# Anxiety and depression in patients with chronic cardiovascular disease—factors differentiating rural and urban subpopulations

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# Abstract

**Background**. People suffering from cardiovascular diseases (CVD) increasingly experience depression and anxiety disorders. Therefore, it is essential to improve identification strategies and methods of coping for these conditions.

**Objectives**. The aim of the study was to analyse selected variables differentiating rural from urban populations as well as identify potentially increased levels of depression and anxiety.

**Material and methods.** The study was carried out in 193 CVD patients home-cared by a district nurse.

**Results**. Women constituted the majority of respondents (71.7%, n = 81 City-C vs 65.8%, n = 50 Village-V). The median age of the C patients was 76 (range 17-101) vs. 72 (range 18-94) for the V patients. The correlation coefficients displayed significant differences in anxiety, number of cardiologist visits (p = 0.005) and interventions provided by a district nurse (p = 0.03). The rural population stood out in number of home visits, age, assessment of needs and QoL. In addition, a strong relationship between anxiety and age was noted in the rural population (1/OR=1.04; 95% CI: 0.91–0.99), the assessment of satisfied needs (1/OR=293.86; 95% CI: 0.00001–0.56), depression (OR=5.85; 95% CI: 1.58–25.66), QoL in physical (OR=1.56; 95% CI: 1.11–2.33), social (1/OR=1.53; 95% CI: 0.04–0.94) and environmental domains (OR=1.67; 95% CI: 1.06–3.00) as well as between depression and anxiety (OR=4.60; 95% CI: 1.45–16.28), QoL in physical (1/OR=1.39; 95% CI: 0.50–0.97) and psychological (OR=1.37; 95% CI: 1.01–1.93) domains.


# Background

Cardiovascular diseases decrease mobility, reduce work and social activity and thus are a cause of social isolation. This health condition may also result in chronic anxiety, depressed mood and, consequentially, development and aggravation of depressive and anxiety syndrome [1-3].

It is estimated that anxiety disorders are found in 28–44% of young people and 14–24% of old people with CVD [4]. Conversely, patients with anxiety disorders have also been noted to have a higher chance of developing coronary artery disease [5]. The risk of death caused by ischemic heart disease is doubled if patients develop panic disorder as well [6]. A high level of anxiety has also been proven to be a significant predictor of recurrent heart

incidents [7,8]. High emotional states and levels of anxiety might directly lead to the development of sudden cardiological incidents as well [9].

The incidence of depression in CVD patients is twice as high as in the general population and results in a worse medical prognosis for these patients [10]. One out of five patients with ischemic heart disease or heart failure suffers from depression, three times as high as in the general population. Depression affects an even higher percentage of post-stroke patients (one out of three) [2]. Depressed mood is found in 66.6% of hospitalized patients who have experienced a heart infarct, while depression is diagnosed in 15%. Patients with chronic heart failure are even more prone to depression (10–40% of cases) [11,12]. Depression in patients suffering from coronary heart disease is the strongest prognostic factor of death (depressive patients have a doubled risk of death over patients without depression) [13]. The state is also related to the aggravation of functional disorders, lower therapeutic compliance and reduced participation in cardiological rehabilitation [14]. It was shown that patients with depression develop CVD in the subsequent 6 years two or three times more often [15]. In Poland, depression is diagnosed in 5–16% of population, with symptom severity increasing with age [16]. The economic and health-related indicators of CVD and depression result in higher treatment costs, higher demand for health services and decreased efficiency [17].

Although diagnosis of depression is steadily increasing (it is currently the 3$^{rd}$ most common cause of all GP appointments), a great number of cases remain unnoticed or treated late [18]. Research shows that depression is found less frequently in depressive CVD patients than in patients with similar symptoms but not suffering from cardiovascular disease [19].

As mental condition has a huge impact on treatment and prognosis, the need for better identification strategies is increasingly recognized. The disorders ought to be diagnosed earlier and appropriate treatment given [20-22]. Anxious and depressive patients without social support, whose symptoms of diseases do not progress, might develop an unfavourable attitude towards disease, helplessness and anxiety. The symptoms of anxiety

and depression decrease the motivation for changing lifestyle, tend towards social isolation and even mental escape from crucial issues [23].

