ISSN 2304-3415, Russian Open Medical Journal
2025. Volume 14. Issue 4 (December). Article CID e0408
DOI: 10.15275/rusomj.2025.0408

Original article

Psychological Distress in Patients with Chronic Coronary Syndrome: Features of Coping Strategies and Cognitive Appraisal in Depression and Type D Personality

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Received 28 April 2025, Revised 6 June 2025, Accepted 5 August 2025

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Abstract: Psychological distress is associated with a poor prognosis in patients with coronary artery disease (CAD). The development of specific coping strategies is preceded by a cognitive appraisal of a stressful situation. This study aimed to examine the relationship between cognitive appraisal, coping strategies, Type D personality, and depression levels in patients with chronic coronary syndrome.
Material and methods — A total of 209 patients with CAD were enrolled. In addition to clinical evaluation and medical-history data, patients completed questionnaires to assess Type D personality (DS-14), depression (Hospital Anxiety and Depression Scale, HADS), coping strategies (Ways of Coping Questionnaire, WCQ) and cognitive appraisal of stressful situations (criteria for assessing the complexity of a life situation and types of orientation in a difficult situation). Patients were divided into groups based on the presence or absence of Type D personality and depression.
Results — Patients with depression had lower scores on the *Positive reappraisal* coping strategy compared to those without depression (p=0.03); no differences in coping strategies were found between patients with and without Type D personality. Patients with Type D personality were characterized by more frequent appraisals of situations as uncontrollable (p=0.003) and ambiguous (p=0.026), a focus on losses in difficult situations (p < 0.001), orientation towards obstacles (p=0.009), and inactivity (p=0.019). The depression group was characterized by a greater threat for the future (p=0.026), and simultaneously a less pronounced striving for difficulties (p=0.023) and a weaker focus on opportunities (p=0.008).
Conclusion — In CAD patients, differences in cognitive appraisal and coping strategies for stress were revealed according to presence of Type D personality and depression. The most pronounced differences in cognitive appraisal were observed in patients with Type D personality, who more frequently perceived situations as uncontrollable and incomprehensible, focused on losses, and exhibited avoidance and inactivity.

Keywords: type D personality, coping strategies, depression, stress, cognitive appraisal, coronary artery disease.

Cite as Sumin AN, Shcheglova AV, Anchkova MI, Fedorova DN, Prokashko IYu. Psychological distress in patients with chronic coronary syndrome: Features of coping strategies and cognitive appraisal in depression and Type D personality. *Russian Open Medical Journal* 2025; 14: e0408.

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Introduction

Psychosocial stress is a recognized risk factor for the development and progression of cardiovascular disease [1-4]. Psychosocial stressors may precipitate either acute episodes of psychological distress (e.g., anxiety, depression) or induce chronic stress that contributes to the development of enduring personality traits [1, 5]. In recent years, increasing attention has been paid to the Type D (distressed) personality construct, which is characterized by a predisposition to the psychological distress. This personality type is characterized by the combination of negative affectivity (a tendency to experience negative emotions) and social inhibition (the suppression of self-expression in social interactions) [6].

Individuals with Type D personality are not only more vulnerable to depressive reactions, but this personality construct itself has been identified as an independent risk factor for coronary artery disease (CAD) [7], with significant clinical and prognostic implications. Among CAD patients, Type D personality has been associated with poorer quality of life [8], reduced adherence to medical therapy [9], a higher prevalence of multifocal atherosclerosis [10], and the maintenance of unhealthy lifestyle behaviors [11]. Consequently, the adverse prognostic impact of Type D personality in CAD has been confirmed in individual studies [12-14] and in a recent meta-analysis [15].

Depression, another extensively studied psychosocial factor, shares many adverse effects with Type D personality. However, important distinctions exist. For example, in patients with chronic heart failure (CHF), the prognostic relevance of Type D personality has not been demonstrated, in contrast to its established role in coronary heart disease [15]. Depression, in turn, has a well-documented negative effect on prognosis in both coronary heart disease and CHF [16, 17]. Moreover, a wide spectrum of treatment approaches is available for patients with CHF and depression, including pharmacological therapy [18] and non-pharmacological

interventions such as physical exercise, cognitive-behavioral therapy (CBT), and educational activities [19, 20].

First, this personality type is believed to be a stable trait that remains consistent during long-term observation [21], possibly with genetic underpinnings [22]. Second, pharmacological treatments used for depressive disorders are unlikely to be used for individuals with Type D personality. Accordingly, cognitive-behavioral interventions remain the principal therapeutic option. However, studies evaluating CBT for Type D personality have yielded inconsistent findings [23,24]. Some investigations failed to reduce the prevalence of Type D personality among CAD patients [25], while others reported reductions in depressive symptoms in individuals with Type D personality but not in those without it [26].

These mixed results may be attributable to an inappropriate focus of behavioral interventions. Instead of attempting to modify the personality type itself, interventions should target the ways in which individuals with Type D personality appraise and respond to everyday stressors – processes shaped by their cognitive appraisal [27] and coping strategies [28]. Accordingly, recent studies have begun to explore coping mechanisms in Type D individuals [29] and their potential role in mediating the clinical and prognostic implications of this personality construct [14, 30]. Nevertheless, such studies remain limited, and cultural or national factors may further influence coping and appraisal processes.

