Anxiety and Depression Symptomatology Related to Inspiratory Muscle Strength and Functional Capacity in Preoperative Cardiac Surgery Patients: A Preliminary Cross-sectional Study

Kornanong Yuenyongchaiwat[1], Sasipa Buranapuntalug[1], Karan Pongpanit[1], Chitima Kulchanarat[2], Opas Satdhabudha[3]

ABSTRACT

Background: Poor psychological health and cardiorespiratory fitness prior to open heart surgery (OHS) might be predictors of postoperative pulmonary complications that lead to morbidity and mortality. Assessment of physical and psychological conditions should be considered for patients receiving OHS, to possibly prevent these complications. This study investigates how inspiratory muscle strength (IMS) and functional capacity (FC) relate to the psychological health of preoperative cardiac surgery patients.

Method: A cross-sectional study was designed before OHS; the 6-minute walk test and IMS were performed on patients who were admitted for OHS. All participants were requested to complete Hospital Anxiety and Depression Scale. Pearson correlation and hierarchal

regression analysis were performed to determine the relationships between IMS and FC and psychological conditions (anxiety and depression).

Results: Overall, 36 males and 28 females aged 56.89±10.23 years were recruited. Significant relationships were observed between IMS and anxiety and depression symptoms ($r = -0.33$ and $r = -0.27$, respectively). Anxiety was negatively related to FC ($r = -0.25$). These relationships remained significant after adjustment for age, sex, and body mass index (BMI) ($\Delta R^2 = 0.11$ and $\Delta R^2 = 0.09$). In addition, anxiety was also related to FC after controlling for age, sex, and BMI ($\Delta R^2 = 0.09$).

Conclusion: Among patients undergoing OHS, those with a higher level of depression or anxiety had a lower cardiorespiratory fitness than those with a low level of depression or anxiety.

Keywords: Open heart surgery, cardiac surgical procedures, functional capacity, 6-minute walk test, inspiratory muscle, anxiety, depression

Key Messages: Depression and anxiety symptoms in patients who underwent open heart surgery were inversely associated with inspiratory muscle strength. Anxiety symptoms were negatively associated with functional capacity. These relationships remained significant even after controlling for age, sex, and BMI.

World Health Organization showed that 17.8 million people died from cardiovascular disease (CVD) in 2017, and the global mortality rate was 31%.[1] In 2016, CVD had caused over 17.9 million deaths for a global mortality rate of approximately 31.0%. Further, 85% of these deaths were

[1]Physiotherapy Dept., Faculty of Allied Health Sciences, Thammasat University, Prathumthani, Thailand. [2]Physical Therapy Center, Thammasat University Hospital, 99 Khlong Nueng, Pathum Thani, Thailand. [3]Cardiothoracic Surgery Dept., Faculty of Medicine, Thammasat University, Prathumthani, Thailand.

from CVD (i.e., heart attack and stroke).[2] In addition, it was reported that 56.7% of patients aged ≥ 65 years had received a coronary artery bypass graft (CABG); this number is eventually projected to increase to 67.3%.[3] The total cost for patients of a CABG is over $30,000[4]; therefore, medical care costs are significant for patients undergoing CABG.

Poor inspiratory muscle strength (IMS), functional capacity (FC), and psychological health (e.g., symptoms of anxiety, depression) are associated with adverse outcomes after open heart surgery (OHS) and are risk factors for post-surgical morbidity and mortality.[5–11] FC is the ability to perform regular activities requiring aerobic metabolism and is a combination of an individual's performance and cardiovascular, respiratory, and skeletal muscle health.[12]