Taking into consideration the role of primary health care, it is important to examine the epidemiology of anxiety and depressive disorders thoroughly as well as the risk factors for their occurrence in CVD patients in relation to Poland's primary health services.

There is no scientific research on the factors affecting anxiety and depression comparing rural and urban CVD patient populations.

### The aim of the study

Taking into account the above, the aim of the study was to identify variables differentiating rural and urban populations and potentially relating to primary healthcare effectiveness provided to CVD patients.

The identification of positive results will provide insight into the process of creating systems to identify risk groups in whom the level of health services is low, the development of clinical information systems and support decision-making to design personal care models and identification systems for CVD patients living in rural and urban areas needing psychological support.

## Material And Methods

### Study design

The study is a part of a wider range of research which aims at clarifying a purposeful and most effective model of home care over chronically ill patients with CVD in the scope of primary health services.

### Setting

The study was carried out among Polish CVD patients who received home care from a family nurse working within primary health services in Opolskie, Lower Silesian, Masovian, Lublin and Podlesian Voivodeships. Eight primary health care institutions took part in the study. The patients were encouraged to take part in the examination by their family nurse

during planned home visits. The respondents filled in the questionnaires in their home environment. One set of questionnaires was provided to the patients, and the nurses filled out an additional questionnaire concerning the patient (paired questionnaires about the same patient). Data was collected from March 2016 through January 2017.

### Participants

The main factors including the patient in the study were age (over 18) and a diagnosis of chronic CVD provided at least 12 months prior to the study. The patient was supposed to stay at home and be provided with family nurse services. The criteria of exclusion (disqualification was performed by a family nurse) were cognitive and aggravated mental disorders as well as difficulties participating in the study such as vision disorders and non-Polish nationality.

### Variables

The study examined 31 variables, including socio-demographic ones, such as sex, age, marital status, level of education, place of residence as well as variables allowing the assessment of the quality of clinical, social and psychological care (WHOQOL-BREF questionnaire, Health-Related Behaviour Inventory, Camberwell Assessment of Need Short Appraisal, and HADS-M questionnaire) taking into account the place of residence such as city and village.

### Research tools

To evaluate the study patients' quality of life, a short, Polish version of the World Health Organization Quality of Life (WHOQOL) questionnaire was used. It measures the QoL in four domains such as physical, psychological, social relations and environment. The tool also includes some separately analysed questions relating to the individual perception of the quality of life (question 1) and the perception of each patient's health condition (question 2). All responses used the 5-degree Likert's scale.

The reliability of the Polish version of WHOQOL-BREF was checked with the use of Cronbach coefficient α, which were 0.81 for a physical domain, 0.78 for a psychological

domain, 0.69 for social relations domain and 0.77 for the environment domain. The internal test coherence for the whole questionnaire was 0.90 [24, 25].

The Health-Related Behaviour Inventory by Juczynski (HBI) consists of 24 statements measuring four pro-health behaviour categories, i.e., proper eating habits, preventive behaviours, proper mental attitudes and health practices, was also used in the study. The respondents determine the frequency of health behaviours and proper activity based on the scale in which 1 corresponds to hardly ever, 2—rarely/seldom, 3—from time to time, 4—often, 5—usually/almost always. The values marked by examinees are then summed up to calculate an overall measure of health activity intensity, with a value ranging from 24 to 120 points. The higher the value, the higher the intensity of pro-health behaviours. Additionally, the intensity of all four categories is analysed. The indicator equals the average number of points in each category and is calculated by summing up all the points and dividing by 6. The reliability of the test for all four subscales ranges from 0.6 to 0.65 for a total of 0.85 (α-Cronbacha) [26].

The levels of satisfied and unsatisfied needs were evaluated using the Camberwell Assessment of Need Short Appraisal which can be used in chronically ill patients without serious mental disorders. The questionnaire consists of 24 questions focusing on 22 problem areas. It enables the assessment of needs based on patient opinions as met or unmet. 0 represents unmet needs, whereas 1 represents met needs. This makes it possible to calculate the number of needs met (M), the total number of needs (N), and calculate the Camberwell's coefficient as M/N. The test's coherence is $\alpha=0.82$ [27].

