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# Psychological Distress within Cardiovascular Risks Behaviors, Conditions and Diseases Conceptual Framework

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## ABSTRACT

*Psychological distress (PD) is being increasingly recognized as a risk factor for cardiovascular diseases (CVD). Our aim was to recognize an association of PD and CVD in the Croatian adult population. We also explored association's strength obtainable as relative risk of PD on three levels; cardiovascular risk behaviors, conditions and diseases. This study used Croatian Adult Health Survey 2003 (CAHS 2003) data (N = 9,070). PD status was measured by the five-item Mental Health Scale of the Short Form questionnaire (SF-36) hence one distinguished subgroup consisted of population with PD and other without PD. Prevalence of cardiovascular risk behaviors, cardiovascular risk conditions and self-reported cardiovascular diseases within each subgroup were calculated using bootstrap method. Women had higher prevalence of PD in general population. Among distressed population women had higher prevalence of body mass index over 30, metabolic syndrome and angina pectoris. Men with PD had higher prevalence of high blood pressure and myocardial infarction with contradictory lower prevalence of angina pectoris then myocardial infarction. Physical inactivity was proven to be a risk behavior determinant with most impact on mental health. All CVD are consistently associated with higher prevalence and relative risks for PD both in men and women.*

**Key words:** *psychological distress, cardiovascular disease, health behavior, Croatian Adult Health Survey, Croatia*

## Introduction

Psychological distress (PD) is a non-specific dimension of psychopathology, indicating that something is wrong but does not yield diagnostic assessment, comprised usually of anxiety and depression related distress states<sup>1</sup>. Psychological distress is being increasingly recognized as a risk factor for cardiovascular diseases (CVD)<sup>2-4</sup>

The fact that risky lifestyle behaviors like physical inactivity, smoking, heavy alcohol consumption and unhealthy diet are associated with cardiovascular diseases (CVD) is generally accepted<sup>5-8</sup>. Besides cardiovascular risk behaviors, cardiovascular risk conditions such as high blood pressure, outsized waist circumference, BMI ≥

30, and metabolic syndrome, have also been associated with higher risks for CVD<sup>9-14</sup>.

In this paper we present data on cardiovascular risk behaviors, risk conditions and diseases from a large representative sample of adults with psychological distress and without psychological distress. The data were obtained from the 2003 Croatian Adult Health Survey (CAHS), survey conducted on probability sample of individuals living in Croatia. Thus the findings are representative of the general population of adults in Croatia<sup>15</sup>.

This study aims to recognize association of psychological distress and cardiovascular diseases. We also ex-

plored association's strength obtainable as relative risk of psychological distress on three levels: cardiovascular risk behaviors, conditions and diseases.

## Materials and Methods

National risk factors surveys present a very important tool for gathering population based health related information for research and policy. Croatian Adult Health Survey (CAHS) is such a tool, intended to collect population-based, representative and authoritative information on cardiovascular risk factors prevalence<sup>16</sup>. The CAHS sample was designed to provide nearly complete coverage (98%) of the Croatian adult population, based on the random selection of the adult member of the household that was selected in the complex sampling scheme. Additionally, seven-step weighting scheme was applied to further increase the representativeness of the sample, which is considered to be representative for six geographical and administrative regions of Croatia. The first cycle of the project took place in 2003, with a total of 9,070 respondents. The second project cycle is taking place in 2008 and has been converted into the follow-up study (re-surveying the 2003 sample).

In this paper complete survey sample, a total of 9,070 respondents were divided in two subgroups according to the psychological distress status. Psychological distress status was measured by the five-item Mental Health Scale of the SF-36 (MHI-5)<sup>17,18</sup> hence one distinguished subgroup consisted of population with psychological distress and other without psychological distress. MHI-5 is a well validated and reliable measure of mental health status<sup>19</sup>. MHI-5 has been used to identify mental disorders in the community<sup>20</sup> and clinical samples<sup>21–25</sup>.