Decreased IMS and FC (as assessed with the 6-minute walk test, 6-MWT) have been observed in patients after operative cardiac surgery.[5–8] Respiratory muscle dysfunction and the loss of ability to generate force in patients with OHS leads to pulmonary complications such as breathlessness, impaired airway clearance, and poor pulmonary ventilation.[13,14] Therefore, these factors should be assessed and treated before OHS to prevent poor respiratory muscle function and pulmonary ventilation. In addition, symptoms of depression and anxiety prior to OHS are significant predictors of morbidity and mortality in short- and long-term follow-up consultations.[9–11,15–19] For example, patients with moderate to severe depression before heart operations had a higher mortality rate than those without depression.[15] Tully et al.[19] reported that patients suffering from anxiety tended to experience major adverse cardiovascular and cerebrovascular events (e.g., myocardial infarction, stroke) after CABG surgery. Symptoms of depression were also related to a lack of physical function (assessed using the Short Form-36) before cardiac surgery.[20] In addition, patients undergoing cardiac surgery should be assessed in a more comprehensive manner that includes assessments of IMS, FC, and psychological health (i.e., anxiety and depression) to prevent postoperative pulmonary complications (e.g., pneumonia, lung atelectasis, pro-longed ventilation). Therefore, this study examined the relationships between psychological health and cardiorespiratory fitness (i.e., IMS and FC) in patients undergoing preoperative OHS.

Materials and Methods

A cross-sectional study was designed with 64 preoperative OHS participants (i.e., receiving valve replacement or coronary artery bypass grafting) at Thammasat University Hospital between December 2015 and December 2016. The participants were aged 35–70 years and consisted of both males and females. An information sheet was given to the participants prior to participation in the study. The study protocol was approved by the ethics committee board from Thammasat University and Thammasat University Hospital. Written informed consent was obtained from all the participants. In addition, the study was registered in the Thai Clinical Trials Registry (TCTR); the identification number is TCTR 20151215002.

Assessment of FC was conducted via 6-MWT, following the protocol from the American Thoracic Society.[21] IMS was tested using an RPM01 (Micro Medical Ltd., United Kingdom). According to the American Thoracic Society/European Respiratory Society (ATS/ERS) recommendations on respiratory muscle testing, IMS was measured at residual volume.[21] To evaluate IMS, the participants were instructed to exhale slowly and completely, and then inhale deeply and sustain the pressure for 1.5 seconds. Each participant was asked to perform the 3–5 IMS maneuver, with the highest two readings within 10 cmH2O recorded.

In addition, the participants were asked to complete the Hospital Anxiety and Depression Scale (HADS). The Thai translation of HADS has reliability and validity for both anxiety and depression subscales. The sensitivity of anxiety subscales of the Thai HADS subscale was 100% and specificity was 86.0%. For the depression subscale, sensitivity was 85.71% and specificity was 91.3%. Additionally, the Thai version of the HADS had demonstrated good internal consistencies, with Cronbach's alpha coefficients of 0.86 for the anxiety scale and 0.83 for the depression scale.[22] The total scores range from 0 to 21 for both HADS-anxiety and HADS-depression; higher scores indicate greater depression or anxiety.[23] To define an individual with depressive or anxiety symptoms, a cutoff of ≥ 8 on the anxiety and depression subscales was used.[24]

The measurements were performed within 48 hours prior to the cardiac operation. Body mass index (BMI) was calculated using weight/height (meter).[2] According to the World Health Organization, normal BMI is defined as 18.5–23.0 kg/m² in the Asian populations.[25]

Statistical Analysis

Percentages (%), means, and standard deviations (SD) were calculated. A normality of distribution test (the Kolmogorov–Smirnov Goodness of Fitness Test) was performed to verify the distribution data. ANOVA was then conducted to compare psychological health conditions and types of cardiac operations. Pearson correlation coefficients were calculated between psychological health conditions (i.e., anxiety and depression) and IMS and FC. Additionally, a linear regression was applied to evaluate the relationship between HADS anxiety and depression scores, and IMS and 6-MWT.

Results

A total of 64 eligible patients were evaluated in terms of IMS and FC (i.e., 6-MWT). The characteristics of the participants are presented in **Table 1**. Their mean age±SD was 56.89±10.23 years. There were 36 males and 28 females. Thirty-six participants (56.25%) were overweight, with a BMI of ≥ 23.0 kg/m², whereas 28 (43.75%) were categorized as having a normal BMI. In the current study, the average IMS value of patients was 68.25±25.67 cmH2O, indicating inspiratory muscle weakness (defined as the ATS/ERS guideline with IMS values of < 80 cmH2O).