To assess anxiety and depression, a modified version of the HADS questionnaire (Hospital Anxiety Depression Scale), or HADS-M, was applied. The tool uses 7 positions to measure anxiety, 7 to evaluate depression level and 2 to measure nervousness and aggression. The questionnaire is helpful to evaluate anxiety, depression and aggression both in hospitalized and ambulatory patients. It contains 16 cloze test questions assigned to points ranging from 0 to 3. The test's result of the test is obtained from summing up all the points in each category. The maximum result for anxiety and depression is 21, while for aggression it is 6.

The anxiety and depression subscales are interpreted as follows. 0–7 points represent standard behaviour, 8–10 represent border values indicating mild anxiety, while 11–21 are regarded as pathological and indicate an anxiety syndrome/disorder. The validation examinations of the primary and modified version of HADS scale prove its reliability and validity. The Spearman's correlation coefficient between the test positions and the overall result of a given subscale was statistically significant (at least $p<0.01$) and ranged from 0.41 to 0.76. The validity of the test was achieved by comparing the HADS scale results to the interview-based evaluation. The correlation coefficient for the anxiety subscale was found to be 0.54 and for the depression subscale, 0.79 [28, 29].

To evaluate essential socio-demographic features of CVD patients, as well as the number and type of health services provided to them, the author's interview questionnaire was used to obtain information about sex, age, marital status, level of education, financial condition, place of residence, the number of hospitalizations within the prior 3 years, the number of appointments at GPs in primary health institutions within the prior 12 months, the number of consultations at a cardiological clinic within the prior 12 months, the number of family nurse interventions within the prior 12 months and the number of GPs/nurses home visits in the prior 12 months.

### Study size

200 patients were invited to take part in the study, however, the ultimate sample of participants was determined by their time availability. Ultimately 193 participated. The numbers in the columns of age, sex, HADS-M Anxiety (city-village) and HADS-M Depression (city-village) do not sum up to 193 because of some patients left blank spaces in the questionnaires. So, although there are some inconsistencies in numbers, the results achieved are precise and significant.

### Ethics approval and consent to participate

The study was approved by the Bioethical Commission at Medical University in Wroclaw (No KB -86/2016). Participation in the study was voluntary and anonymous. All participants

were informed about the study aims, methods, and the ability to withdraw participation at any stage of the examination.

### Statistical methods

The results of the study were subjected to statistical analysis using the R statistical package (version 3.4.0).

For measurable variables (quantitative), the mean, standard deviation, first quartile—Q.25%, second quartile—Q.50% (median), third quartile—75%, minimum and maximum were calculated. Qualitative variables were determined by frequency (percentage). The Shapiro-Wilk test showed that only a few variables had standard distribution, namely WHOQOL-BREF in physical and psychological domains as well as environment. The distributions of the other variables were totally different from the standard one. Therefore, the Chi-square test, Fisher's test, Wilcoxon's test and Spearman's rank correlation coefficient were used for further analysis. The test probability at the level of $p \leq 0.05$ was considered significant.

To examine the relationship between anxiety or depression and selected variables, logistic regression analysis was used. It enabled the description of relationships examined in the study with the use of the odds ratio. The individual analysis of each double value explained variable was conducted as shown below:

- HADS-M Anxiety: 0—lack of abnormalities (0–10), 1—abnormality present (11–21)
- HADS-M Depression: 0—lack of abnormalities (0–10), 1—abnormality present (11–21).

Next, a separate logistic regression analysis was carried out for each explained variable examining all possible models derived from at most 6 explanatory variables and the explained one. For further analysis, only the models with specific characteristics were chosen. All variables in the model had to be statistically significant and the set of explanatory variables had to be the biggest possible while the number of models the smallest (the study does not present the results of logistic regression and the odds ratio in the model of logistic regression in the group of urban residents with the variable HADS-M

Depression test because of a very small sample). Using the models selected, the odds ratio for the events examined were calculated and conclusions formulated on their basis.

# Results

## Participants

The examinees were mostly women (71.7%; n = 81) living in the city vs. village (65.8%; n = 50). The median age was 76 in city residents (min–max: 17–101) and 72 (min–max: 18–94) in village residents (Table 1).