The MHI-5 used in CAHS is part of the SF-36 version 2 and comprises five questions relating to the past four weeks: 'Have you been very nervous?' 'Have you felt so down in the dumps that nothing could cheer you up?' 'Have you felt calm and peaceful?' 'Have you felt down-hearted and depressed?' 'Have you been happy?' Each of the five questions has five response categories which are scored from 1 to 5: 'all of the time' 1; 'most of the time' 2; 'some of the time' 3; 'a little of the time' 4; or 'none of the time' 5. Response scores were transformed and imputed missing data to a scale of range 0 to 100 using the standard method of the SF Health Outcomes Scoring Software Ver.1.0.1.<sup>18</sup> Lower scores on MHI-5 indicate lower mental health status. Psychological distress was determined when MHI-5 score was less or equal to 52<sup>26,27</sup>.

Variables defining cardiovascular risk behaviors used in this paper are smoking, physical inactivity, unhealthy nutrition and heavy alcohol consumption. Variables defining cardiovascular risk conditions are high blood pressure, oversized waist circumference and body mass index. Metabolic syndrome variable was derived from several indicators that are waist circumference, high blood pressure, body mass index and self reported high level of glucoses and lipids in blood. Details of construction of cardiovascular risk behaviors and risk conditions as well as

metabolic syndrome variables are reported elsewhere<sup>5,10</sup>, with the exception of defining variable overweight as of those having BMI  $\geq 30$ . Three self reported cardiovascular disease diagnoses were examined: angina pectoris (AP), myocardial infarction (MI) and heart failure (HF). Every variable was transformed as dichotomous where 1 means risk while 0 is without risk.

Each subgroup (with or without PD) was then divided and analyzed separately according to gender. Prevalence of cardiovascular risk behaviors, cardiovascular risk conditions and self-reported cardiovascular diseases within each subgroup were calculated using bootstrap method (number of iterations 500) in SAS statistical package Ver. 9.1. Bootstrap method allows reliable cross-sectional variance estimates on the prevalence of various characteristics measured in CAHS for complete population of Croatia. 95% confidence intervals (CI) for each variable were calculated as well and compared within subgroups according to PD status.

As a measure of association strength between variables and PD status relative risks were calculated as a simple ratio between characteristic prevalences of population with and without PD.

## Results

In Croatian population age older than 18 years prevalence of psychological distress is 24.06% (95% CI 21.85–26.26) for men and 27.62% (95% CI 26.08–29.17) for women using the MHI-5 cutoff point of equal or less than 52. These findings are similar to other European countries<sup>27</sup>.

In men, physical inactivity is the only analyzed risk behavior variable showing statistically significant differences in prevalence between population with and without PD. For women, both physical inactivity and unhealthy nutrition showed significant differences in prevalence between PD status subgroups (Table 1).

Among cardiovascular risk conditions all four conditions showed statistical significant differences in prevalence, except for metabolic syndrome in men where 95% CI are overlapping slightly (Table 2).

Table 3 shows most consistent statistically significant differences between population with and without PD. Among analyzed CVD, in population with psychological distress self reported heart failure has the greatest prevalence (men 20.71%, women 29.02%) triple higher than prevalence of angina pectoris (men 7.66%, women 9.67). Unlikely, study shows that prevalence of myocardial infarction in men with PD is higher than prevalence of angina pectoris (MI 8.39%, AP 7.66%) while in population without psychological distress prevalence of MI is lower than of AP (MI 2.86%, AP 3.9%)<sup>28–30</sup>.