Symptoms of Anxiety and Depression

ANOVA was conducted to compare depression and anxiety scores between patients diagnosed with coronary artery disease (CAD), valvular disease, or both. Patients diagnosed with both CAD and

TABLE 1.

Demographic Data in Patients Who Attended the Open Heart Surgery at Baseline (*n* = 64)

		Number (%)	Mean± SD
Gender	Female/	28 (43.75)	
	Male	36 (56.25)	
Type of heart disease	CAD	28 (43.75)	
	Valvular disease	33 (51.56)	
	Both CAD and valvular disease	3 (4.69)	
Age (years)			56.89 ±10.23
BMI (kg/m²)			23.55 ±3.35
6-MWD (meters)			328.16 ±126.64
IMS (cmH2O)			68.28 ±25.67
HADS (scores)	Anxiety		4.55 ±4.06
	Depression		3.38 ±3.35

CAD: coronary artery disease, BMI: body mass index, 6-MWD: 6-minute walk distance, IMS: inspiratory muscle strength, HADS: Hospital Anxiety and Depression Scale.

or anxiety scores, lower the FC and IMS (**Table 2**).

Relationship of IMS and FC with Psychological Conditions

The impact of heart disease in cardiorespiratory function, specifically IMS and FC, was observed in participants who received OHS (see **Table 3**). HADS anxiety scores were inversely correlated with both FC and IMS. In addition, depression scores were negatively related to IMS but not correlated to FC.

Hierarchical regression was then performed to determine how depression and anxiety were correlated with IMS and FC.

When comparing IMS and FC with the HADS (anxiety and depression) scores, patients who underwent OHS had high anxiety scores and lower IMS and FC. Hierarchical regression revealed that, after controlling for age, sex, and BMI, lower IMS remained correlated to higher anxiety and depression scores (β = −0.34, P = 0.001, and β = −0.30, P < 0.001, respectively), explaining 35.4% and 33.0% of the variance, respectively (**Table 4**). Furthermore, after hierarchical regression, anxiety scores

and 6-MWT scores were still associated after controlling for age, sex, and BMI (β = −0.31, P = 0.001), explaining 32.6% of the variance (**Table 5**). Multicollinearity was not a concern (anxiety scores and IMS values, variance inflation factor (VIF) = 1.05; depression scores and IMS values, VIF = 1.05; anxiety scores and 6-MWT, VIF = 1.05) (see **Tables 4 and 5**)

Discussion

We evaluated how IMS and FC are related to depressive and anxiety symptoms in patients who underwent OHS. This is the first study to explore the relationships between psychological health (i.e., anxiety and depression) and cardiorespiratory fitness (i.e., IMS and FC) in patients undergoing OHS. We found that anxiety scores are negatively correlated with IMS and FC. In addition, depression scores were inversely related to IMS. Finally, these negative relationships remained significant even after adjusting for age, sex, and BMI.

In the present study, 20.3% of the patients showed symptoms of anxiety, and 18.8% showed symptoms of depression. Several studies had reported that patients show high anxiety and depression scores during the preoperative period; however, these studies did not focus on

valvular disease had higher scores for both anxiety (9.33±4.51 vs. 3.32±3.40; $F_{(2, 63)}$ = 4.09; P = 0.022) and depression (9.00±5.29 vs. 2.50±2.06; $F_{(2, 63)}$ = 6.10, P = 0.004) than those with only CAD. However, no significant difference was observed between CAD and valvular disease in terms of anxiety or depression scores (5.15±4.20 vs. 3.32±3.40, P=0.070 and 3.61±3.62 vs. 2.50±2.06, P=0.158, respectively).