Table 1. Socioeconomic situation in the respondent group*

| Variable | Place of residence | n | M | SD | Q.25% | Me | Q.75% | min | max | Wilcoxon Test p |
|---|---|---|---|---|---|---|---|---|---|---|
| Age (in years) | City | 113 | 71.50 | 17.21 | 62.00 | 76.00 | 84.00 | 17.00 | 101.00 | 0.202 |
| | Village | 75 | 69.25 | 16.56 | 62.50 | 72.00 | 81.50 | 18.00 | 94.00 | |
| **Variable** | **Categories** | **City** | | **Village** | | **Fisher Test - p** | | | | |
| | | **n** | **%** | **n** | **%** | | | | | |
| Gender | Women | 81 | 71.7 | 50 | 65.8 | 0.423 | | | | |
| | Men | 32 | 28.3 | 26 | 34.2 | | | | | |
| | Total | 113 | 100 | 76 | 100 | | | | | |

Legend: n-group quantity, % - percentage; M – mean; SD – standard deviation; Q.25% – first quartile; Me – median; Q.75% – third quartile; Min. – minimum; Max. – maximum; *p* – calculated level of significance for standard test Shapiro-Wilk; *p* – calculated level of significance for standard test Fisher. * The figures in column n do not sum up to 193 due to gaps in the questionnaires completed by the carers.

## The evaluation of anxiety and depression

The analysis of anxiety and depression occurrence in the group of patients, calculated into standard ten, is presented in Table 2. The pathological disorder such as the anxiety syndrome was found in 61.1% (n = 72) patients living in cities and in 68.9% (n = 51) of rural residents. Low intensity (mild) of anxious behaviours was observed in 32.1% (n = 35) City vs. 28.4% (n = 21) Village. A lack of abnormalities was confirmed in 1.8% (n = 2) City vs. 2.7% (n = 2) Village. The analysis of HADS-M Depression variable found depression in

68.8% (n = 75) of city residents vs. 68% (51) of village patients. Mild depressive behaviours were found in 26.6% (n = 29) City vs. 28% (n=21) Village. Lack of depression was confirmed in 4.6% (n = 5) City vs. 4% (n = 3) Village. Lack of significant differences between city and village residents was observed at the level of significance equal to 0.05.

Table 2. The level of anxiety and depression by place of residence

| Variable | Place of residence | n | M | SD | Q.25% | M3 | Q.75% | min | max | Wilcoxon Test p |
|---|---|---|---|---|---|---|---|---|---|---|
| HADS-M Anxiety | City | 109 | 109 | 11.51 | 2.29 | 10.00 | 12.00 | 13.00 | 6.00 | 0.491 |
| | Village | 74 | 74 | 11.73 | 2.26 | 10.00 | 12.00 | 13.00 | 6.00 | |
| HADS-M Depression | City | 109 | 11.51 | 2.25 | 10.00 | 12.00 | 13.00 | 5.00 | 17.00 | 0.64 |
| | Village | 75 | 11.39 | 1.76 | 10.00 | 11.00 | 12.00 | 7.00 | 15.00 | |
| **Variable** | **Categories** | | **City** | | **Village** | | **Fisher Test - p** | | | |
| | | | **n** | **%** | **n** | **%** | | | | |
| HADS-M Anxiety | Lack of abnormality (0–7) | | 2 | 1.8 | 2 | 2.7 | 0.78 | | | |
| | Border conditions (8–10) | | 35 | 32.1 | 21 | 28.4 | | | | |
| | Abnormality confirmed (11–21) | | 72 | 66.1 | 51 | 68.9 | | | | |
| | Total | | 109 | 100 | 74 | 100 | | | | |
| HADS-M Depression | Lack of abnormality (0–7) | | 5 | 4.6 | 3 | 4 | 0.962 | | | |
| | Border conditions (8–10) | | 29 | 26.6 | 21 | 28 | | | | |
| | Abnormality confirmed (11–21) | | 75 | 68.8 | 51 | 68 | | | | |
| | Total | | 109 | 100 | 75 | 100 | | | | |

Legend: n-group quantity, % - percentage; M – mean; SD – standard deviation; Q.25% – first quartile; Me – median; Q.75% – third quartile; Min. – minimum; Max. – maximum; *p* – calculated level of significance for standard test Shapiro-Wilk; *p* – calculated level of significance for standard test Fisher. * The figures in column n do not sum up to 193 due to gaps in the questionnaires completed by the carers.