Except for smoking in women all variable prevalences are higher in population with psychological distress. Such consistency is better seen when relative risks are calculated (Figure 1). Among cardiovascular risk behaviors the highest relative risk for women is heavy alcohol con-

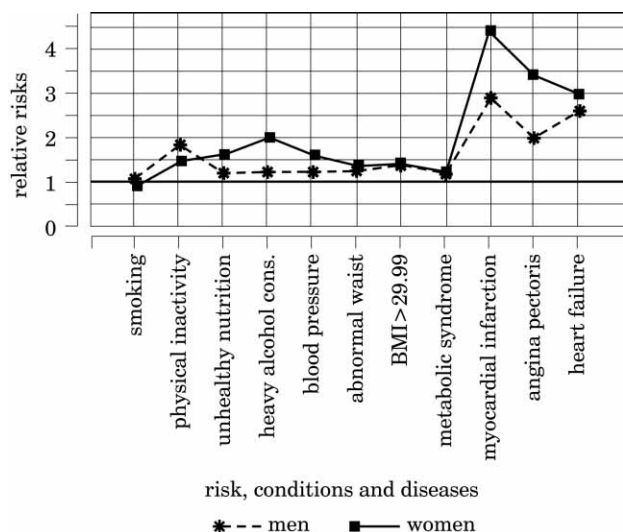


Fig. 1: Relative risks plot of having one of cardiovascular risks behaviors, conditions, diseases and psychological distress.

sumption (women 1.98; men 1.25) while for men physical inactivity has the highest relative risk (men 1.82; women 1.40). The lowest relative risk among risk behaviors for both men and women has smoking (men 1.05; women 0.88).

Among cardiovascular risk conditions relative risk for high blood pressure is highest for women (women 1.58; men 1.26) while men have highest risk for BMI  $\geq 30$  (men 1.43; women 1.35). The lowest relative risk for both men and women has metabolic syndrome (men 1.21; women 1.24).

Cardiovascular diseases have the highest relative risks of all measured variables. Women with psychological distress are having consistently higher relative risks for all diseases than men. The highest measured relative risk is for the MI (men 2.93; women 4.35), than relative risk for AP (men 1.96; women 3.44) while for HF relative risk is

the lowest (men 2.60; women 2.99) but still higher than relative risks for behaviors and conditions.

## Discussion

The study results suggest that psychological distress is a burden among participants with various cardiovascular conditions and diagnoses. The estimated prevalence of psychological distress, defined as a MHI-5 score  $\leq 52$  is 24.06% for men and 27.62% for women in general population of adults in Croatia.

There are several potential pathways for the effect of PD on CVD but two are referenced most often. First, PD may be indirectly associated with CVD through associations with the adoption of unhealthy behaviors such as smoking, unhealthy diet, heavy alcohol consumption and physical inactivity, which in themselves increase risk of CVD. Second PD may have direct effect on CVD independent of other behavioral and psychosocial factors mediated other by neurohumoral or by metabolic disturbance<sup>31</sup>.

Ferketich and Binkley showed in a study on US population strong correlation between PD and current smoking, physical activity and hypertension while in our study results for smoking are contrary<sup>32</sup>. This study showed that for women relative risk of being smoker and having PD is actually less than one, which could be hypothesized as protective influence of smoking on mental health. In men, smoking has relative risk 1.05 and this was the lowest relative risk measured for men in our study. Prevalence showed overlapping of 95% confidence interval and relative risks should be considered as statistically non significant.

Malyutina et al. in a study on Russian population associated moderate alcohol consumption with reduced cardiovascular mortality, but binge drinking showed detrimental effect on cardiovascular health<sup>33</sup>. We examined effects of heavy and binge drinking in a population and our results haven't showed statistically significant differ-

TABLE 1  
PREVALENCES OF CARDIOVASCULAR RISK BEHAVIORS

	Population without psychological distress		Population with psychological distress	
	Prevalence (%)	95% confidence interval	Prevalence (%)	95% confidence interval
Men	Risk behaviors prevalence			
Smoking	27.89	25.03–30.75	29.37	24.66–34.08
Physically inactive	24.09	21.50–26.69	43.93	37.46–50.40
Unhealthy nutrition	19.27	16.82–21.72	23.29	18.87–27.72
Heavy alcohol consumption	11.61	9.34–13.38	14.50	11.47–17.53
Women	Risk behaviors prevalence			
Smoking	17.57	16.12–19.03	15.40	13.21–17.59
Physically inactive	28.72	26.3–31.14	40.16	36.48–43.84
Unhealthy nutrition	10.49	8.98–12.01	16.50	14.14–18.85
Heavy alcohol consumption	0.56	0.29–0.83	1.11	0.53–1.7