Because the development of specific coping strategies is preceded by cognitive appraisal of stressors, it is essential to examine tools that assess perceptions of challenging life situations in patients with varying degrees of psychological distress. These considerations formed the rationale for the present investigation. The aim of this study was to examine the relationships among cognitive appraisal, coping strategies, Type D personality, and depression levels in patients with chronic coronary syndrome.

Methods

Study design and participants

This study included patients who underwent elective percutaneous coronary intervention (PCI) at the Research Institute of Complex Issues of Cardiovascular Diseases. Participants were recruited from December 2020 to October 2021 and from December 2023 to October 2024.

Inclusion criteria were as follows: diagnosis of chronic coronary syndrome requiring myocardial revascularization, ability to complete psychological questionnaires accurately, and provision of written informed consent. Exclusion criteria included a recent acute coronary syndrome (<6 months), the presence of severe comorbid pathology or psychiatric disorders, and withdrawal of consent at any study stage.

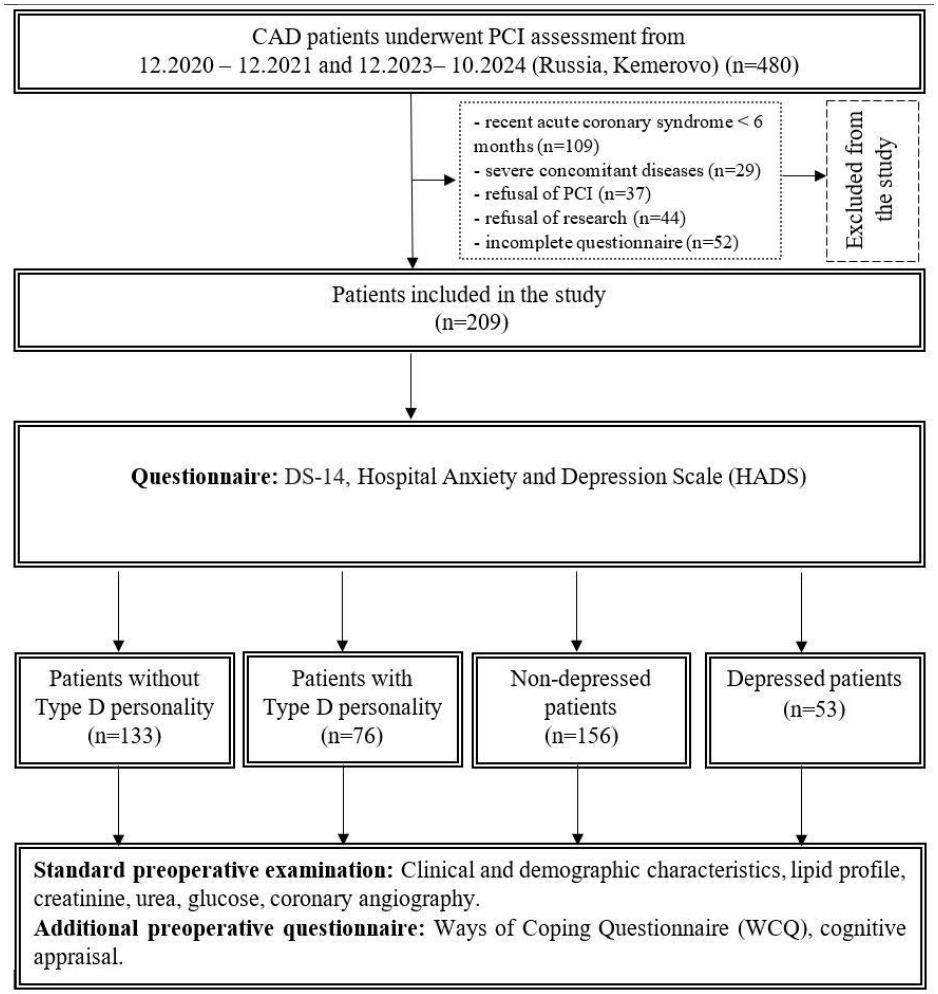

Figure 1. Flowchart of patients' selection. CAD, coronary artery disease; PCI, percutaneous coronary intervention.

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Initially, 480 patients aged 33-81 years undergoing elective PCI were screened. After applying the inclusion and exclusion criteria, 209 patients were enrolled in the final analysis. Clinical, laboratory, and instrumental data, as well as medical history, were obtained from medical records. The study protocol was approved by the local ethics committee of the institution and conformed to the principles of the Declaration of Helsinki. All participants provided written informed consent.

Preoperative clinical, anamnestic, laboratory, and instrumental characteristics were assessed. Psychological evaluation included assessment of Type D personality, anxiety and depression levels, coping strategies, and cognitive appraisal of stressful life situations (*Figure* 1). A detailed description of the psychological assessment methodology has been published previously [19].