## Correlations of the number of visits and interventions in the prior 12 months with the HADS-M scale

Statistically significant differences between the correlation coefficients of city and village residents were found relating to anxiety and the number of visits in cardiological clinics (p

= 0.005) and the number of interventions of a family nurse (p = 0.03). In village patients the number of visits to cardiological units (r = 0.32, p = 0.005) and the number of nurse interventions (r = 0.25, p = 0.033) correlates positively with the HADS-M Anxiety scale. This correlation was not found in city patients. The correlation between the number of visits to cardiological units and HADS-M Anxiety was found to be insignificant (r = −0.1, p = 0.306) as well as between the number of a nurse interventions and HADS-M Anxiety (r = −0.06, p = 0.516) (Table 3).

Table 3. The correlation between number of visits, appointments and interventions in the prior 12 months with HADS-M scale

| Variable | | | GP appointments | | | | | Visits in Cardiological Clinic | | | | | Family Nurse Interventions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | r | r=0 p | * | n | r=r p | * | r | r=0 p | * | N | r=r p | * | r | r=0 p | * | n | r=r | * |
| HADS-M | Anxiety | City | -0.11 | 0.244 | | 109 | 0.439 | | -0.1 | 0.306 | | 109 | 0.005 | * | -0.06 | 0.516 | | 109 | 0.03 | * |
| | | Village | -0.23 | 0.051 | | 74 | | | 0.32 | 0.005 | * | 74 | | | 0.25 | 0.033 | * | 74 | | |
| | Depression | City | -0.21 | 0.031 | * | 109 | 0.694 | | -0.03 | 0.739 | | 109 | 0.37 | | -0.05 | 0.628 | | 109 | 0.35 | |
| | | Village | -0.15 | 0.204 | | 75 | | | 0.1 | 0.374 | | 75 | | | 0.09 | 0.427 | | 75 | | |

Legend: (r) – Spearman's rank correlation coefficient (0 means $r \leq 0.01$), ($r = 0$ p) – calculated significance level for test verifying null hypothesis that correlation coefficient $r$ equals 0; * appears in column (*) if $p \leq 0.05$, then null hypothesis is rejected (0 means $p < 0.001$) ($r =$ r p) – calculated significance level for test verifying null hypothesis that two correlation coefficients are equal, * appears in column (*) if $p \leq 0.05$, then null hypothesis is rejected (0 means $p < 0.001$). * The figures in column n do not sum up to 161 due to gaps in the questionnaires completed by the carers.

## Results of logistic regression

The logistic regression analysis in the group of CVD patients living in urban areas (Table 4a) led to the selection of models, which allowed for the odds ratio calculation (Table 4b).

Table 4a. The results of logistic regression analysis in group of city residents. Explained variable: HADS-M Anxiety (0—lack of abnormalities, 1—abnormality confirmed)

| Explanatory variables | | | $b_i$ | $SE_i$ | $z_i$ | $p_i = Pr(>\|z_i\|)$ |
|---|---|---|---|---|---|---|
| *Models with 4 explanatory variables* | | | | | | |
| **Model 1** (n=100) | | | | | | |
| $Chi^2 = 25.57$, df = 4, p<0.001, pseudo $R^2 = 0.2$ | | | | | | |
| Free term | | | - | - | - | - |
| 1 | X18 | WHOQOL-BREF physical domain | -0.231 | 0.116 | -1.991 | 0.046 |
| 2 | X19 | WHOQOL-BREF psychological domain | 0.399 | 0.147 | 2.723 | 0.006 |
| 3 | X26 | HBI - health practices | -0.583 | 0.225 | -2.597 | 0.009 |
| 4 | X28 | HADS-M depression | 1.406 | 0.481 | 2.924 | 0.003 |

Legend: Chi-squared – statistical hypothesis test of $chi^2$ model adjustment; df – number of degrees of freedom; $p$ – calculated level of test significance (if $p \leq 0.05$, model introduces relevant information as it differs significantly from free term model); pseudo $R^2$ – value which evaluates explanatory variable anticipation according to the model ($0 \leq$ pseudo $R^2 < 1$, the bigger the value the better the anticipation); $bi$ – coefficient estimation in regression model; SE$i$ – standard error estimation for $bi$ coefficient; $zi$ – value of test statistics in standard distribution; ($pi = \Pr(>|zi|)$) – calculated probability value $pi$ for double-sided critical area equal to $z$ (if $pi \leq 0{,}05$, null hypothesis is rejected that $bi$ coefficient =0 which means that $i$-variable is relevant in the model); n-group quantity

Table 4b presents the results of the odds ratio in a logistic regression model for the risk of anxiety occurrence in chronic CVD patients living in cities. It was found that in patients who differed at the level of Qol in physical domain of WHOQOL-BREF questionnaire by 1 degree, those with a lower score have a 1.25 times higher chance of anxiety occurrence than those with a higher result. In patients who differed in this score by 14.85, those with a lower one have a 30.93 times higher chance of developing anxiety.

