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# Depression Screening in Cardiac Surgery Patients

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## Background

Depression is common in patients with ischaemic heart disease and preoperative depression is a risk factor following coronary artery bypass grafting. The American Heart Association recommends depression screening in all patients with heart disease. Our aim was to assess the feasibility and results of a depression screening program in cardiac surgery patients.

## Methods

We introduced a depression screening project at the cardiac surgery department at Karolinska University Hospital and included patients between 2013 and 2016. Patients scheduled for elective surgery received the Patient Health Questionnaire (PHQ-9), a depression screening instrument, by mail approximately 2 weeks before surgery. Urgent patients received the PHQ-9 on the ward. Baseline characteristics, medical history, and medications were collected from patient charts, and entered into a study database together with the results from the PHQ-9 questionnaires.

## Results

During the study period, 2548 patients underwent cardiac surgery; 1133 (45%) completed PHQ-9. The response-rate in patients scheduled for elective surgery was 64%, and 15% in urgent patients. Fifteen per cent had a PHQ-9 score  $\geq 10$  suggestive of major depression. Reporting a PHQ-9 score  $\geq 10$  was twice as common in women as in men (23% vs 12%).

## Conclusions

Systematic depression screening using PHQ-9 in cardiac surgery patients was feasible and not very resource-intensive. The project showed a satisfactory response-rate in elective patients, but adjustments to increase the response-rate in urgent patients are needed. Future studies should investigate if and how patients with symptoms of depression would benefit from depression management.

## Keywords

Depression • Screening • Heart disease • Cardiac surgery

## Introduction

Depression and heart disease are common and serious conditions. The lifetime incidence of depression in the US is predicted to be 12% in men and 20% in women [1]. In patients with cardiac disease approximately 15–20% meet the criteria for major depressive disorder, including patients with congestive heart failure [2,3] or acute coronary syndrome [4]. Preoperative depression has shown to be a significant risk factor for mortality and rehospitalisations following

coronary artery bypass grafting [5,6]. This association between depression and worse prognosis after cardiac surgery indicates that depression may occur before, and continue after, an acute cardiac event. Depression can take different expressions in men and women [7]. If only traditional depression symptoms are taken into account, depression could be underdiagnosed in men [7].

The American Heart Association (AHA) and the US Preventive Services Task Force recommend depression screening in all patients with heart disease [8,9]. It has not been shown that

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screening leads to improved outcomes in cardio-vascular populations, but it is important to assess depression in patients with heart disease because depression is associated with poorer health-related quality of life, and cardiac complaints [10]. To offer treatment and support for depressive symptoms may reduce mortality and increase quality of life [11].

We performed a population-based cohort study to investigate the feasibility of a depression screening program at our institution. Our aim was to assess the feasibility of a depression screening program in cardiac surgery patients using the PHQ-9 as outlined by the AHA Prevention Committee and to evaluate the results separately for men and women.

## Methods

We introduced a depression screening project at the cardiac surgery department at Karolinska University Hospital which was approved by the human research ethics committee in Stockholm (Dnr: 2013/35-31/4). We included patients between 2013 and 2016. The AHA recommended using the two-item Patient Health Questionnaire (PHQ-2), a depression screening instrument [12], patients with a positive PHQ-2 screen would then undergo a nine-item Patient Health Questionnaire (PHQ-9) [13]. The PHQ-9 has been validated in patients with heart disease [13].

In this study, we used the Swedish version of PHQ-9. Patients who were scheduled for elective surgery received the PHQ-9 by mail approximately 2 weeks before surgery. Urgent patients received the PHQ-9 prior to surgery on the ward from the nurse in charge of patient care as part of the standard clinical routine. In addition to the PHQ-9 questionnaire, patients filled out a standard admission form regarding medications, allergies, food preferences, and also four questions related to quality of life. Baseline characteristics, medical history, and medications were collected from patient charts, and entered into a study database together with the results from the PHQ-9 questionnaires, and the four questions from the admission form.

## Patients

All patients above 18 years of age coming to Karolinska University Hospital for heart surgery between 2013 and 2016 were eligible to receive the PHQ-9 as part of routine clinical care.

## Screening Instrument

The PHQ-9 comprises the nine criteria upon which the diagnosis of DSM-IV depressive disorders is based (Supplemental Material). The nine items of PHQ-9 can be scored from 0 (not at all) to 3 (nearly every day) per individual item, and overall scores can range from 0 to 27. A score  $\geq 10$  is considered predictive for a major depression episode with a sensitivity and specificity of 88% [13].