DS-14 questionnaire

Type D personality was assessed using a validated Russian-language version of the DS-14 questionnaire [30]. The questionnaire consists of 14 items covering two subscales – Negative Affectivity (NA) and Social Inhibition (SI) – each containing 7 items. High scores indicate a greater tendency to experience negative emotions and to inhibit emotional expression in social interactions, contributing to increased psycho-emotional distress.

Each item is rated on a 5-point Likert scale. A total score of ≥10 on both subscales indicates the presence of Type D personality. The DS-14 has been shown to be a valid and reliable measure of NA and SI in Russian samples [30]. In the current study, Cronbach's α was 0.78 for NA and 0.74 for SI, confirming satisfactory internal consistency of the Russian version of DS14.

Hospital Anxiety and Depression Scale

Depression and anxiety were evaluated using the Hospital Anxiety and Depression Scale (HADS), translated and adapted into Russian. The questionnaire comprises 14 items forming two subscales – Anxiety (A) and Depression (D) – each rated on a 4-point scale (0-3). Higher scores reflect greater symptom severity. Subclinical anxiety or depression was defined as ≥ 8 points.

The Russian version demonstrated high internal consistency (Cronbach's α=0.90 overall; 0.86 for anxiety; 0.84 for depression). Patients were categorized into two groups: those with subclinical or clinical depression (≥ 8 points) and those without (<8 points). Subsequent analyses compared cognitive appraisal and predominant coping strategies between patients with and without Type D personality or depression (*Figure* 1).

Coping strategies questionnaire

Coping strategies were assessed using the Ways of Coping Questionnaire (WCQ), designed to evaluate cognitive and behavioral responses to stress. The Russian-adapted version was used [31], demonstrating acceptable reliability (Cronbach's α=0.78 overall; range 0.75-0.81). The instrument includes 50 items describing possible reactions to stressful situations, rated as "never", "rarely", "sometimes", or "often."

Mean scores were calculated across eight scales: confrontive coping, distancing, self-controlling, seeking social support, accepting responsibility, escape-avoidance, planful problem solving, and positive reappraisal [19]. These reflect both adaptive and maladaptive coping tendencies. Each strategy was further classified as rarely, moderately, or frequently used based on individual scores.

Cognitive appraisal questionnaires

Cognitive appraisal of stressful situations was evaluated using the questionnaire *Cognitive Assessment of a Difficult Life Situation* [32]. A detailed description of this questionnaire has been provided earlier [19]. The tool generates mean scores across eight scales describing individual perceptions of challenging events: (1) general features of difficult situations; (2) lack of control of the situation; (3) ambiguity (unclearness) of the situation; (4) need for rapid and active response; (5) decision-making difficulty (dilemma); (6) difficulty predicting the situation; (7) negative emotions; (8) threat for the future. The following model fit indices were observed: RMSEA=0.044; CFI=0.910; χ^2=912.899; df=378 [32].

Table 1. Clinical and demographic characteristics of study groups with and without Type D personality or depression

Variable n (%) or Me (LQ; UQ)	*Non-Type D personality (n=133)*	*Type D personality (n=76)*	*p*	*Non-depressed (n=156)*	*Depressed (n=53)*	*p*
Clinical characteristics						
Male	85 (63.9)	48 (63.2)	0.913	102 (65.4)	31 (58.5)	0.367
Age, years	63.0 [56.0; 68.0]	62.0 [56.0; 67.0]	0.779	63.0 [56.0; 67.0]	65.0 [58.0; 71.0]	0.079
Body mass index, kg/m^2	25.8 [22.0; 27.7]	25.2 [21.3; 27.2]	0.164	25.6 [21.9; 27.4]	25.1 [21.3; 27.4]	0.486
Smoking	60 (45.1)	31 (40.8)	0.454	71 (45.5)	24 (45.3)	0.895
Hypertension	120 (90.2)	68 (89.5)	0.818	142 (91.0)	49 (92.5)	0.835
Diabetes melitus	23 (17.6)	23 (30.7)	0.029	37 (23.7)	12 (22.6)	0.749
Stroke	19 (14.3)	5 (6.6)	0.091	22 (14.1)	5 (9.4)	0.279
Myocardial infarction	78 (58.6)	36 (47.4)	0.123	84 (53.8)	32 (60.4)	0.562
Laboratory data						
Total cholesterol, mmol/L	3.8 [3.1; 4.9]	3.8 [3.0; 4.8]	0.947	3.8 [3.2; 5.0]	3.8 [2.9; 4.4]	0.209
Urea, mmol/L	6.2 [5.2; 8.1]	5.9 [5.0; 7.7]	0.382	6.1 [5.1; 8.1]	6.3 [4.4; 7.6]	0.709
Creatinine, µmol/L	89.0 [73.0; 104.0]	83.5 [69.0; 102.0]	0.164	89.0 [73.0; 101.5]	84.0 [71.0; 102.0]	0.487
Glucose, mmol/L	5.4 [4.5; 6.4]	5.4 [4.5; 6.9]	0.812	5.4 [4.5; 6.6]	5.5 [4.6; 6.6]	0.488
Coronary angiography						
Single-vessel disease (stenosis ≥70%)	99 (74.4)	59 (77.6)	0.604	120 (76.9)	38 (71.7)	0.444
Two-vessel disease (stenosis ≥70%)	23 (17.3)	12 (15.8)	0.779	26 (16.7)	9 (17.0)	0.957
Three-vessel disease (stenosis ≥70%)	11 (8.3)	5 (6.6)	0.658	10 (6.4)	6 (11.3)	0.245

Data are presented as n (%) for categorical variables and median [LQ; UQ] for continuous variables.