**TABLE 2**  
PREVALENCES OF CARDIOVASCULAR RISK CONDITIONS

	Population without psychological distress		Population with psychological distress	
	Prevalence (%)	95% confidence interval	Prevalence (%)	95% confidence. interval
Men	Risk conditions prevalence			
High blood pressure	38.09	35.10–41.08	48.10	43.57–52.62
Waist $\geq$ 102cm	32.65	30.10–35.20	42.35	37.87–46.83
BMI $\geq$ 30	18.57	16.42–20.72	25.07	21.42–28.73
Metabolic syndrome	28.74	26.27–31.21	34.64	30.63–38.65
Women	Risk conditions prevalence			
High blood pressure	30.17	28.33–32.02	47.61	44.68–50.55
Waist $\geq$ 88cm	46.46	44.77–48.16	63.36	60.79–65.93
BMI $\geq$ 30	18.44	17.03–19.85	26.31	23.92–28.69
Metabolic syndrome	40.36	38.69–42.04	49.99	47.31–52.68

BMI – body mass index

**TABLE 3**  
PREVALENCES OF CARDIOVASCULAR DISEASES

	Population without psychological distress		Population with psychological distress	
	Prevalence (%)	95% confidence interval	Prevalence (%)	95% confidence. interval
Men	Cardiovascular disease prevalence			
Myocardial infraction	2.86	2.23–3.49	8.39	6.56–10.21
Angina pectoris	3.90	3.13–4.67	7.66	5.43–9.89
Heart failure	7.96	6.57–9.34	20.71	16.95–24.46
Women	Cardiovascular disease prevalence			
Myocardial infraction	1.28	0.93–1.63	5.57	4.36–6.77
Angina pectoris	2.81	2.32–3.30	9.67	7.94–11.41
Heart failure	9.71	8.37–11.05	29.02	25.97–32.07

ences in men while in women alcohol seemed to be detrimental on mental health. Results for heavy alcohol consumption for women should be taken with reserve since coefficient of variability is 26.5 that is higher than recommended value 16.5 considered as statistically significant for population<sup>15</sup>. Such unreliable coefficient of variability is due to rigorous criteria for variable heavy alcohol consumption<sup>5</sup> that lead to small number of women characterized as under risk.

What makes healthy nutrition is a topic of numerous debates. According to American Heart Association of major importance for CVD are nutrients like vegetables, fruits, whole-grain products and fat-free or low-fat dairy products and low salt intake<sup>34</sup>. Our results showed statistically significant association between PD and unhealthy diet for women but not for men.

Physical inactivity is the only risk behavior showing statistically significant prevalence difference for both men and women. Physical inactivity is proven as a risk factor both for CVD and PD<sup>31</sup>. Although causality re-

mains unclear it should be emphasized that considering the robustness of the study physical inactivity is proven by the study to be major risk behavior in Croatian population for PD. That applies especially for men.

In our study cardiovascular conditions showed to be more reliably associated with PD than cardiovascular risk behaviors. Except metabolic syndrome for men where confidence intervals are slightly overlapping all other cardiovascular conditions showed statistically significant difference in prevalence between population with and without PD. Cardiovascular conditions are more reliable determinants for CVD than cardiovascular risk behaviors since it is accepted that risk behaviors are precursor of cardiovascular conditions although causality is much more complex. Relative risks are moderate ranging from 1.20 to 1.58 still showing consistently increased risk of being distressed and having cardiovascular condition. Such consistency could be considered as qualitative indicator of importance of PD as part of CVD conceptual framework<sup>35</sup>.



Answer to main question whether PD is related to CVD is given without uncertainties in Figure 1. Since relative risk of having PD and CVD is several times higher than in population without PD and all prevalences are statistically significant, the unanswered question still remaining is the one of causality. That could not be answered with cross-sectional study but next study, CAHS 2008, which will be in form of cohort study might provide further explanations. Results of the study are consistent for all CVD, with myocardial infarction having highest relative risk for both men and women (2.93 men and 4.35 women). Acuteness of MI and fear of proximity of death might be one of the reasons for such high association strength because it could have huge detrimental impact on mental health.