## Statistical Analysis

Baseline characteristics were described with frequencies and percentages for categorical variables and means and

standard deviations for continuous variables. We used t tests for continuous variables and chi-square tests for categorical variables.

## Results

During the study period, 2512 patients underwent cardiac surgery; 1133 (45%) completed PHQ-9 and were included in the study. Among patients scheduled for elective surgery 990/1544 (64%) completed the PHQ-9 questionnaire, and among urgent patients the response rate was 143/968 (15%). Fifteen per cent (166/1133) had a PHQ-9 score  $\geq 10$  suggestive of major depression. Reporting a PHQ-9 score

$\geq 10$  was twice as common in women as in men 23% vs 12% (Table 1). Baseline characteristics of the study population are reported in Table 1. The mean PHQ-scores in screening negative and screening positive patients are shown in Figure 1. The distribution of PHQ-9 total points are shown in Figure 2.

## Screening Negative Patients

Women with a PHQ-9 score  $< 10$  were significantly more worried, sadder, had more difficulty sleeping and had poorer appetite compared to men (Table 2). Screening negative women were also to a greater extent living alone (Table 1). This corresponds well with the significant differences noted in items 3, 5, and 7 of the PHQ-9 between men and women (Figure 3 and Table 3). Item 3 is "Trouble falling or staying asleep, or sleeping too much?", item 5 "Poor appetite or overeating?", and item 7 "Trouble concentrating on things, such as reading the newspaper or watching television?". Item 9 "Thoughts that you would be better off dead, or of hurting yourself in some way?" was, as expected, close to zero in screening negative men and women (Figure 3).

## Screening Positive Patients

In patients reporting a PHQ-9 score  $\geq 10$ , men were significantly younger than women (59.8 vs. 65.4 years;  $p = 0.018$ ) (Table 1). There were no significant differences between men and women with PHQ-9 score  $\geq 10$  regarding worry, poor appetite, sadness, and difficulty sleeping (Table 2). Responses to item 9 did not differ between men and women (Figure 3 and Table 3).