In patients who differed in the level of Qol in the psychological domain of WHOQOL-BREF questionnaire by 1 degree, those with a higher score have a 1.49 times higher chance of anxiety occurrence than those with a lower one. In patients who differed in this score by 14.66, those with a higher result have a 48.75 times higher chance of anxiety abnormalities.

It was found that in patients who differed in the level of Qol in the intensity of health practices of WHOQOL-BREF questionnaire by 1 degree, those with a lower score have a 1.79 times higher chance of anxiety occurrence than those with a higher one. In patients who differed in this score by 2.83, those with a lower one have a 5.21 times higher chance of developing anxiety.

It was also discovered that for patients who differed in the assessment of depression in HADS-M scale by 1 degree, those with a higher score have a 4.07 times higher chance of anxiety occurrence than those with a lower one.

Table 4b. The odds ratio in the model of logistic regression in group of city residents.
Explained variable: HADS-M Anxiety (0—lack of abnormalities, 1—abnormality confirmed)

| Explanatory variables | | Per unit | | | | On the Range | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | OR | 95% CI | | 1/OR | OR | 95% CI | | 1/OR | range |
| *Model 1* | | | | | | | | | | |
| X18 | WHOQOL-BREF physical domain | 0.79 | 0.62 | 0.98 | 1.25 | 0.03 | 0.00 | 0.84 | 30.93 | 14.85 |
| X19 | WHOQOL-BREF psychological domain | 1.49 | 1.13 | 2.01 | 0.67 | 48.75 | 6.17 | 29800 | 0.00 | 14.66 |
| X26 | HBI - Health Practices | 0.55 | 0.35 | 0.85 | 1.79 | 0.19 | 0.05 | 0.64 | 5.21 | 2.83 |
| X28 | HADS-M Depression | 4.07 | 1.62 | 10.83 | 0.24 | 4.07 | 1.62 | 10.80 | 0.24 | 1.00 |

Legend: OR - odds ratio, CI - 95% confidence interval for OR

The logistic regression analysis in the group of CVD patients living in rural areas (Table 5a) led to the selection of models, which allowed for odds ratio calculations (Table 5b).

Table 5a. The results of logistic regression analysis in the village group. Explained variable: HADS-M Anxiety (0—lack of abnormalities, 1—abnormality confirmed)

| Explanatory variables | | | $b_i$ | $SE_i$ | $z_i$ | $p_i = Pr(>\|z_i\|)$ |
|---|---|---|---|---|---|---|
| *Models with 6 explanatory variables* | | | | | | |
| **Model 1** (n=72) | | | | | | |
| $Chi^2 = 40.05$, df = 6, $p<0.001$, pseudo $R^2 = 0.4$ | | | | | | |
| Free term | | | - | - | - | - |
| 1 | X9 | Age (in years) | -0.040 | 0.020 | -2.014 | 0.044 |
| 2 | X15 | Camberwell | -5.683 | 2.741 | -2.073 | 0.038 |
| 3 | X18 | WHOQOL-BREF physical domain | 0.446 | 0.185 | 2.405 | 0.016 |
| 4 | X20 | WHOQOL-BREF social relations domain | -0.427 | 0.214 | -1.997 | 0.046 |
| 5 | X21 | WHOQOL-BREF environment domain | 0.516 | 0.260 | 1.987 | 0.047 |
| 6 | X28 | HADS-M depression | 1.768 | 0.698 | 2.532 | 0.011 |
| *Models with 4 explanatory variables* | | | $b_i$ | $SE_i$ | $z_i$ | $p_i = Pr(>\|z_i\|)$ |
| **Model 2** (n=73) | | | | | | |
| $Chi^2 = 24.39$, df =4 , $p<0.001$, pseudo $R^2 = 0.24$ | | | | | | |
| Free term | | | - | - | - | - |
| 1 | X4 | Number of home visits by a nurse during the last 12 months | -0.102 | 0.050 | -2.059 | 0.040 |
| 2 | X15 | Camberwell | -4.397 | 2.098 | -2.096 | 0.036 |
| 3 | X19 | WHOQOL-BREF psychological domain | 0.281 | 0.124 | 2.276 | 0.023 |
| 4 | X28 | HADS-M depression | 1.201 | 0.559 | 2.148 | 0.032 |

