Neglected cardiovascular risk factors: Relationship of anxiety and depression with percutaneous coronary angioplasty

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Abstract

Introduction: Coronary artery disease (CAD) is the leading cause of mortality in Malaysia. Psychological risk factors are associated with detrimental outcomes in CAD. Our study aimed to evaluate procedural anxiety and depression levels among subjects who underwent coronary angioplasty.

Methods: A single-centre prospective cohort study was conducted on patients electively admitted to a tertiary hospital in Malaysia for percutaneous coronary intervention (PCI) over a half-year period. The Hospital Anxiety and Depression Scale (HADS) and the EuroQol-5 Dimension (EQ5D) Health Questionnaire were used to evaluate subjects’ psychological statuses. The EQ Visual Analogue Scale was used for the global assessment of their health.

Results: The analysis included 65 patients with a mean age of 63 years from a predominately educated population (n=54; 83.1%). Before the PCI procedure, female sex was found to be protective against depression, with an odds ratio (ORs) of 0.29 (95% confidence interval (CI) 0.08–1.03). A high level of education was protective against anxiety (OR=0.21; 95% CI 0.06–0.83). After the PCI, females were more likely to be depressed (OR=3.89; 95% CI 1.13–13.37), and those of Malay ethnicity were more likely to experience anxiety (OR=4.2; 95% CI 1.03–17.07). Using the HADS, subjects were significantly less anxious and depressed (pre-PCI: median (IQR) score=4 (7.0)); post-PCI: median (IQR) score=3 (5.0), measured by the HADS. Using the EQ5D, subjects had an improved mean VAS score (post-PCI: 75 ± 14.9; pre-PCI: 68 ± 12.6; p<0.05).

Conclusions: PCI may predispose patients with CAD to psychological stressors. Female patients and those of Malay ethnicity are more likely to experience psychological stress. Being highly educated is protective against such stress.

Keywords
Coronary artery diseases, cardiovascular risk factor, psychology, depression, percutaneous coronary angiogram

Introduction

Cardiovascular diseases, which include coronary artery disease (CAD), have been the leading cause of morbidity and mortality in Malaysia and globally. Conventional risk factors for CAD include hypertension, diabetes mellitus, dyslipidaemia, cigarette smoking and a family history of CAD. Although the majority (85.6%) of patients with CAD present with at least one conventional risk factor, a sizeable population (14.4%) do not present with any of the five risk factors. Other risk factors include obesity, sedentary lifestyle, psychological illness and elevated serum high-sensitivity C-reactive protein and coronary artery calcium score. Establishing these risk factors would provide highly comprehensive clinical risk strata and therefore enable better management of these patients.
The emergence of depression, anxiety and chronic psychosocial stress is associated with a determinantal outcome towards CAD, which is often overlooked by clinicians.\textsuperscript{5,6} The disease progression is believed to be mediated by heart rate variability, endothelial inflammation and impaired myocardial perfusion linked to mental stress, such as depression and anxiety.\textsuperscript{7,8} A paucity of knowledge exists regarding the level of perfusion linked to mental stress, such as depression and variability, endothelial inflammation and impaired myocardial disease progression is believed to be mediated by heart rate (HADS-D) over the past two weeks.\textsuperscript{9}

Little is known about which baseline characteristics in Malaysian patients are associated with mental stresses before and after a procedure. The objective of this study is to evaluate the procedural anxiety level among subjects who underwent CAG or PCI. We aimed to elucidate the clinical characteristics that could be attributed to high anxiety levels, which may in turn be associated with poor clinical outcomes in patients with CAD.

**Methods**

**Subjects**

The study was a prospective single-centre cohort study conducted at the Cardiology Unit, University of Malaya Medical Centre, between June 2020 and December 2020. All the patients aged $\geq$ 18 years who underwent CAG or PCI were recruited into the study. We defined ‘elective’ PCI as all PCI procedures that were not to be delivered urgently within 24 hours of myocardial infarction, excluding patients with ST-Elevation myocardial infarction (STEMI), where PCI treatment should be delivered in a timely fashion. Elective PCI cases were further classified into two main groups: (a) elective outpatient (clinic) admissions, where the decision to admit made in clinic visits precedes the time of actual admission to hospital; and (b) elective inpatients/ad hoc PCI cases, where the decision for PCI was made after the actual admission and schedule for PCI as inpatients after 24 hours. A total of 100 elective cases for CAG or PCI who consented to participate in the study by written consent were subsequently enrolled. Exclusion criteria included a history of at least one of the following: any psychological disorder; valvular heart diseases, heart failure, stroke or cognitive impairment. The patients were interviewed the day before the elective angiogram and the day after the angiogram for psychological tests. Demographics, clinical data on cardiac evaluation and laboratory investigation were documented at the initial interview. The details of the CAG findings and intervention done were recorded on the day of PCI.