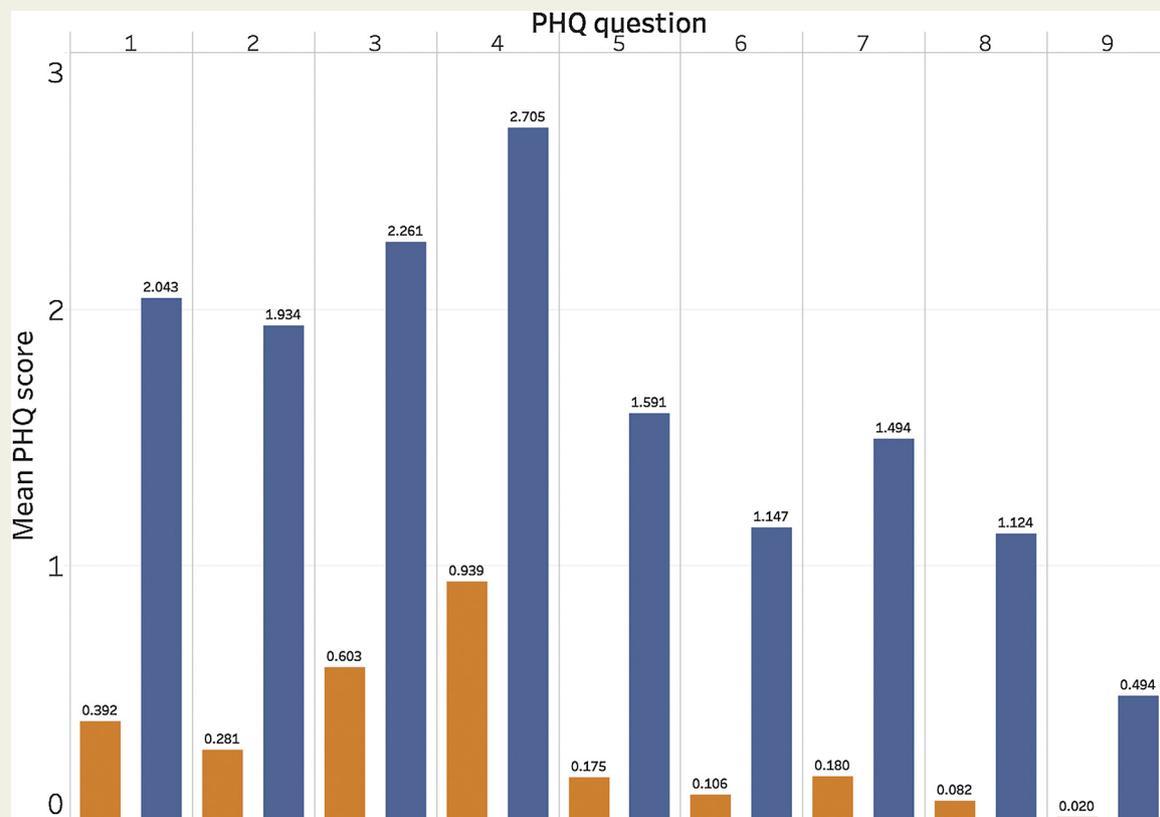
## Discussion

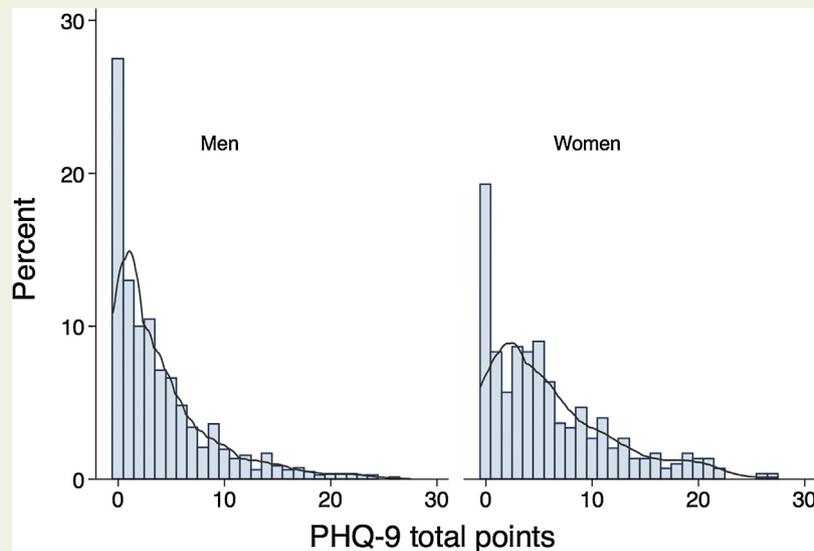
In this population-based prospective cohort study investigating the feasibility of a depression screening program, 64% of all patients scheduled for elective cardiac surgery completed the PHQ-9 screening questionnaire. However, the response rate was considerably lower among urgent patients (15%). We introduced the depression screening program in the clinical care pathway without engaging extra staff, because the aim was to evaluate the feasibility with as little interference with standard practice as possible. We found a

**Table 1** Baseline characteristics in screening negative and screening positive patients, according to sex.

Variable	Screening negative			Screening positive		
	Men	Women	p	Men	Women	p
Number of patients (%)	736 (65%)	232 (20%)		97 (9%)	69 (6%)	
Age, years	65.4 (11.1)	66.6 (12.4)	0.142	59.8 (12.7)	64.5 (11.7)	0.018
Living alone	163 (23%)	93 (42%)	<0.001	22 (24%)	22 (34%)	0.166
Children	501 (72%)	163 (73%)	0.607	71 (79%)	51 (81%)	0.755
Diabetes	118 (16%)	25 (11%)	0.058	18 (20%)	12 (18%)	0.862
History of stroke	19 (3%)	5 (2%)	0.717	3 (3%)	0 (0%)	0.136
Current use of antidepressants or benzodiazepines	6 (1%)	2 (1%)	0.951	3 (4%)	6 (10%)	0.147
Alcohol consumption			0.014			0.048
Never	46 (6%)	24 (11%)		16 (18%)	18 (28%)	
Moderate	637 (90%)	196 (88%)		62 (69%)	45 (69%)	
High	26 (4%)	2 (1%)		12 (13%)	2 (3%)	
Smoking	42 (6%)	16 (7%)	0.498	12 (13%)	11 (17%)	0.498
Type of surgery			<0.001			0.264
Isolated CABG	227 (31%)	26 (11%)		32 (33%)	17 (25%)	
Isolated valve	304 (41%)	129 (56%)		51 (53%)	36 (52%)	
Other	205 (28%)	76 (33%)		14 (14%)	16 (23%)	
Urgent procedure	93 (13%)	24 (10%)	0.361	12 (12%)	10 (14%)	0.691

Abbreviations: CABG, coronary artery bypass graft.