Legend: Chi-squared – statistical hypothesis test of $chi^2$ model adjustment; df – number of degrees of freedom; $p$ – calculated level of test significance (if $p \leq 0.05$, model introduces relevant information as it differs significantly from free term model); pseudo $R^2$ – value which evaluates explanatory variable anticipation according to the model ($0 \leq$ pseudo $R^2 < 1$, the bigger the value the better anticipation); $bi$ – coefficient estimation in regression model; SE$i$ – standard error estimation for $bi$ coefficient; $zi$ – value of test statistics in standard distribution; ($pi = Pr(>|zi|)$ – calculated probability value $pi$ for double-sided critical area equal to $z$ (if

*pi* ≤ 0,05, null hypothesis is rejected that *bi* coefficient =0 which means that *i*-variable is relevant in the model); n-group quantity.

Table 5b presents the results of the odds ratio in a logistic regression model for the risk of anxiety occurrence in chronic CVD patients living in villages.

It was found that for patients who differed in age by 1 year, younger patients have a 1.04 times higher chance of anxiety occurrence than older patients, while in patients who differed by 76 years the chance was 21.2 times higher.

In patients who differed in the Camberwell evaluation of needs by 0.83, those with a lower score have a 113 times higher chance of anxiety occurrence than those with a higher assessment. In patients who differed in the assessment by 1, those with a lower assessment have a 293.86 times higher chance of such abnormalities.

In patients who differed in the level of Qol in physical domain of WHOQOL-BREF questionnaire by 1 degree, those with a higher score have a 1.49 times higher chance of developing anxiety than those with a lower one. In patients who differed in this assessment by 14.28, those with a higher assessment have a 585 times higher chance of anxiety disorders.

In patients who differed in the level of Qol in social relations domain of WHOQOL-BREF questionnaire by 1 degree, those with a lower score have a 1.53 times higher chance of anxiety occurrence than those with a higher one. In patients who differed in this assessment by 14.66, those with a lower one have a 522 times higher chance of anxious behaviours.

It was also discovered that in patients who differed in the level of Qol in the environment domain of WHOQOL-BREF questionnaire by 1 degree, those with a higher score have a 1.67 times higher chance of anxiety occurrence than those with a lower one. In patients who differed in this assessment by 11.92, those with a higher one have a 473 times higher chance of anxiety disorders.

It was confirmed that in patients who differed in the assessment of depression by 1 on HADS-M scale, those with a higher score have a 5.85 times higher chance of anxiety

disorders than those with a lower score.

In patients who differed in the number of a family nurse visits in the last 12 months by 1, it was found that those with a lower number of visits have a 1.11 times higher chance of anxiety development than those with a greater number of visits. However, in patients who differed in the number of visits by 28, those with a smaller number have a 51.39 times higher chance of such behaviours.

Patients who differed in the level of Qol in psychological domain of WHOQOL-BREF questionnaire by 1 degree, those with a higher score have a 1.32 times higher chance of anxiety occurrence than those with a lower score. But, in patients who differed in this assessment by 14, those with a higher score have a 51.39 times higher chance of developing anxiety.

Table 5b. The odds ratio in the model of logistic regression in the village group. Explained variable: HADS-M Anxiety (0—lack of abnormalities, 1—abnormality confirmed)