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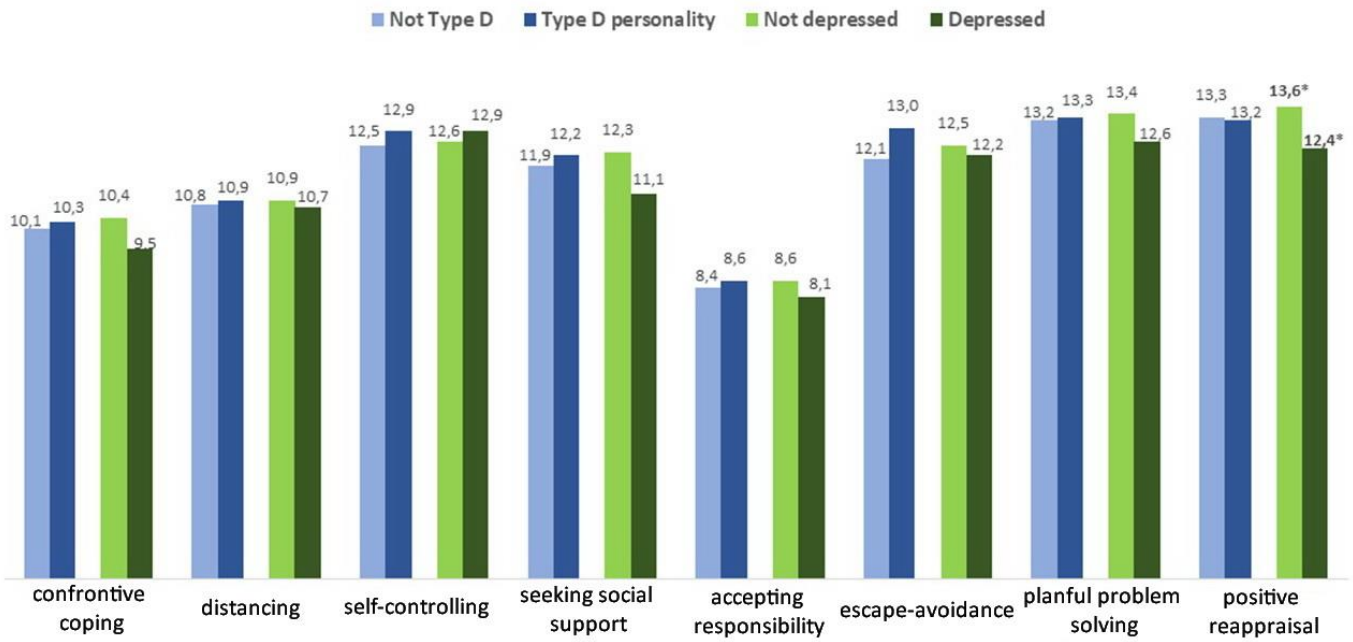

Figure 2. Distribution of coping strategies according to the WCQ questionnaire in groups with coronary heart disease with the presence/absence of the type D or depression.

* p=0,03.

The second instrument, *Types of Orientations in Difficult Life Situations* (TODS) [33], assessed individual patterns of orientation in stressful situations. It identifies responses contributing to or mitigating psychological distress. Adaptive orientations include assertiveness (striving for difficulties), diligence (orientation toward high work intensity), vigilance (attention to threat signals), and focus on opportunities. Maladaptive orientations involve focus on losses, orientation towards obstacles, rejection, conservation of resources (inaction), and neglecting problems (carelessness). Model fit indices were satisfactory (RMSEA=0.049; CFI=0.900; χ^2=3068.835; df=1171) [33].

Based on average scores across scales, predominant cognitive appraisals and orientations were determined for each participant. These patterns were subsequently compared between CAD patients with and without psychological distress (presence vs absence of Type D personality and/or depression).

Statistical analyses

Statistical analyses were performed using SPSS Statistics 17.0 (IBM Corp., the USA). Normality of quantitative variable distributions was assessed with the Kolmogorov–Smirnov test. Non-normally distributed data were presented as medians (Me) with interquartile ranges (25th-75th percentiles).

Group comparisons were conducted using the Mann–Whitney U test for continuous variables and the chi-square (χ^2) test for categorical variables. Factors associated with Type D personality and subclinical depression were examined using multiple binary logistic regression (Forward Stepwise LR method). Two regression models were tested for each outcome: Model 1 included WCQ variables, and Model 2 included TODS variables. A p-value < 0.05 was considered statistically significant.