**Assessment of anxiety and depression**

Hospital Anxiety and Depression Scale. The Hospital Anxiety and Depression Scale (HADS) is a 14-item self-reported questionnaire developed as a screening tool in the assessment of anxiety and a depressive state in non-psychiatric departments. The HADS comprises four-point Likert-scale items evaluating the presence of anxiety (HADS-A) and depression (HADS-D) over the past two weeks.\textsuperscript{10} Items in the HADS-A and HADS-D are summed up to a total score of 21 each. HADS-A has an optimal cut-off of $\geq$8 (sensitivity 0.89; specificity 0.75), and HADS-D has an optimal cut-off of $\geq$8 (sensitivity 0.80; specificity 0.88). Both scales correlate to generalised anxiety disorder and major depressive episodes. The HADS Malay version has been validated and utilised for good understanding by the Malaysian population.\textsuperscript{10}

**EuroQol-5 Dimension Health Questionnaire.** The EuroQol-5 Dimension Health Questionnaire (EQ5D) is a widely used generic quality-of-life scale to measure health outcomes and has two parts. The EQ-SD-5L self-classifier comprises five questions involving mobility, self-care, pain, usual activities and psychological status. Patients are required to describe their health in the level of problems classified as ‘no’, ‘some’ or ‘extreme’ for each of the five categories. The EQ Visual Analogue Scale (EQ VAS) is a vertical analogue scale with values between 0 (the worst imaginable health) to 100 (the best imaginable healthy); it is focused on providing a global assessment of patient health.\textsuperscript{11}

Following the psychological test, the patients underwent elective CAG or PCI, as planned. The HADS and EQ5D questionnaires are provided in the Supplemental Material.

**Analytical methods**

Statistical analysis was performed using IBM SPSS Statistics for Windows v24 (IBM Corp., Armonk, NY). Normality was tested using a Shapiro–Wilk test. Qualitative and quantitative demographic data are presented in tabulated and graphical format. From the results, sensitivity and specificity study were calculated. Discrete variables were analysed using a chi-square test, and normally distributed continuous variables were analysed with an independent t-test. Data that were not normally distributed were analysed using a Mann–Whitney U-test. For the correlation test, either Spearman or Pearson correlation tests were performed, depending on the data collected.

**Results**

**General characteristics**

All patients who consented ($n=100$) and who were electively admitted for CAG or PCI were initially recruited. Sixty-five subjects were subsequently enrolled and analysed, whereas 35 patients were excluded due to the presence of at least one of the exclusion criteria upon further history taking and reassessment in the ward. The participants had a mean age of 63 $\pm$ 10.7 years and were predominately male (male-to-female ratio 1:0.3). The majority of the sampled population were of Malay ethnicity ($n=36; 55.4\%$), married ($n=54; 83.4\%$) and had secondary or tertiary education ($n=54; 83.1\%$). Just under half ($n=10; 45.5\%$) had a middle-class income, which is defined as monthly income of more than 4000 Malaysian Ringgit. The study population had at least one of the following conventional cardiovascular risk factors: dyslipidaemia ($n=59; 90.8\%$), followed by hypertension ($n=50; 76.9\%$), active or ex-smoker ($n=44; 67.3\%$) and diabetes mellitus ($n=30; 46.2\%$). Details on the demographic breakdown are shown in Supplemental Table S1.
Determination of factors associated with symptoms of anxiety and depression before and after PCI

A univariate analysis of risk factors was conducted to evaluate the correlation of anxiety and depression with the following baseline characteristics as independent variables: age, sex, race, education, smoking, diabetes mellitus, dyslipidaemia and hypertension. The analysis indicated that females were less likely to be depressed before the procedure ($p=0.047$, odds ratio (OR)=0.29, 95% confidence interval (CI) 0.08–1.03) compared to males. As shown in Table 1, subjects with hypertension were less likely to be depressed than those without hypertension ($p=0.047$, OR=0.29, 95% CI 0.08–1.03). The type of PCI was significantly associated with depressive symptoms before the procedure. Elective PCI cases were significantly associated with more depressive symptoms ($n=9; 40.9%$; $p=0.046$) compared to ad hoc PCI cases ($n=2; 9.5%$). Furthermore, a higher level of education, which was defined as secondary school and above, was identified as a protective factor against preoperative anxiety ($p=0.03$, OR=0.21, 95% CI 0.06–0.83). However, the level of education did not confer any significance for preoperative depressive symptoms (Table 2).

