstet*. 2015;291(5):1127–1133. doi:10.1007/s00404-014-3537-5 [PubMed: 25384520]

11. Lindau ST, Abramssohn E, Gosch K, et al. Patterns and loss of sexual activity in the year following hospitalization for acute myocardial infarction (a United States national multisite observational study). *The American Journal of Cardiology*. 2012;109(10):1439–1444. doi:10.1016/j.amjcard.2012.01.355 [PubMed: 22546209]
12. Lindau ST, Abramssohn EM, Bueno H, et al. Sexual activity and counseling in the first month after acute myocardial infarction among younger adults in the United States and Spain: a prospective, observational study. *Circulation*. 2014;130(25):2302–2309. doi:10.1161/CIRCULATIONAHA.114.012709 [PubMed: 25512442]
13. Lindau ST, Abramssohn E, Bueno H, et al. Sexual activity and function in the year after an acute myocardial infarction among younger women and men in the United States and Spain. *JAMA cardiology*. 2016;1(7):754–764. doi:10.1001/jamacardio.2016.2362 [PubMed: 27579897]
14. Johansson I, Karlson BW, Grankvist G, Brink E. Disturbed sleep, fatigue, anxiety and depression in myocardial infarction patients. *Eur J Cardiovasc Nurs*. 2010;9(3):175–180. doi:10.1016/j.ejcnurse.2009.12.003 [PubMed: 20071239]
15. Söderberg LH, Johansen PP, Herning M, Berg SK. Women's experiences of sexual health after first-time myocardial infarction. *J Clin Nurs*. 2013;22(23–24):3532–3540. doi:10.1111/jocn.12382 [PubMed: 24118632]
16. Kazemi-Saleh D, Pishgou B, Assari S, Tavallai SA. Fear of sexual intercourse in patients with coronary artery disease: a pilot study of associated morbidity. *J Sex Med*. 2007;4(6):1619–1625. doi:10.1111/j.1743-6109.2007.00619.x [PubMed: 17970974]
17. Steinke EE, Wright DW. The role of sexual satisfaction, age, and cardiac risk factors in the reduction of post-MI anxiety. *Eur J Cardiovasc Nurs*. 2006;5(3):190–196. doi:10.1016/j.ejcnurse.2005.12.002 [PubMed: 16442845]
18. Kroenke K, Yu Z, Wu J, Kean J, Monahan PO. Operating characteristics of PROMIS four-item depression and anxiety scales in primary care patients with chronic pain. *Pain Med*. 2014;15(11):1892–1901. doi:10.1111/pme.12537 [PubMed: 25138978]
19. Rahmanian E, Salari N, Mohammadi M, Jalali R. Evaluation of sexual dysfunction and female sexual dysfunction indicators in women with type 2 diabetes: a systematic review and meta-analysis. *Diabetol Metab Syndr*. 2019;11:73. doi:10.1186/s13098-019-0469-z [PubMed: 31467595]
20. Falk SJ, Dizon DS. Sexual health issues in cancer survivors. *Semin Oncol Nurs*. 2020;36(1):150981. doi:10.1016/j.soncn.2019.150981 [PubMed: 31983486]
21. Thygesen K, Alpert JS, Jaffe AS, et al. Third universal definition of myocardial infarction. *Journal of the American College of Cardiology*. 2012;60(16):1581–1598. doi:10.1016/j.jacc.2012.08.001 [PubMed: 22958960]
22. Kalmbach DA, Ciesla JA, Janata JW, Kingsberg SA. Specificity of anhedonic depression and anxious arousal with sexual problems among sexually healthy young adults. *The Journal of Sexual Medicine*. 2012;9(2):505–513. doi:10.1111/j.1743-6109.2011.02533.x [PubMed: 22024317]
23. Rosen R, Brown C, Heiman J, et al. The Female Sexual Function Index (FSFI): a multidimensional self-report instrument for the assessment of female sexual function. *Journal of Sex & Marital Therapy*. 2000;26(2):191–208. doi:10.1080/009262300278597 [PubMed: 10782451]
24. Kalmbach DA, Ciesla JA, Janata JW, Kingsberg SA. The validation of the Female Sexual Function Index, Male Sexual Function Index, and Profile of Female Sexual Function for use in healthy young adults. *Archives of Sexual Behavior*. 2015;44(6):1651–1662. doi:10.1007/s10508-014-0334-y [PubMed: 25091215]
25. Snell WE, Fisher TD, Walters AS. The Multidimensional Sexuality Questionnaire: an objective self-report measure of psychological tendencies associated with human sexuality. *Annals of Sex Research*. 1993;6(1):27–55. doi:10.1007/BF00849744
26. Cella D, Riley W, Stone A, et al. The Patient-Reported Outcomes Measurement Information System (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005–2008. *J Clin Epidemiol*. 2010;63(11):1179–1194. doi:10.1016/j.jclinepi.2010.04.011 [PubMed: 20685078]