Using the HADS score of 8 as the cutoff point for both the depression and the anxiety categories, 13 (20.31%) participants were categorized as anxious. Similarly, 12 (18.75%) were categorized as depressed and 11 (17.19%) were categorized as having mixed anxiety and depressive symptoms. There was no significant group difference in age and BMI in anxiety and depression (P > 0.05). Differences in FC and IMS were observed in patients who had both anxiety and depressive symptomatology: higher the depression

TABLE 2.

Baseline Characteristics of the Study Population Assessed by HADS Depression and Anxiety Scores

		Participants (%)			
		Anxiety symptoms		Depression symptoms	
		Anxiety (n = 13)	Nonanxiety (n = 51)	Depression (n = 12)	Nondepression (n = 52)
Sex	Female (n = 28)	6 (9.38%)	22 (34.38%)	4 (6.25%)	24 (37.50%)
	Male (n = 36)	7 (10.94%)	29 (45.31%)	8 (12.50%)	28 (43.75%)
Heart disease	CAD (n = 28)	4 (6.25%)	24 (37.50%)	3 (4.69%)	25 (39.06%)
	Valvular disease (n = 33)	7 (10.94%)	26 (40.63%)	7 (10.94%)	26 (40.63%)
	CAD and valvular disease (n = 3)	2 (3.13%)	1 (1.56%)	2 (3.13%)	1 (1.56%)
		Mean ± SD		Mean ± SD	
Age (years)		57.08±9.73	56.84±10.44	55.58±11.44	57.19±10.03
BMI (kg/m²)		23.41±4.97	23.58±3.62	23.45 ± 5.16	23.57 ± 3.60
IMS (cmH2O)		57.23 ± 23.92	71.10± 25.56	56.92±23.08	70.90±25.72
6-MWD (meters)		242.23±119.10	350.07±119.97	264.17±131.24	342.93±122.10

HADS: Hospital Anxiety and Depression Scale, CAD: coronary artery disease, BMI: body mass index, 6-MWD: 6-minute walk distance, IMS: inspiratory muscle strength.

TABLE 3.

Correlation Between Cardiorespiratory Fitness and HADS Scores

	Functional Capacity		Inspiratory Muscle Strength	
	Pearson correlation r	P value	Pearson correlation r	P value
Anxiety	−0.25	0.046[*]	−0.33	0.007[**]
Depression	−0.15	0.241	−0.27	0.033[*]

HADS: Hospital Anxiety and Depression Scale, [*]P < 0.05, [**]P < 0.01.

TABLE 4.

A Hierarchical Regression Outcomes Between Inspiratory Muscle Strength and HADS Scores

	β	T	VIF	R^2	F	ΔR^2	ΔF
Step 1				0.25	6.47[*]	0.25	6.47[*]
Age	−0.33	−2.72[*]					
Sex	−0.37	−3.00[*]					
Body mass index	0.34	3.01[*]					
Step 2.1				0.35	8.06[**]	0.11	10.04[*]
Anxiety scores	−0.34	−3.17[*]	1.05				
Step 2.2				0.33	7.28[**]	0.09	7.57[*]
Depression scores	−0.30	−2.75[*]	1.05				

HADS: Hospital Anxiety and Depression Scale, VIF: variance inflation factor. [*]P = 0.001, [**]P < 0.001.

TABLE 5.

A Hierarchical Regression Outcomes Between Functional Capacity (6-MWT) and HADS Scores

	β	T	VIF	R^2	F	ΔR^2	ΔF
Step 1				0.24	6.15[*]	0.24	6.15[*]
Age	−0.50	−4.08[**]					
Sex	−0.17	−1.36					
Body mass index	0.154	1.33					
Step 2							
Anxiety scores	−0.310	−2.83[*]	1.05	0.33	7.15[**]	0.09	7.99[*]

6-MWT: 6minute walk test, HADS: Hospital Anxiety and Depression Scale, VIF: variance inflation factor. [*]P = 0.001, [**]P < 0.001.