As shown in Table 3, females were three times more likely to develop depression following the PCI than males were ($p=0.03$, OR=3.89, 95% CI 1.13–13.37). Patients of Malay ethnicity were four times more likely to be anxious after the procedure compared to other races in Malaysia ($p=0.04$, OR=4.2, 95% CI 1.03–17.07). The other factors were found not to be significantly associated with depressive or anxiety symptoms after PCI (Table 4).

HADS score over time

Subjects were found to be clinically less anxious and depressive following PCI compared to before PCI, as evidenced by a statistically significant reduction of scores on median depressive and anxiety symptoms (Wilcoxon signed rank test). Seventeen (26.1%) patients were clinically anxious before PCI, and only 14 (21.5%) patients were clinically anxious following PCI. HADS scores showed a statistically significant decline in anxiety level (pre-PCI: median (IQR) score=4 (7.0); post-PCI: median (IQR) score=3 (5.0); $p=0.02$).

Furthermore, more subjects ($n=18; 27%$) had depression after PCI compared to before PCI ($n=14; 21.5%$). However, HADS median scores showed a significant decline in depression level (pre-PCI: median (IQR) score=5 (4.5); post-PCI: median (IQR) score=4 (3.3); $p=0.006$). The results of the psychological test using HADS are shown in Table 5.

EQ-5D-5L and EQ VAS scores over time

The quality-of-life outcome was measured before and after PCI based on the EQ-5D-5L. Results showed an improvement in patients' mobility following PCI (79.6%) relative to before PCI (76.9%). The subjects experienced less anxiety and depression after PCI, with 85.2% reporting no symptoms, compared to before PCI (67.7%). The mean current health VAS score improved significantly following PCI with a score of 75±14.9, compared to before PCI with a score of 68±12.6 ($p<0.005$; Tables 5 and 6).

### Table 1. Association between patient background and abnormal depressive symptoms before PCI.

| Factor                  | Depressive symptoms before PCI | p-Value | Crude OR (95% CI)$^a$ |
|-------------------------|--------------------------------|---------|-----------------------|
|                         | Normal ($n$ | %) | Abnormal ($n$ | %) |                     |
| Age (SD)                | 62 | 11.1 | 65 | 8.7 | 0.33$^b$ | 1.03 (0.97–1.10) |
| Sex                     | 9 | 60.0 | 6 | 40.0 | 0.047 | 0.29 (0.08–1.03) |
| Ethnicity               | Non-Malay 23 | 79.3 | 6 | 20.7 | 0.88 | 1 |
|                         | Malay | 28 | 77.8 | 8 | 22.2 | 1.10 (0.33–3.61) |
| Education               | Primary and below 9 | 81.8 | 2 | 18.2 | 1.00 | 1 |
|                         | Secondary and above 42 | 77.8 | 12 | 22.2 | 1.29 (0.24–6.77) |
| Marital status          | Married 41 | 75.9 | 13 | 24.1 | 0.47$^c$ | 1 |
|                         | Single 4 | 100.0 | 0 | 0.0 | – |
| Smoking                 | Former 17 | 81.0 | 4 | 19.0 | 0.76$^c$ | 1 |
|                         | Never 27 | 75.0 | 9 | 25.0 | 1.42 (0.38–5.33) |
|                         | Yes 7 | 87.5 | 1 | 12.5 | 0.61 (0.06–6.44) |
| Alcohol intake          | No 46 | 76.7 | 14 | 23.3 | 0.58$^c$ | 1 |
|                         | Yes 22 | 73.3 | 8 | 26.7 | 0.35 | 1.76 (0.53–5.81) |
| Diabetes mellitus       | Yes 48 | 81.4 | 11 | 18.6 | 0.11 | 0.23 (0.04–1.29) |
| Dyslipidaemia           | Yes 42 | 84.0 | 8 | 16.0 | 0.047 | 0.29 (0.08–1.03) |
| Hypertension            | Yes 42 | 84.0 | 8 | 16.0 | 0.047 | 0.29 (0.08–1.03) |

Statistically significant $p$-values ($p<0.05$) are shown in bold.