Results

Clinical and demographic characteristics of the comparison groups

Patients were divided into groups according to two classification criteria:

1. presence (n=76) or absence (n=133) of Type D personality;

2. presence of subclinical or clinical depression (HADS≥8; n=53) or its absence (HADS<8; n=156).

Clinical and demographic characteristics are presented in *Table 1*. In both comparisons, male patients predominated. Diabetes mellitus was more frequent among individuals with Type D personality (30.7%) compared to those without it (17.6%; p=0.029). No statistically significant differences were found in laboratory or instrumental parameters between the groups. According to coronary angiography, single-vessel disease predominated across the cohort (75.6%).

Distribution of coping strategies according to the WCQ

Analysis of coping strategies using the WCQ (*Figure 2*) showed that patients with depression scored significantly lower on the *positive reappraisal* scale compared with non-depressed patients (p=0.03). No other statistically significant differences in coping strategies were observed between the depression groups.

The frequency distribution of specific coping strategies among patients with CAD stratified by Type D personality and depression status is presented in *Table 2*.

Patients without Type D personality less frequently employed *escape–avoidance* (p=0.014), *accepting responsibility* (p=0.021), and *self-controlling* (p=0.003) strategies compared with Type D individuals.

Moderate use of *confrontive coping* (p=0.041) and *accepting responsibility* (p=0.009) was more typical among Type D patients.

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Table 2. Coping strategies in groups with and without Type D personality or depression according to the Ways of Coping Questionnaire

Variable, n (%)	*Non-Type D personality (n=133)*	*Type D personality (n=76)*	*p*	*Non-depressed (n=156)*	*Depressed (n=53)*	*p*
Confrontive coping						
Rare use of strategy	25(18.8)	9(11.8)	0.190	18(11.5)	16(30.2)	0.001
Moderate use of strategy	70(52.6)	51(67.1)	0.041	98(62.8)	23(43.4)	0.013
Strong preference for strategy	36(27.1)	14(18.4)	0.158	38(24.4)	12(22.6)	0.801
Distancing						
Rare use of strategy	19(14.3)	8(10.5)	0.436	22(14.1)	5(9.4)	0.381
Moderate use of strategy	70(52.6)	39(51.3)	0.854	81(51.9)	28(52.8)	0.909
Strong preference for strategy	41(30.8)	28(36.8)	0.373	51(32.7)	18(34.0)	0.865
Self-controlling						
Rare use of strategy	14(10.5)	0(0)	0.003	13(8.3)	1(1.9)	0.104
Moderate use of strategy	39(29.3)	28(36.8)	0.263	50(32.1)	17(32.1)	0.997
Strong preference for strategy	78(58.7)	44(57.9)	0.916	90(57.7)	32(60.4)	0.732
Seeking social support						
Rare use of strategy	15(11.3)	4(5.3)	0.146	11(7.1)	8(15.1)	0.078
Moderate use of strategy	58(43.6)	36(47.4)	0.599	73(46.8)	21(39.6)	0.365
Strong preference for strategy	57(42.9)	35(46.1)	0.654	71(45.5)	21(39.6)	0.455
Accepting responsibility						
Rare use of strategy	29(21.8)	7(9.2)	0.021	22(14.1)	14(26.4)	0.402
Moderate use of strategy	97(72.9)	67(88.2)	0.009	127(81.4)	37(69.8)	0.076
Strong preference for strategy	4(3.0)	0(0)	0.126	4(2.6)	0(0)	0.239
Escape-avoidance						
Rare use of strategy	17(12.8)	2(2.6)	0.014	15(9.6)	4(7.6)	0.651
Moderate use of strategy	43(32.3)	24(31.6)	0.911	46(29.5)	21(39.6)	0.172
Strong preference for strategy	70(52.6)	48(63.2)	0.139	92(59.0)	26(49.1)	0.208
Planful problem solving						
Rare use of strategy	7(5.3)	2(2.6)	0.367	5(3.21)	4(7.6)	0.179
Moderate use of strategy	41(30.8)	23(30.3)	0.932	52(33.3)	12(22.6)	0.145
Strong preference for strategy	82(61.7)	49(64.5)	0.685	96(61.5)	35(66.0)	0.558
Positive reappraisal						
Rare use of strategy	10(7.5)	4(5.3)	0.531	10(6.4)	4(7.6)	0.775
Moderate use of strategy	44(33.1)	25(32.9)	0.977	49(31.4)	20(37.7)	0.398
Strong preference for strategy	75(56.4)	45(59.2)	0.691	94(60.3)	26(49.1)	0.154

Table 3. Cognitive appraisal in groups with and without Type D personality or depression according to the *Cognitive Assessment of a Difficult Life Situation* questionnaire