the patient's physiological condition (e.g., pulmonary function, functional capacity).[18,26–34] Poole et al.[34] found depression and anxiety symptoms in patients who had undergone OHS; in addition, patients who had higher anxiety also had more negative physical symptoms (e.g., numbness, swelling) after the operation. Similarly, Rodrigues et al.[30] found that patients with greater anxiety and depression symptoms before OHS had a higher frequency of complications (e.g., hemodynamic instability, prolonged intubation) after OHS during their stay in the intensive care unit. Anxiety and depression might affect the severity of a patient's symptoms, leading to a poorer quality of life for the patients.[35,36]

One explanation might be that these patients required cardiac surgery because they either had intractable angina from CAD or extreme dyspnea from valvular disease. It is possible that the more severe their disease, the worse their preoperative symptoms were, and the less they were able to perform daily activities. Therefore, these severe symptoms would have caused the anxiety and depression. However, it should be noted that only three patients were diagnosed with both CAD and valvular disease. Thus, the interpretations regarding the severity of the symptoms of the heart disease should be taken cautiously. Navarro-Garcia et al.[37] had found that 32% of patients showed preoperative anxiety, and 19% showed symptoms of depression; they also reported that a prolonged preoperative hospital stay was associated with both the conditions. In addition, Geulayov et al.[31] found that symptoms of depression and anxiety one year after cardiac surgery were positively associated with mortality. Therefore, further studies should explore the relationships among preoperative psychological conditions and length of hospital stay after operations as well as longitudinal changes in anxiety and depression symptoms post operation.

The mean walking distance in the present study was 328.16±126.64 meters, which corresponds to the findings of Fiorina et al.[6] who reported a mean walking distance of 304±89 meters in 1370 patients. Shuldham et al.[38] evaluated the FC in older women with and without mitral valve disease. Using a set of questionnaires (i.e., the SF-36 Health Status questionnaire and the Functional Limitations Profile), they found that higher depression and anxiety levels are related to limited FC in patients with mitral valve stenosis compared to participants without mitral valve stenosis or other heart conditions.

In addition, IMS values were negatively correlated with anxiety and depression in preoperative heart surgery. Similarly, Demir et al.[35] reported that IMS and FC are negatively associated with quality of life (e.g., emotional dimension) among patients with atrial fibrillation. Therefore, a poor IMS and low FC are associated with poor psychological health conditions, and also cardiorespiratory fitness is one of the predictors of mortality in patients with OHS.[39,40] In addition, individuals with negative psychological health (i.e., symptoms of anxiety and depression) are associated with the risk factor of mortality and morbidity in OHS.[34,37]

Several limitations of this study have been noted. Firstly, it was a cross-sec-

tional study that explored an event at a singular point in time rather than over the development of the condition; a prospective cohort study might determine the relationships between psychological conditions and IMS and FC in a patient who underwent OHS. In addition, the study had a relatively small sample size. Furthermore, the duration of the preoperative hospital stay, history of functional class (e.g., New York Heart Association (NYHA) Functional Classification) prior to the operation, the severity of the heart disease, and the demographic data (e.g., education, socioeconomic status, marital status, occupation, family type or domicile) were not recorded, that limit the generalizability of the results. A future study needs to explore these relationships with a large sample size and a prospective cohort design.

Conclusion

Patients undergoing OHS had a high level of depression or anxiety as well as lower FC and IMS. Depressive and anxiety symptoms were inversely correlated with IMS; additionally, anxiety symptoms were negatively correlated with FC. These relationships remained significant even after controlling for age, sex, and BMI. Therefore, it might be beneficial for health professionals to assess psychological health conditions including cardiorespiratory fitness in patients undergoing OHS.