$^a$Simple logistic regression.

$^b$Independent sample $t$-test.

$^c$Fisher’s exact test.

PCI: percutaneous coronary intervention; OR: odds ratio; CI: confidence interval; SD: standard deviation.
CAD is the leading cause of mortality in Malaysia and worldwide. Contemporary cardiology excels at managing conventional cardiac risk factors as primary or secondary prevention strategies. Non-conventional cardiac risk factors, such as anxiety and depression, which may contribute to detrimental outcomes, are often overlooked. Addressing these non-conventional cardiac risk factors may provide added benefits to the clinical outcome of CAD patients.

Table 2. Association between patient background and abnormal anxiety symptoms before PCI.

| Factor                     | Anxiety symptoms before PCI | p-Value | Univariate OR (95% CI)* |
|----------------------------|----------------------------|---------|-------------------------|
|                            | Normal | Abnormal |                      |
| Gender (SD)                | 11.3   | 8.3      | 0.20b                 | 1.04 (0.98–1.10) |
| Sex                        | Female | 60.0     | 40.0                  | 0.16       | 2.37 (0.69–8.09) |
| Malay                      | 72.4   | 27.6     | 0.81                  | 1          |
| Malay                      | 75.0   | 25.0     | 0.88                  | (0.29–2.66) |
| Education                  | Primary and below | 45.5 | 54.5 | 0.03 |
| Marital status             | Married | 72.2 | 27.8 | 0.85c |
| Single                     | 75.0   | 1      | 25.0                  | 0.87       | (0.08–9.00) |
| Divorced                   | 85.7   | 1      | 14.3                  | 0.43       | (0.05–3.91) |
| Smoking                    | Former | 71.4 | 28.6 | 0.95 |
| Never                      | 75.0   | 25.0     | 0.83                  | 0.13–5.35) |
| Smoking                    | Yes | 80.0  | 20.0     | 1.00c |
| Never                      | 75.0   | 25.0     | 0.83                  | 0.25–2.80) |
| Alcohol intake             | No | 50.0  | 50.0     | 0.26 |
| Yes                        | 88.4  | 11.6     | 0.61                  | 0.09–1.45 |
| Diabetes mellitus          | Yes | 57.7  | 42.3     | 0.08 |
| Dyslipidaemia              | Yes | 69.8  | 30.2     | 0.87c |
| Hypertension               | Yes | 70.5  | 29.5     | 0.78 |

Statistically significant p-values (p<0.05) are shown in bold.
*Simple logistic regression.
bIndependent samples t-test.
cFisher’s exact test.

Table 3. Association between patient background and abnormal depressive symptoms following PCI.

| Factor                     | Depressive symptoms after PCI | p-Value | Univariate OR (95% CI)* |
|----------------------------|-------------------------------|---------|-------------------------|
|                            | Normal | Abnormal |                      |
| Gender (SD)                | 9.8    | 12.1     | 0.27c                 | 3.89 (1.13–13.37) |
| Sex                        | Female | 46.7  | 53.3     | 0.03      |
| Malay                      | 70.4   | 29.6     | 0.89                  | 1          |
| Malay                      | 68.8   | 31.3     | 1.08 (0.35–3.29) |
| Marital status             | Married | 71.4 | 28.6 | 0.55c |
| Single                     | 75.0   | 1      | 25.0                  | 0.83       | (0.08–8.71) |
| Widowed/widower            | 50.0   | 0      | 50.0                  | 2.5        | (0.45–13.91) |
| Education                  | Primary and below | 50.0 | 50.0 | 0.26 |
| Secondary and above        | 73.5   | 26.5     | 0.36                  | 0.09–1.45 |
| Smoking                    | Former | 68.4  | 31.6     | 0.61 |
| Never                      | 66.7   | 33.3     | 1.08                  | 0.32–3.63 |
| Yes                        | 85.7   | 1      | 14.3                  | 0.36       | (0.04–3.70) |
| Alcohol intake             | No | 67.3  | 32.7     | 0.17c |
| Diabetes mellitus          | Yes | 57.7  | 42.3     | 0.08 |
| Dyslipidaemia              | Yes | 69.8  | 30.2     | 0.87c |
| Hypertension               | Yes | 70.5  | 29.5     | 0.78 |

Statistically significant p-values (p<0.05) are shown in bold.
*Simple logistic regression.
*Independent samples t-test.
*Fisher’s exact test.