Variable	*Non-Type D personality (n=133)*	*Type D personality (n=76)*	*p*	*Non-depressed (n=156)*	*Depressed (n=53)*	*p*
General features of difficult situations	17.0 [14.0; 19.0]	16.0 [14.0; 18.0]	0.716	16.0 [14.0; 18.0]	17.0 [15.0; 19.0]	0.324
Lack of control	11.0 [6.0; 13.0]	12.5 [9.0; 16.0]	0.003	12.0 [8.0; 14.0]	11.5 [9.0; 16.0]	0.749
Ambiguity of the situation	13.0 [6.0; 20.0]	17.0 [13.0; 20.0]	0.026	15.0 [9.0; 20.0]	17.5 [13.0; 20.0]	0.057
Need for rapid and active response	17.0 [13.0; 20.0]	16.0 [14.0; 19.0]	0.265	17.0 [14.0; 19.0]	17.0 [14.0; 20.0]	0.228
Decision-making difficulty	14.0 [11.0; 17.0]	15.0 [12.0; 17.0]	0.276	14.0 [11.0; 16.0]	15.0 [12.0; 20.0]	0.043
Difficulty predicting the situation	10.0 [7.0; 13.0]	10.0 [7.0; 13.0]	0.671	10.0 [7.0; 13.0]	10.0 [7.0; 12.0]	0.887
Negative emotions	13.0 [11.0; 17.0]	14.0 [12.0; 17.0]	0.223	14.0 [11.0; 16.0]	14.0 [12.0; 17.0]	0.302
Threat for the future	13.0 [10.0; 15.0]	13.0 [11.0; 14.0]	0.167	13.0 [10.0; 15.0]	13.0 [11.0; 16.0]	0.301

Continuous variables are presented as median with lower and upper quartiles (Me [LQ; UQ]).

In contrast, among patients with depression rare use of *confrontive coping* was more common (30.2 % vs 11.5 %, p=0.001), while, for non-depressed patients, moderate use of the strategy was more typical (62.8 % vs 43.4 %, p=0.013).

Results of cognitive appraisal questionnaires

In individuals exhibiting psychological distress, the predominant cognitive appraisal dimension was *ambiguity of the situation* (median=17.0 for Type D patients; median=17.5 for depressed patients).

Patients with Type D personality scored significantly higher on *lack of situation control* (p=0.003) and *ambiguity of the situation* (p=0.026). Patients with depression more frequently reported *difficulty in decision-making* (p=0.043) (Table 3).

Regarding types of orientation in difficult situations, non-Type D personality patients most commonly demonstrated *striving for difficulties* (p=0.013). Conversely, Type D patients exhibited significantly higher levels of *orientation toward obstacles* (p=0.009), *focus on losses* (p<0.001), and *resource conservation* (p=0.019) than those without Type D personality.

Patients with depression showed significantly lower levels of *striving for difficulties* (p<0.001), *attention to threat signals* (p=0.038), and *focus on opportunities* (p<0.001), while demonstrating higher *focus on losses* (p=0.039), compared to non-depressed patients (Table 4).

Table 4. Cognitive appraisal in groups with and without Type D personality or depression according to the *Types of Orientations in Difficult Life Situations* questionnaire

Variable	*Non-Type D personality (n=133)*	*Type D personality (n=76)*	*p*	*Non-depressed (n=156)*	*Depressed (n=53)*	*p*
Striving for difficulties	23.0 [20.0; 27.0]	21.0 [18.0; 24.0]	0.013	23.0 [20.0; 26.5]	20.0 [17.0; 23.0]	<0.001
Orientation toward high work intensity	12.0 [11.0; 13.0]	11.0 [10.0; 13.0]	0.233	12.0 [11.0; 13.0]	11.0 [10.0; 13.0]	0.174
Attention to threat signals	12.0 [10.5; 14.0]	12.0 [10.0; 13.0]	0.194	12.0 [11.0; 14.0]	11.0 [9.0; 13.0]	0.038
Focus on opportunities	18.0 [17.0; 10.0]	18.0 [15.0; 20.0]	0.154	18.0 [17.0; 20.0]	16.0 [14.0; 18.0]	<0.001
Orientation towards obstacles	12.0 [10.5; 13.0]	13.0 [11.0; 14.0]	0.009	13.0 [11.0; 14.0]	12.0 [9.0; 13.0]	0.073
Focus on losses	15.0 [13.0; 18.0]	18.0 [15.0; 20.0]	<0.001	16.0 [14.0; 19.0]	17.0 [15.0; 19.0]	0.039
Resource conservation	15.0 [12.5; 17.0]	16.0 [14.0; 17.0]	0.019	15.0 [13.0; 17.0]	15.0 [14.0; 18.0]	0.216
Neglecting problems	12.0 [10.0; 13.5]	13.0 [10.0; 14.0]	0.067	12.0 [10.0; 14.0]	12.0 [11.0; 15.0]	0.128

Continuous variables are presented as median with lower and upper quartiles (Me [LQ; UQ]).