27. Amirkhan JH. A factor analytically derived measure of coping: The Coping Strategy Indicator. *Journal of Personality and Social Psychology*. 1990;59(5):1066–1074. doi:10.1037/0022-3514.59.5.1066
28. Sterne JA, White IR, Carlin JB, et al. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. *BMJ*. 2009;338:b2393. Published 2009 Jun 29. doi:10.1136/bmj.b2393 [PubMed: 19564179]
29. Rothrock NE, Amtmann D, Cook KF. Development and validation of an interpretive guide for PROMIS scores. *J Patient Rep Outcomes*. 2020;4(1):16. doi:10.1186/s41687-020-0181-7 [PubMed: 32112189]
30. Liu H, Waite LJ, Shen S, Wang DH. As sex good for your health? A national study on partnered sexuality and cardiovascular risk among older men and women. *J Health Soc Behav*. 2016;57(3):276–296. doi:10.1177/0022146516661597 [PubMed: 27601406]
31. Hodži E, Durek A, Begi E, Šabanovi Bajramovi N. Effect of myocardial infarction on the occurrence of erectile dysfunction. *Med Glas (Zenica)*. 2019;16(1):35–39. doi:10.17392/981-19 [PubMed: 30589239]
32. Steinke EE, Jaarsma T, Barnason SA, et al. Sexual counseling for individuals with cardiovascular disease and their partners: a consensus document from the American Heart Association and the ESC Council on Cardiovascular Nursing and Allied Professions (CCNAP). *Circulation*. 2013;128(18):2075–2096. doi:10.1161/CIR.0b013e31829c2e53 [PubMed: 23897867]
33. Nilsson UG, Ivarsson B, Alm-Roijer C, Svedberg P, SAMMI-study group. The desire for involvement in healthcare, anxiety and coping in patients and their partners after a myocardial infarction. *Eur J Cardiovasc Nurs*. 2013;12(5):461–467. doi:10.1177/1474515112472269 [PubMed: 23303764]
34. Cheng C, Inder K, Chan SW-C. Coping with multiple chronic conditions: an integrative review. *Nurs Health Sci*. 2020;22(3):486–497. doi:10.1111/nhs.12695 [PubMed: 32104949]
35. Son H, Friedmann E, Thomas SA, Son Y-J. Biopsychosocial predictors of coping strategies of patients post myocardial infarction. *Int J Nurs Pract*. 2016;22(5):493–502. doi:10.1111/ijn.12465 [PubMed: 27492735]
36. Brännström M, Kristofferzon M-L, Ivarsson B, et al. Sexual knowledge in patients with a myocardial infarction and their partners. *J Cardiovasc Nurs*. 2014;29(4):332–339. doi:10.1097/JCN.0b013e318291ede6 [PubMed: 23612040]
37. Meyer-Bahlburg HFL, Dolezal C. The female sexual function index: a methodological critique and suggestions for improvement. *J Sex Marital Ther*. 2007;33(3):217–224. doi:10.1080/00926230701267852 [PubMed: 17454519]



**Figure 1.** Individual changes in MSFI scores from two weeks to three months in men post-MI (n=18)

**Table 1**

## Characteristics of study participants

	<b>(n=18)</b>
Sociodemographic characteristics	
Mean age (SD) in years	60.5 (13.6)
Race, No. (%)	
White	17 (94.4)
Other	1 (5.6)
Marital status, No. (%)	
Single	2 (11.1)
In a relationship	2 (11.1)
Married	11 (61.1)
Divorced	2 (11.1)
Widowed	1 (5.56)
Education status, No. (%)	
Some high school	2 (11.1)
High school degree	2 (11.1)
Some college	5 (27.8)
College degree	3 (16.7)
Graduate degree	6 (33.3)
Rehabilitation status, No. (%)	
Currently enrolled	3 (16.7)
Planning to enroll	7 (38.9)
Not enrolled	8 (44.4)
Employment status, No. (%)	
Employed	9 (50)
Unemployed	1 (5.6)
Retired	6 (33.3)
Medical Leave	2 (11.1)
Clinical characteristics	
MI Severity, No. (%)	
STEMI	7 (38.9)
NSTEMI	11 (61.1)
Mean troponin (SD) in ng/mL	1081.9 (2314)
Mean LVEF (SD) in %	48.5 (12.3)

*Note.* (N)STEMI ST(Non)-Elevated Myocardial Infarction; LVEF Left Ventricular Ejection Fraction