Discussion

CAD is the leading cause of mortality in Malaysia and worldwide. Contemporary cardiology excels at managing conventional cardiac risk factors as primary or secondary prevention strategies. Non-conventional cardiac risk factors, such as anxiety and depression, which may contribute to detrimental outcomes, are often overlooked. Addressing these non-conventional cardiac risk factors may provide added benefits to the clinical outcome of CAD patients.

The disease burden of depression is significantly higher in females than in males in the general population, consistent
with the prevalence of depression observed in the CAD population.12 Several examples in the literature have postulated that psychosocial factors, sex role factors and biological factors (i.e. hormonal) are the main contributors to the higher prevalence of depression among women than among men with CADs. Differences in behavioural and coping mechanisms, lack of social support, social integration and marital stress may be the main contributory factors to depression in women.13–15 The present study showed that sex was associated with anxiety and depressive symptoms both before and after PCI. Delewi et al. reported that their female study population had a significantly higher anxiety score before PCI, and this remained after PCI and upon hospital discharge compared to males.16 Conversely, we found that females had 71% lower odds of developing depressive symptoms before the procedure than their male counterparts, but they were three times more likely to be depressive following the procedure.

Malaysia and Singapore have diverse multi-ethnic societies, namely, Malay, Chinese, Indian and other ethnicities. Our study reported that Malay ethnicity is one of the strongest predictors of anxiety after PCI, with a four-times likelihood of anxiety after PCI compared to other races. However, various published studies have shown an inconclusive association between race and anxiety following PCI, citing no significant association found between race and anxiety.17,18

| Table 4. Association between patient background and abnormal anxiety symptoms after PCI. |
|---------------------------------|--------------------------------|---------------------------------|
| Factor                          | Anxiety symptoms after PCI | p-Value | Univariate OR (95% CI) |
|                                 | Normal | Abnormal | | |
| M (SD)                          | n      | %       | n      | %     |
| Sex                             | Female | 12 80.0 | 3 20.0 | 0.69 | 0.75 (0.18–3.16) |
| Ethnicity                       | Non-Malay | 24 88.9 | 3 11.1 | 0.04 | 1 |
| Marital status                  | Married | 38 77.6 | 11 22.4 | 0.84 | 1 |
| Education                       | Primary and above | 6 60.0 | 4 40.0 | 0.23 | 1 |
| Smoking                         | Former | 14 73.7 | 5 26.3 | 0.87 | 1 |
| Alcohol intake                  | No | 41 74.5 | 14 25.5 | 0.25 | 1 |
| Diabetes mellitus               | Yes | 17 65.4 | 9 34.6 | 0.08 | 2.96 (0.85–10.33) |
| Dyslipidaemia                   | Yes | 40 75.5 | 13 24.5 | 0.67 | 1.63 (1.17–15.21) |
| Hypertension                    | Yes | 32 72.7 | 12 27.3 | Yes | 2.44 (1.48–12.44) |

| Statistically significant p-values (p<0.05) are shown in bold. |
| Simple logistic regression. |
| Independent samples t-test. |
| Fisher’s exact test. |

| Table 5. Difference in HADS symptoms score and EQSD VAS score before and after PCI. |
|---------------------------------|---------------------------------|
| Outcome                         | Before PCI | After PCI | p-Value |
| HADS                            |            |            |         |
| Depressive symptoms score, median (IQR) | 5 (4.5) | 4 (6.3) | 0.006* |
| Anxiety symptoms score, median (IQR) | 4 (7.0) | 3 (5.0) | 0.02* |
| EQSD                            |            |            |         |
| Current health VAS, M (SD)      | 68 (12.6) | 75 (14.9) | 0.006* |

| Statistically significant p-values (p<0.05) are shown in bold. |
| Wilcoxon signed rank test. |
| Paired t-test. |