Table 5. Psychological status of groups with and without Type D personality or depression

Variable	*Non-Type D personality (n=133)*	*Type D personality (n=76)*	*p*	*Non-depressed (n=156)*	*Depressed (n=53)*	*p*
DS-14						
Negative affectivity	8.0 [6.0; 9.0]	14.0 [12.0; 16.0]	<0.001	9.0 [6.0; 13.0]	13.0 [10.0; 16.0]	<0.001
Social inhibition	8.0 [6.0; 9.0]	12.5 [11.0; 14.5]	<0.001	8.5 [7.0; 12.0]	10.0 [8.0; 14.0]	0.044
HADS						
Depression	4.0 [2.0; 6.0]	5.0 [3.0; 9.0]	<0.001	3.0 [2.0; 5.0]	9.0 [9.0; 11.0]	<0.001
Anxiety	5.0 [3.0; 7.0]	7.0 [5.0; 10.0]	<0.001	5.0 [3.0; 7.0]	8.0 [5.0; 11.0]	<0.001

Continuous variables are presented as median with lower and upper quartiles (Me [LQ; UQ]).

Table 6. Association of psychological factors with the presence of Type D personality or depression according to logistic regression analysis

	B	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*	*95% CI for EXP(B)*	
							Lower	Upper
Association of coping strategies with the presence of Type D personality								
Accepting responsibility, moderate use	1.423	0.493	8.337	1	0.004	4.149	1.579	10.899
Positive reappraisal	-0.107	0.045	5.754	1	0.016	0.899	0.823	0.981
Constant	-0.206	0.630	0.107	1	0.743	0.814		
Association of coping strategies with the presence of depression								
Confrontive coping, rare use	2.261	0.550	16.901	1	0.000	9.597	3.265	28.208
Distancing, rare use	-1.462	0.699	4.369	1	0.037	0.232	0.059	0.913
Self-controlling	0.199	0.060	10.849	1	0.001	1.220	1.084	1.373
Positive reappraisal	-0.138	0.052	7.122	1	0.008	0.871	0.787	0.964
Constant	-2.092	0.864	5.863	1	0.015	0.123		
Association of cognitive appraisal with the presence of Type D personality								
Lack of control of the situation	0.099	0.037	7.178	1	0.007	1.104	1.027	1.188
Rejection	0.116	0.036	10.180	1	0.001	1.122	1.046	1.205
Constant	-3.636	0.755	23.168	1	0.000	0.026		
Association of cognitive appraisal with the presence of depression								
Threat for the future	0.127	0.057	4.988	1	0.026	1.135	1.016	1.269
Striving for difficulties	-0.093	0.041	5.153	1	0.023	0.911	0.840	0.987
Focus on opportunities	-0.160	0.061	6.964	1	0.008	0.852	0.757	0.960
Constant	2.118	1.194	3.149	1	0.076	8.318		

Psychological status

Results from the DS-14 and HADS questionnaires across the cohort are presented in *Table 5*. Patients with Type D personality exhibited significantly higher anxiety (p<0.001) and depression (p<0.001) scores than non-Type D individuals. Similarly, depressed patients demonstrated higher levels of *negative affectivity* (p<0.001) and *social inhibition* (p=0.044) compared with those without depression.

Binary logistic regression: associations of psychological factors with Type D personality and depression

Binary logistic regression analysis (*Table 6*) identified the following independent associations:

Type D personality was positively associated with moderate use of the *accepting responsibility* coping strategy (B=1.423; p=0.004) and inversely associated with *positive reappraisal* (B=-0.107; p=0.045).

Depression was positively associated with rare use of *confrontive coping* (B=2.261; p=0.001) and higher reliance on *self-controlling* (B=0.199; p=0.001), while inversely related to *positive reappraisal* (B=-0.138; p=0.008) and rare use of *distancing* (B=-1.462; p=0.037).

Regarding cognitive appraisal variables, Type D personality was independently associated with higher *lack of situation control* (B=0.099; p=0.007) and *rejection* (B=0.116; p=0.001). Depression was associated with greater *threat for the future* (B=0.127; p=0.026) and inversely associated with *striving for difficulties* (B=-0.093; p=0.023) and *focus on opportunities* (B=-0.160; p=0.008).

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Discussion

In this study, patients with CAD and depression exhibited lower scores on the *Positive reappraisal* coping scale, while no significant differences were found among patients with Type D personality. When analyzing the frequency of coping strategy use, both Type D and depressed patients demonstrated a predominance of maladaptive strategies. In terms of cognitive appraisal, individuals with Type D personality were more likely to perceive stressful situations as uncontrollable and ambiguous, to focus on losses, and to display rejection and inaction in challenging circumstances.

These findings were somewhat unexpected. Previous studies have more consistently reported maladaptive coping strategies among individuals with Type D personality. For instance, the predominance of *Escape–avoidance* coping was observed both in healthy individuals with Type D personality [34,35] and in CAD patients [36]. Similarly, the maladaptive strategy *Acceptance-resignation* was reported among healthy participants [35] and CAD patients [36]. In CAD cohort, additional coping features such as *Shifting responsibility* [37], infrequent use of *Confrontation* [36] and *Planning* [37] were also identified. Before cardiac surgery, Type D patients demonstrated a significantly greater tendency toward helplessness and a less frequent use of optimistic coping strategies [38].