**Figure 1** Mean PHQ-9 score by item in screening negative (orange) and screening positive (blue) patients.



**Figure 2** Distribution of total PHQ-9 points in men and women.

**Table 2** Four questions related to quality of life in screening negative and screening positive patients, according to sex.

Variable	Screening negative			Screening positive		
	Men	Women	p	Men	Women	p
Poor appetite	17 (2%)	18 (8%)	<0.001	16 (18%)	15 (23%)	0.424
Difficulty sleeping	107 (15%)	62 (28%)	<0.001	50 (55%)	40 (62%)	0.411
Worry	179 (25%)	103 (46%)	<0.001	64 (71%)	47 (70%)	0.896
Sadness	67 (9%)	41 (18%)	<0.001	57 (63%)	45 (68%)	0.529

satisfactory response-rate in elective patients, but adjustments to increase the response-rate in urgent patients was needed.

The screening program identified 15% with a PHQ-9 score  $\geq 10$  suggestive of major depression. This is higher than the prevalence rate of depression of 5% in the general population [14], but somewhat lower than other studies reporting a depression frequency of 20–45% in patients with heart disease [15]. Women who screened negative were significantly more worried, sadder, had more difficulty sleeping, and had poorer appetite compared to men. They were also, to a greater extent, living alone compared to men.

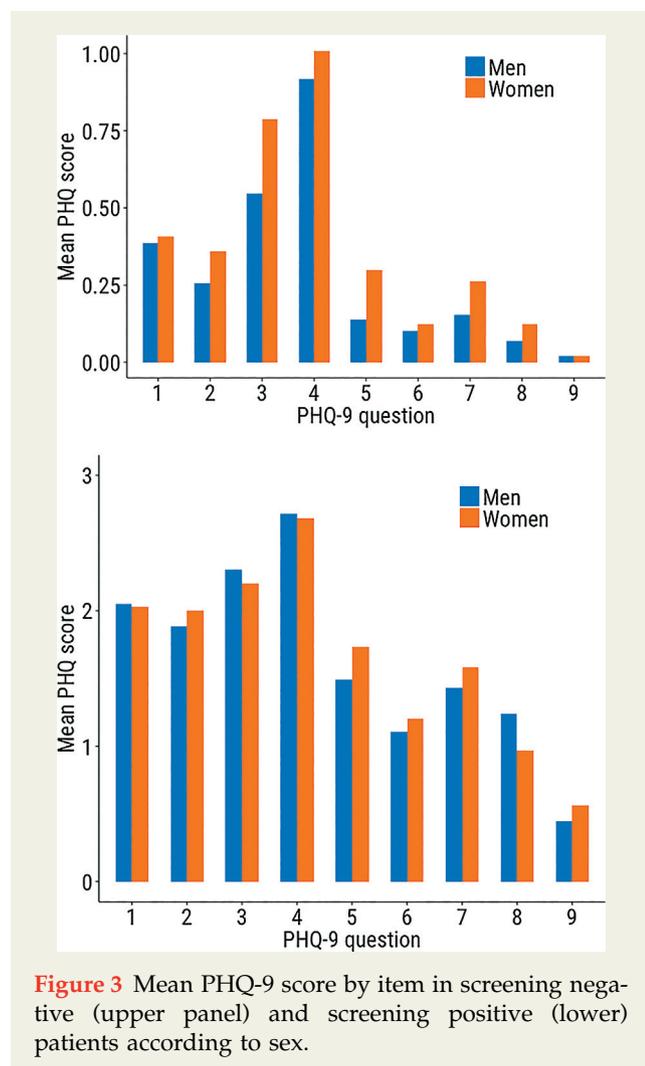
A strength of our study includes the prospective population-based design. The findings from our study should be generalisable, and could be applied in other institutions.