One of limitations of this study is self reporting of CVD. Therefore higher prevalence of angina pectoris than myocardial infarction in men with PD might be bias error. But such discrepancy might highlight Croatian men's neglect for less dramatic symptoms of cardiovascular diseases.

The main advantage of the study is statistical robustness, so results represent valid estimate of population prevalences of cardiovascular risk, conditions and diseases as well as psychological distress. In order to limit findings on those most important, authors have intentionally excluded age and socioeconomic determinants from statistical analysis although it is clear that in further study it is necessary to include them. Major reason for including age in analysis is time needed to develop CVD following suggested pathway cardiovascular risk behavior-condition-disease, while socioeconomic determinants (e.g. education) are among major factors involved in development of health inequalities and PD.

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## Conclusion

Women have a higher prevalence of psychological distress in general population. Among distressed population women have higher prevalence of BMI  $\geq 30$ , metabolic syndrome, angina pectoris and heart failure. Men have higher prevalence of high blood pressure and myocardial infarction with contradictory lower prevalence of angina pectoris than myocardial infarction. Smoking that is considered a major risk for CVD has the lowest relative risk for PD and even protective effect on mental health for women. Physical inactivity is proven to be risk behavior determinant with most impact on mental health. All cardiovascular diseases are consistently associated with higher relative risks for psychological distress both in men and women. Highest measured relative risk for having PD and CVD was for myocardial infarction as high as 4.35 for women and 2.93 for men. The results reported in this paper suggest that there is strong association between psychological distress and cardiovascular conditions and cardiovascular diseases, but cardiovascular risks haven't proved such association. Causality of association between cardiovascular conditions and diseases and psychological distress remains yet to be investigated in further studies. CAHS 2008 cohort study might be excellent platform for such investigation.

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## **PSIHOLOŠKA PATNJA PREPOZNATA KAO DIO KONCEPTUALNOG OKVIRA »RIZIČNO PONAŠANJE-STANJE-BOLEST« ZA KARDIOVASKULARNE BOLESTI**

### **S A Ž E T A K**

Psihološka patnja (PP) postaje prepoznatljiv rizični čimbenik kardiovaskularnih bolesti (KVB). Cilj ovoga istraživanja bio je prepoznati povezanost PP i KVB u odrasloj populaciji Hrvatske. Također smo istraživali snagu povezanosti putem relativnog rizika za PP na tri razine: kardiovaskularnih rizičnih ponašanja, stanja i bolesti. U istraživanju su korišteni podaci Hrvatske zdravstvene ankete 2003 (HZA 2003). Ukupno je prikupljeno 9070 odgovora ispitanika državljana Hrvatske starijih od 18 godina. Kompletan uzorak je podijeljen u dvije podgrupe, prva s PP a druga bez PP. Postojanje PP procijenjeno je temeljem Skale mentalnog zdravlja koja je dio SF-36 upitnika. Prevalencije kardiovaskularnih rizičnih ponašanja, kardiovaskularnih rizičnih stanja te KVB prema iskazu ispitanika unutar svake podgrupe izračunate su korištenjem »bootstrap« metode. U općoj populaciji, žene imaju veću prevalenciju PP. U populaciji s PP žene imaju veću prevalenciju indeksa tjelesne težine većeg od 30, metaboličkog sindroma, angine pectoris te zatajenja srca. A muškarci u skupini s PP imaju veću prevalenciju povišenog krvnog tlaka, infarkta miokarda te kontradiktorno manju prevalenciju angine pectoris naspram infarkta. Tjelesna neaktivnost pokazala se kao rizično ponašanje s najviše utjecaja na mentalno zdravlje. Sve KVB konzistentno su povezane s većim relativnim rizikom za PP kako u muškaraca tako i u žena.