References

1. Roth GA, Abate D, Abate KH, et al. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980–2017: A systematic analysis for the Global Burden of Disease Study 2017. Lancet 2018; 392: 1736–1788.
2. World Health Organization. Cardiovascular diseases (CVDs) fact sheet [Cited 2019 Nov 10]. http://www.who.int/en/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds).
3. Etzioni DA and Starnes VA. The epidemiology and economics of cardiothoracic surgery in the elderly. In MR Katlic (ed.), *Cardiothoracic surgery in the elderly: Evidence-based practice*. New York, NY: Springer, 2011: 5–24.
4. Mark DB and Hlatky MA. Medical economics and the assessment of value in cardiovascular medicine: Part II. Circulation 2002; 106: 626–630.
5. Barros GF, Santos CdaS, Granado FB, et al. Respiratory muscle training in patients submitted to coronary arterial bypass graft. Rev Bras Cir Cardiovasc 2010; 25(4): 483–490.
6. Fiorina C, Vizzardi E, Lorusso R, et al. The 6-min walking test early after cardiac surgery. Reference values and the effects of rehabilitation programme. Eur J Cardiothorac Surg 2007; 32(5): 724–729.
7. Riedi C, Mora CT, Driessen T, et al. Relation between respiratory muscle strength with respiratory complication on the heart surgery. Rev Bras Cir Cardiovasc 2010; 25(4): 500–505.
8. Yuenyongchaiwat K, Buranapuntalug, S, Pongpanit K, et al. Respiratory fitness and mental health in patients who had undergoing open heart surgery: A preliminary observational study. Res J Appl Sci 2018; 13(6): 363–368.
9. Tully PJ and Baker RA. Depression, anxiety, and cardiac morbidity outcomes after coronary artery bypass surgery: A contemporary and practical review. J Geriatr Cardiol 2012; 9(2): 197–208.
10. Pignay-Demaria V, Lesperance F, Demaria RG, et al. Depression and anxiety and outcomes of coronary artery bypass surgery. Ann Thorac Surg 2003; 75: 314–321.
11. Krannich JA, Weyers P, Lueger S, et al. Presence of depression and anxiety before and after coronary artery bypass graft surgery and their relationship to age. BMC Psychiatr 2007; 7: 47.
12. Arena R, Myers J, Williams MA, et al. Assessment of functional capacity in clinical and research settings: A scientific statement from the American Heart Association Committee on exercise, rehabilitation, and prevention of the Council on Clinical Cardiology and the Council on Cardiovascular Nursing. Circulation 2007; 116: 329–343.
13. Morsch KT, Leguisamo CP, Camargo MD, et al. Ventilatory profile of patients undergoing CABG surgery. Rev Bras Cir Cardiovasc 2009; 24(2): 180–187.
14. Westerdahl E, Lindmark B, Almgren SO, et al. Chest physiotherapy after coronary artery bypass graft surgery: A comparison of three different deep breathing techniques. J Rehabil Med 2001; 33(2): 79–84.
15. Blumenthal JA, Lett HS, Babyak MA, et al. Depression as a risk factor for mortality after coronary artery bypass surgery. Lancet 2003; 362: 604–609.
16. Burg MM, Benedetto MC, Rosenberg R, et al. Presurgical depression predicts medical morbidity 6 months after coronary artery bypass graft surgery. Psychosom Med 2003; 65: 111–118.
17. Burg MM, Benedetto MC, and Soufer R. Depressive symptoms and mortality two years after coronary artery bypass graft surgery (CABG) in men. Psychosom Med 2003; 65: 508–510.
18. Tully PJ, Baker RA, and Knight JL. Anxiety and depression as risk factors for mortality after coronary artery bypass surgery. J Psychosom Res 2008; 4: 285–290.
19. Tully PJ, Winefield HR, Baker RA, et al. Depression, anxiety and major adverse cardiovascular and cerebrovascular events in patients following coronary artery bypass graft surgery: A five-year longitudinal cohort study. Biopsychosoc Med 2015; 9: 14.
20. Mallik S, Krumholz HM, Lin ZQ, et al. Patients with depressive symptoms have lower health status benefits after coronary artery bypass surgery. Circulation 2005; 111: 271–277.
21. American Thoracic Society/European Respiratory Society. ATS/ERS statement on respiratory muscle testing. Am J Respir Crit Care Med 2002; 166: 518–524.
22. Nilchaikovit T, Lortrakul M, and Phisansuthideth U. Development of Thai version of Hospital Anxiety and Depression Scale in cancer patients. J Psychiatr Assoc Thailand 1996; 41: 18–30.
23. Zigmond A and Snaith R. The Hospital Anxiety and Depression Scale. Acta Psychiatr Scand 1983; 67: 361–370.
24. Bjelland I, Dahl AA, Haug TT, et al. The validity of the Hospital Anxiety and Depression Scale: An updated literature review. J Psychosom Res 2002; 52: 69–77.
25. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implication for policy and intervention strategies. Lancet 2004; 363: 157–163.
26. Cserép Z, Losoncz E, Balog P, et al. A. The impact of preoperative anxiety and education level on long-term mortality after cardiac surgery. J Cardiothorac Surg 2012; 7: 86.
27. Goncalves KKN, Silva JI, Gomes ET, et al. Anxiety in the preoperative period of heart surgery. Rev Bras Enferm 2016; 69(2), 374–380.
28. Jiang W, Kuchibhatla M, Cuffe MS, et al. Prognostic value of anxiety and depression in patients with chronic heart