HADS: Hospital Anxiety and Depression Scale; EQSD: EuroQol-5 Dimension; VAS: visual analogue scale; IQR: interquartile range.
non-PCI-enabled centres around the nation, leading to long waiting lists for PCI interventions in the government sector.21 The CAD cases in our centre were triaged to the following based on the urgency of PCI intervention (in order): STEMI for primary PCI, NSTEMI for PCI, angina pain (unstable/stable) and diagnostic coronary angiography. The elective cases scheduled for PCI from the outpatient clinic were typical of lower priority for PCI than elective ad hoc cases, comprising cases admitted for acute coronary syndrome (i.e. NSTEMI/unstable angina), which may benefit from early PCI intervention. Our study concluded that elective PCI cases were significantly associated with more depressive symptoms than elective ad hoc cases. We postulate that the longer waiting period required for elective outpatient cases preceded the intervention, which may heighten the stress, anxiety and depressive symptoms of the subjects, as they might be fearful of the procedure and feel uncertain of the outcome of their illness. Bengtson et al. suggested a strong association between anxiety and depression with the severity of angina pain and the uncertainty of the waiting period in a cohort awaiting coronary revascularisation.22 The literature on patients with CAD waiting for coronary artery bypass surgery reports that angina symptoms, uncertainty about the waiting period for intervention, physical limitation due to CAD and dissatisfaction with the quality of health services are sources of anxiety.23,24

Table 6. Quality of life before and after PCI based on the EQ-SD-5L

| Quality-of-life outcome | Before PCI | After PCI |
|------------------------|-----------|-----------|
|                        | n  | %    | n  | %    |
| Mobility               |    |       |    |       |
| No problem             | 50 | 76.9  | 43 | 79.6  |
| Slight problem         | 15 | 23.1  | 9  | 16.7  |
| Moderate problems      | 0  | 0.0   | 2  | 3.7   |
| Self-care              |    |       |    |       |
| No problem             | 64 | 98.5  | 53 | 98.1  |
| Slight problem         | 1  | 1.5   | 1  | 1.9   |
| Moderate problems      | 0  | 0.0   | 0  | 0.0   |
| Usual activities       |    |       |    |       |
| No problem             | 60 | 92.3  | 46 | 85.2  |
| Slight problem         | 5  | 7.7   | 8  | 14.8  |
| Moderate problems      | 0  | 0.0   | 0  | 0.0   |
| Pain/discomfort        |    |       |    |       |
| No problem             | 45 | 69.2  | 30 | 55.6  |
| Slight problem         | 18 | 27.7  | 22 | 40.7  |
| Moderate problems      | 2  | 3.1   | 2  | 3.7   |
| Anxiety/depression     |    |       |    |       |
| No problem             | 44 | 67.7  | 46 | 85.2  |
| Slight problem         | 19 | 29.2  | 6  | 11.1  |
| Moderate problems      | 2  | 3.1   | 2  | 3.7   |

Conclusions

The study concluded that PCI predisposes patients with CAD to experience psychological stressors, such as anxiety and depression. Female sex and Malay ethnicity were more significantly associated with psychological stress after PCI, whereas a higher education level appeared to be protective. Physicians should adopt multidisciplinary approaches in managing patients with CAD by targeting interventions on the psychological aspect, which is the non-conventional cardiovascular risk factor, and the conventional ones. General screening following PCI enables the identification of patients vulnerable to psychological stress. A simplified and comprehensive explanation of the procedure should be offered, especially to the less educated population. Social support from caregivers and society needs to be emphasised in physicians’ daily practices.

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M.F., B.H., K.S.W.S., M.B.M.F. and I.B.Z.A. conceptualised the design of the study. S.K.W.W. and E.B.M.A. contributed to the acquisition and analysis of the data. M.F.B.H. and K.S.W.S. drafted and interpreted the data for the initial manuscript. M.F.B.H., K.S.W.S., M.B.M.F. and I.B.Z.A. reviewed and revised the intellectual content of the manuscript. All authors read and approved the final manuscript.

Availability of data and materials
The data used in the literature review are available from the corresponding author on reasonable request.