A prior study showed that depression screening using PHQ-2 and PHQ-9 was feasible and not markedly resource-intensive [16]. The researchers captured 73% of patients admitted to three cardiac units in a general hospital. The depression screen was added to the nursing interview and completed as part of routine clinical care [16]. In our study, we did not have the nursing interview,

and we captured 64% of all elective patients. In a study by Caro et al., [17] 561 hospitalised patients with heart disease were consecutively screened with PHQ-2. They found that 13.5% of the patients had a positive depression screen [17]. This is in line with our findings of a positive depression screen rate of 15%.

### Why Screening for Depression in Patients With Heart Disease?

Depression is a disease that can be treated successfully [11] but depression is often unrecognised in patients with cardiovascular disease because symptoms in both conditions often are the same. Therefore, depression screening is important in patients with cardiac disease. An observational multicentre cohort study that enrolled 4062 patients with myocardial infarction showed that patients with treated depression had one-year mortality rates that were not different from patients without depression. However, patients with untreated depression had higher one-year mortality in comparison with patients without depression [11]. Smolderen's study stresses the importance of detecting and treating depression in order to prolong survival and increase quality



**Figure 3** Mean PHQ-9 score by item in screening negative (upper panel) and screening positive (lower) patients according to sex.

of life [7]. This practice is supported by the US Preventive Services Task Force, recommending screening for the general adult population, especially in individuals dealing with chronic diseases [9].

**Table 3** PHQ-9 mean values in screening negative and screening positive patients, according to sex.

PHQ item	Screening negative			Screening positive		
	Male	Women	p	Men	Women	p
1	0.39 (0.77)	0.41 (0.70)	0.727	2.05 (1.00)	2.03 (0.98)	0.883
2	0.26 (0.55)	0.36 (0.57)	0.021	1.89 (1.03)	2.00 (0.97)	0.475
3	0.55 (0.83)	0.79 (0.93)	<0.001	2.30 (0.94)	2.20 (1.04)	0.523
4	0.92 (1.00)	1.01 (0.96)	0.225	2.72 (0.55)	2.68 (0.68)	0.673
5	0.14 (0.44)	0.30 (0.63)	<0.001	1.49 (1.23)	1.74 (1.07)	0.187
6	0.10 (0.36)	0.12 (0.42)	0.429	1.11 (1.04)	1.20 (1.21)	0.586
7	0.15 (0.46)	0.26 (0.61)	0.004	1.43 (1.15)	1.58 (1.18)	0.423
8	0.07 (0.32)	0.12 (0.48)	0.049	1.24 (1.14)	0.97 (1.08)	0.136
9	0.02 (0.15)	0.02 (0.15)	0.789	0.44 (0.83)	0.57 (0.93)	0.376

## Differences Between Men and Women

We found that a positive depression screen was twice as common in women as in men. This is in line with prior knowledge [18]. It has been argued that depression takes different shapes in men and women [7]. Traditional depressive symptoms (e.g. sadness, crying) may not be in line with societal ideals of masculinity. Therefore, men might be reluctant to report experiencing these symptoms. Another explanation could be that depression symptoms men are experiencing (e.g. anger or somatic symptoms, irritability, risk-taking behaviours, and substance abuse) are not included in traditional diagnostic criteria [7]. The PHQ-9 has been validated in both men and women [13].

A noteworthy finding in our study was that among screening negative patients, women reported significantly more worry, poorer appetite, sadness, and difficulty sleeping compared to men. Among screening positive patients, there was no difference between men and women regarding these symptoms.

## Study Limitations

Although the response-rate among elective patients was satisfactory (64%), the total response rate was 45%, and the response rate among urgent patients was low (15%).

There might be several explanations for this. Urgent patients may not have the time or energy to fill out a questionnaire or nurses on the ward might not have had the time to distribute the questionnaire. One way to improve the response rate could be to include the PHQ-9 questionnaire in a preoperative admission interview. Rates of positive depression screens were 15%, which is somewhat lower than other studies reporting a depression frequency of 20–45% in patients with heart disease [15,19], but in line with other large epidemiologic studies of major depression among cardiac surgery patients [5,6].

## Conclusions

Systematic depression screening using PHQ-9 in cardiac surgery patients was feasible and not very resource-intensive. The project showed a satisfactory response-rate in elective patients, but adjustments to increase the response-rate in urgent patients is needed. Future studies should further investigate how patients with symptoms of depression would benefit from depression management.

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## Conflict of Interest Disclosures

None.

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