failure. Circulation 2004; 110(Suppl 22): 3452–3456.

29. Rosenbloom JI, Wellenius GA, Mukamal KJ, et al. Self-reported anxiety and the risk of clinical events and atherosclerotic progression among patients with Coronary Artery Bypass Grafts (CABG). Am Heart J 2009; 158(Suppl 5): 867–873.

30. Rodrigues HF, Furuya RK, Dantas RAS, et al. Association of preoperative anxiety and depression symptoms with postoperative complications of cardiac surgeries. Rev Lat Am Enfermagem 2018; 26: e3107.

31. Geulayov G, Novikov I, Dankner D, et al. Symptoms of depression and anxiety and 11-year all-cause mortality in men and women undergoing coronary artery bypass graft (CABG) surgery. J Psychosom Res 2018; 105: 106–114.

32. Botzet K, Dalyanoglu H, Schäfer R, et al. Anxiety and depression in patients undergoing mitral valve surgery: A prospective clinical study. Thorac Cardiovasc Surg. 2018; 66(7): 530–536.

33. Takagi H, Ando T, Umemoto T; ALICE (All-Literature Investigation of Cardiovascular Evidence) Group. Perioperative depression or anxiety and postoperative mortality in cardiac surgery: A systematic review and meta-analysis. Heart Vessels 2017; 32(12): 1458–1468.

34. Poole L, Ronaldson A, Kidd T, et al. Pre-surgical depression and anxiety and recovery following coronary artery bypass graft surgery. J Behav Med 2017; 40(2): 249–258.

35. Demir R, Zeren M, Gurses HN, et al. Relationship of respiratory muscle strength, pulmonary function, and functional capacity with quality of life in patients with atrial fibrillation. J Int Med Res 2018; 46(1): 195–203.

36. Tsounis D, Ioannidis A, Bouras G, et al. Assessment of health-related quality of life in a Greek symptomatic population with atrial fibrillation: Correlation with functional status and echocardiographic indices. Hell J Cardiol 2014; 55: 475–85.

37. Navarro-García MA, Marín-Fernández B, Carlos-Alegre V, et al. Preoperative mood disorders in patients undergoing cardiac surgery: risk factors and postoperative morbidity in the intensive care unit. Rev Esp Cardiol 2011; 64(11): 1005–1010.

38. Shuldham, C, Goodman H, Fleming S, et al. Anxiety, depression and functional capacity in older women with mitral valve stenosis. Int J Nurs Pract 2001; 7: 322–328.

39. Snowden CP, Prentis J, Jacques B, et al. Cardiorespiratory fitness predicts mortality and hospital length of stay after major elective surgery in older people. Ann Surg 2013; 257(6): 999–1004.

40. Ross R, Blair SN, Arena R, et al., Importance of assessing cardiorespiratory fitness in clinical practice: A case for fitness as a clinical vital sign: a scientific statement from the American Heart Association. Circulation 2016; 134: e653–e699.