**Table 2**

Mean scores and changes on sexual function, anxiety, depression, sexual fear, and coping in men post-MI (n=18)

	Two weeks		Three months		% change	p-value
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)		
MSFI: Total Scores (range 2–30)*	8.9 (7.3)	14.6 (8.9)	18.8	0.03		
Desire (range 1.2–6)	2.6 (1.6)	3.1 (1.3)	8.9	0.06		
Arousal (range 0–6)	1.3 (1.8)	2.4 (2)	17.9	0.13		
Erection (range 0–6)	1.2 (1.8)	2.8 (2.4)	27.8	0.01		
Orgasm (range 0–6)	1.3 (2.2)	2.8 (2.5)	25.9	0.04		
Satisfaction (range 0.8–6)*	2.2 (1.3)	2.9 (1.8)	11	0.18		
PROMIS: Anxiety (range 0–20)	7.9 (3.1)	7.5 (3.1)	-2.2	0.57		
PROMIS: Depression (range 0–20)	7.1 (2.6)	7.3 (3.4)	1.1	0.59		
MSQ: Sexual Fear (range 0–20)	8.3 (5.9)	7.2 (5.5)	-5.3	0.4		
CSI: Seeking Support (range 11–33)	20.5 (5.0)	20.4 (7.1)	-0.3	0.92		
CSI: Problem Solving (range 11–33)	25.8 (4.7)	25.4 (5.8)	-1.2	0.76		
CSI: Avoidance (range 11–33)	18 (3.7)	17.6 (4.6)	-1.3	0.68		

Note. MSFI Male Sexual Function Index, MSQ Multidimensional Sexuality Questionnaire, PROMIS Patient-Reported Outcomes Measurement Information System, CSI Coping Strategy Indicator.

Higher scores on the MSFI total scores and subscales indicate higher sexual function. Higher scores on the PROMIS measurements indicate worse anxiety and depression. Higher scores on the MSQ indicate more sexual fear. Higher scores on the CSI subscales indicate greater use of coping strategies.

\* Satisfaction and total scores calculated with missing data removed ( $n=4$ )

**Table 3**

Mean scores and changes on sexual function, anxiety, depression, sexual fear, and coping in men post-MI by sexual status (n=18)

	Sexually active (n=13)			Sexually inactive (n=5)		
	Two weeks	Three months	% change	Two weeks	Three months	% change
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
MSFI: Total Scores (range 2–30)*	10.2 (8.2)	18.4 (7.7)	27.3 †	5.7 (1.6)	5 (1.0)	-2.3
Desire (range 1.2–6)	2.8 (1.7)	3.6 (1.1)	12.3	1.9 (1.0)	1.9 (1.0)	0
Arousal (range 0–6)	1.4 (2.0)	3.1 (2.0)	27.9 †	1.1 (1.1)	0.6 (0.8)	-8
Erection (range 0–6)	1.5 (2.0)	3.9 (2.0)	38.8 †	0.2 (0.2)	0.1 (0.2)	-1
Orgasm (range 0–6)	1.8 (2.4)	3.9 (2.0)	35.9 †	0	0	0
Satisfaction (range 0.8–6)*	2.3 (1.4)	3.4 (1.9)	15.3	2.0 (1.2)	2.0 (1.2)	0
PROMIS: Anxiety (range 0–20)	7.8 (3.1)	7.1 (2.4)	-3.5	8.4 (2.9)	8.6 (4.2)	1
PROMIS: Depression (range 0–20)	6.9 (2.3)	6.7 (2.6)	-1.2	7.6 (3)	9 (4.4)	7
MSQ: Sexual Fear (range 0–20)	6 (4.6)	5.5 (5.3)	-2.3	14.2 (4.6)	11.6 (3.3)	-13
CSI: Seeking Support (range 11–33)	20.5 (5.7)	21.4 (8)	2.6	20.4 (2.87)	17.8 (1.9)	-7.9
CSI: Problem Solving (range 11–33)	27.1 (4.1)	27.2 (5.2)	0.5	22.6 (4.6)	20.8 (4.5)	-5.5
CSI: Avoidance (range 11–33)	18.2 (3.7)	17.2 (3.8)	-3	17.6 (3.8)	18.6 (6.1)	3

Note. Higher scores on the MSFI total scores and subscales indicate higher sexual function. Higher scores on the PROMIS measurements indicate worse anxiety and depression. Higher scores on the MSQ indicate more sexual fear. Higher scores on the CSI subscales indicate greater use of coping strategies.

† p<0.05

\* Satisfaction and total scores calculated with missing data removed (n=3 sexually active, 1 sexually inactive)