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Supplemental material
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References
1. GBD 2017 Causes of Death Collaborators. 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. Omar A, Ganapathy SS, Anuar MFM, et al. Cause-specific mortality estimates for Malaysia in 2013: results from a national sample verification study using medical record review and verbal autopsy. BMC Public Health 2019; 19: 110.
3. Canto JG, Kiefte CI, Rogers WJ, et al. Number of coronary heart disease risk factors and mortality in patients with first myocardial infarction. JAMA 2011; 306: 2120–2127.
4. Lin JS, Evans CV, Johnson E, et al. Nontraditional risk factors in cardiovascular disease risk assessment: updated evidence report and systematic review for the US Preventive Services Task Force. JAMA 2018; 320: 281–297.
5. Carney RM, Freedland KE and Jaffe AS. Depression as a risk factor for coronary heart disease mortality. Arch Gen Psychiatry 2001; 58: 229–230.
6. Barth J, Schumacher M and Herrmann-Lingen C. Depression as a risk factor for mortality in patients with coronary heart disease: a meta-analysis. Psychosom Med 2004; 66: 802–813.
7. Burg MM, Meadows J, Shimbo D, et al. Confluence of depression and acute psychological stress among patients with stable coronary heart disease: effects on myocardial perfusion. J Am Heart Assoc 2014; 3: e000898.
8. Munk PS, Ibsken K, Brønneck K, et al. Symptoms of anxiety and depression after percutaneous coronary intervention are associated with decreased heart rate variability, impaired endothelial function and increased inflammation. Int J Cardiol 2012; 158: 173–176.
9. Zigmond AS and Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand 1983; 67: 361–370.
10. Yahya F, Othman and Zahiruddin. Validation of the Malay version of Hospital Anxiety and Depression Scale (HADS) in Hospital Universiti Sains Malaysia. Int Med J 2015; 22: 80–82.
11. Olsson I, Mykletem A and Dahlo AA. The hospital anxiety and depression rating scale: a cross-sectional study of psychometrics and case finding abilities in general practice. BMC Psychiatry 2005; 5: 46.
12. Shankmugasegaram S, Russell KL, Kovacs AH, et al. Gender and sex differences in prevalence of major depression in coronary artery disease patients: a meta-analysis. Maturitas 2012; 73: 305–311.
13. Naqvi TZ, Naqvi SS and Merz CN. Gender differences in the link between depression and cardiovascular disease. Psychosom Med 2005; 67: 515–518.
14. Titubos AN, Brähler E, Ernst M, et al. Course of depressive symptoms in men and women: differential effects of social, psychological, behavioral and somatic predictors. Sci Rep 2019; 9: 18929.
15. Kristofferzon ML, Löfmark R and Carlsson M. Myocardial infarctions: gender differences in coping and social support. J Adv Nurs 2003; 44: 360–374.
16. Delewri R, Vlaistra W, Rohling WJ, et al. Anxiety levels of patients undergoing coronary procedures in the catheterization laboratory. Int J Cardiol 2017; 228: 926–930.
17. Eng HS, Yean LC, Das S, et al. Anxiety and depression in patients with coronary heart disease: a study in a tertiary hospital. Iran J Med Sci 2011; 36: 201–206.
18. Yeoh SH, Tam CL, Wong CP, et al. Examining depressive symptoms and their predictors in Malaysia: stress, locus of control, and occupation. Front Psychol 2017; 8: 1411.
19. Gu G, Zhou Y, Zhang Y, et al. Increased prevalence of anxiety and depression symptoms in patients with coronary artery disease before and after percutaneous coronary intervention treatment. BMC Psychiatry 2016; 16: 259.
20. Qin S, Gu Y and Song T. Effect of peer support on patient anxiety during the coronary angiography or percutaneous coronary intervention perioperative period: a protocol for a systematic review and meta-analysis of randomised controlled trials. BMJ Open 2020; 10: e031952.
21. Lee KY, Ong TK, Low EV, et al. Cost of elective percutaneous coronary intervention in Malaysia: a multicentre cross-sectional costing study. BMJ Open 2017; 7: e014307.
22. Bengtson A, Herlitz J, Karlsson T, et al. Distress correlates with the degree of chest pain: a description of patients awaiting revascularisation. Heart 1996; 75: 257–260.
23. Fitzsimons D, Parahoo K, Richardson SG, et al. Patient anxiety while on a waiting list for coronary artery bypass surgery: a qualitative and quantitative analysis. Heart Lung 2003; 32: 23–31.
24. McCormick KM, Naimark BJ and Tate RB. Uncertainty, symptom distress, anxiety, and functional status in patients awaiting coronary artery bypass surgery. Heart Lung 2006; 35: 34–45.
25. Chaudhury S and Srivastava K. Relation of depression, anxiety, and quality of life with outcome after percutaneous transluminal coronary angioplasty. Sci World J 2013; 2013: 465979.