Differences in reported coping patterns may be caused by the use of different assessment tools and scales, as well as to cultural factors. For instance, the *Acceptance-resignation* coping pattern has been described specifically among Chinese patients, who often perceive stress as uncontrollable, demonstrate reluctance to seek medical help and low treatment adherence [39]. In contrast, our results align with those of Moryś et al., who also failed to detect a clear preference for any specific coping style among CAD patients with Type D personality [40]. In addition, in our recently published study, Type D personality was associated with one-year adverse outcomes after PCI, while no associations were found with coping strategies [19].

Given that the adoption of certain coping strategies is preceded by cognitive appraisal of stressful situations, it is reasonable to assume that group differences (Type D vs non-Type D; with vs without depression) may be more clearly reflected in cognitive appraisal scales than in coping measures.

Research on cognitive appraisal in individuals with Type D personality remains limited, and findings are inconsistent. This inconsistency likely stems from variations in clinical context and methodological design. For example, cognitive appraisals of threat and challenge were found to mediate the relationship between Type D personality and the frequency of major adverse cardiovascular events (MACE) within one year after PCI in CAD patients [36]. Another cohort with post-PCI MACE demonstrated low baseline scores for *Negative emotions* and *Future Prospects* on cognitive appraisal measures [19]. Among elderly Type D patients, negative appraisals of illness were linked to poorer self-care abilities [41].

The present study provides further evidence that both Type D personality and depression are characterized by unproductive cognitive appraisals of stress, which hinder effective problem-solving. In contrast to Type D personality, coping research in depression has a long tradition. A recent meta-analysis by Muñoz-Cruz et al. [42] demonstrated a robust association between dysfunctional coping strategies and clinically significant depressive symptoms, while adaptive strategies such as *Acceptance* and *Positive reappraisal* were consistently linked to fewer depressive symptoms. Another recent study confirmed that greater use of adaptive coping strategies was associated with lower depression scores, whereas maladaptive strategies correlated with higher anxiety and depression [43]. It has also been suggested that when negative external or internal stimuli exceed an individual's cognitive appraisal capacity, the risk of developing depression increases [44].

Coping-based approaches play an important role in the treatment of depression. Studies show that individuals with depression tend to use strategies such as self-acceptance (e.g., recognizing and accepting one's feelings, accepting one's present self, hold onto hope), activity (e.g., recreational activities, exercise, volunteering), reduction of stressors and symptoms (e.g., avoidance of triggers, medical consultation), and seeking interpersonal support from family members, friends, and peers [45]. Depression management often incorporate cognitive-behavioral therapy (CBT) [22, 23], which emphasizes *Cognitive reappraisal* techniques [46-48].

Our findings indicate that Type D personality and depression are associated with distinct cognitive appraisal patterns. Depression was marked by a lower tendency toward active engagement (manifested as difficulty in decision-making, lack of desire for challenges, and reduced focus on opportunities), while Type D personality was characterized by passive observation (focus on losses and obstacles, conservation of resources, and lack of control). Therefore, CBT programs for individuals with Type D personality should be designed in accordance with these personality-specific cognitive features. As demonstrated in this study, therapeutic approaches should consider not only patients' predominant coping strategies but also their underlying cognitive appraisals of stress.

This study has several limitations. First, psychological status was assessed via self-report questionnaires, which inherently introduce a degree of subjectivity. Second, the study was conducted in a single center, limiting the replication of findings. Third, the cross-sectional design does not allow to assess the cause-and-effect relationships between the clinical and psychological indicators. Finally, Type D personality was evaluated dichotomously rather than as continuous scores of its subcomponents or their interaction. This approach may overestimate its prognostic impact [49]. Nevertheless, recent research in patients with CAD supports the adverse prognostic significance of both dichotomous and interaction-based assessments of Type D personality [20, 50]. Thus, either approach may be valid for evaluating the "Type D effect"; in the present study, we chose the dichotomous method for its utility.

Conclusion

In patients with CAD and comorbid depression, lower scores were observed on the *Positive reappraisal* coping scale, while no significant differences were detected among individuals with Type D personality. However, differences in cognitive appraisal of stressful situations were more pronounced in the Type D group. These patients more frequently perceived situations as uncontrollable and ambiguous, demonstrated a tendency to focus on losses, and exhibited avoidance and inaction in difficult circumstances. When designing behavioral intervention programs for patients with CAD, we suggest considering both the patients'

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cognitive appraisals of their difficulties and the predominant coping strategies they employ to manage stress.

Financing

The work was supported by the Comprehensive Basic Research Program of the SB RAS within the framework of the basic research topic of the Research Institute of Complex Problems of Cardiovascular Diseases No. 0419-2022-0002 "Development of innovative models for managing the risk ofdeveloping diseases of the circulatory system, taking into account comorbidity based on the study offundamental, clinical, epidemiological mechanisms and organizational technologies for providing medical carein the industrial region of Siberia".

Conflict of interest

All authors declare no conflict of interest

Ethical approval

All procedures performed in studies involving human participants were conducted in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

AI or AI-Assisted Technologies

The authors did not use AI or AI-assisted technologies in the preparation of this manuscript.

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