| Explanatory variables | | Per unit | | | | On the Range | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | OR | 95% CI | | 1/OR | OR | 95% CI | | 1/OR | range |
| *Model 1* | | | | | | | | | | |
| X9 | Age (in years) | 0.96 | 0.919 | 0.99 | 1.04 | 0.05 | 0.002 | 0.73 | 21.2 | 76.00 |
| X15 | Camberwell | 0.00 | 0.00001 | 0.56 | 293.86 | 0.01 | 0.00007 | 0.62 | 113 | 0.83 |
| X18 | WHOQOL-BREF physical domain | 1.56 | 1.11 | 2.33 | 0.64 | 585 | 4.58 | 177000 | 0.002 | 14.28 |
| X20 | WHOQOL-BREF social relations domain | 0.65 | 0.40 | 0.94 | 1.53 | 0.002 | 0.000002 | 0.46 | 522 | 14.66 |
| X21 | WHOQOL-BREF environment domain | 1.67 | 1.06 | 3.00 | 0.59 | 473 | 2.11 | 503000 | 0.002 | 11.92 |
| X28 | HADS-M depression | 5.85 | 1.58 | 25.66 | 0.17 | 5.85 | 1.58 | 25.60 | 0.17 | 1.00 |
| *Model 2* | | | | | | | | | | |
| X4 | Number of home visits by a nurse during the last 12 months | 0.90 | 0.81 | 0.99 | 1.11 | 0.06 | 0.01 | 0.83 | 17.64 | 28 |
| X19 | WHOQOL-BREF psychological domain | 1.32 | 1.05 | 1.71 | 0.75 | 51.39 | 2.03 | 1960.55 | 0.02 | 14 |

Legend: OR - odds ratio, CI - 95% confidence interval for OR

The analysis of logistic regression in chronically ill CVD patients living in rural areas (Table 6a) led to the identification of models which permitted calculation of the odds ratio (Table

6b).

Table 6a. The results of logistic regression analysis in the village group. Explained variable: HADS-M Depression (0—lack of abnormalities, 1—abnormality confirmed)

| Explanatory Variables | | | $b_i$ | $SE_i$ | $z_i$ | $p_i = Pr(>\|z_i\|)$ |
|---|---|---|---|---|---|---|
| *Models with 3 explanatory variables* | | | | | | |
| **Model 1** (n=73) | | | | | | |
| $Chi^2 = 19.55$, df = 3, $p<0.001$, pseudo $R^2 = 0.19$ | | | | | | |
| Free term | | | - | - | - | - |
| 1 | X18 | WHOQOL-BREF physical domain | -0.334 | 0.167 | -2.003 | 0.045 |
| 2 | X19 | WHOQOL-BREF psychological domain | 0.321 | 0.162 | 1.984 | 0.047 |
| 3 | X28 | HADS-M anxiety | 1.528 | 0.609 | 2.507 | 0.012 |

Legend: Chi-squared – statistical hypothesis test of $chi^2$ model adjustment; df – number of degrees of freedom; $p$ – calculated level of test significance (if $p \leq 0.05$, model introduces relevant information as it differs significantly from free term model); pseudo $R^2$ – value which evaluates explanatory variable anticipation according to the model ($0 \leq$ pseudo $R^2 < 1$, the bigger the value the better anticipation); $bi$ – coefficient estimation in regression model; SE$i$ – standard error estimation for $bi$ coefficient; $zi$ – value of test statistics in standard distribution; ($pi = Pr(>|zi|)$ – calculated probability value $pi$ for double-sided critical area equal to $z$ (if $pi \leq 0{,}05$, null hypothesis is rejected that $bi$ coefficient = 0 which means that $i$-variable is relevant in the model); n-group quantity.

Table 6b presents the results of the odds ratio in the model of logistic regression for the risk of depression in chronically ill CVD patients living in rural areas.

In patients who differed in the level of Qol in physical domain of WHOQOL-BREF questionnaire by 1 degree, those with a lower score have a 1.39 times higher chance of depression than those with a higher score. In patients who differed in this assessment by 14.28, those with a lower score have a 118.39 times higher chance of developing such conditions.

In patients who differed in the level of Qol in the psychological domain of WHOQOL-BREF questionnaire by 1 degree, those with a higher score have a 1.37 times higher chance of depressive behaviours than those with a lower score. For patients who differed in this assessment by 14, those with a higher score have 89.07 times higher chance of such abnormalities.

It was also found that in patients who differed in the assessment of anxiety on HADS-M scale by 1, those with a higher score have a 4.6 times higher chance of depression than those with a lower score.

Table 6b. The odds ratio in the model of logistic regression in the village group. Explained variable: HADS-M Depression (0—lack of abnormalities, 1—abnormality confirmed)

| Explanatory Variables | | Per unit | | | | On the Range | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | OR | 95% CI | | 1/OR | OR | 95% CI | | 1/OR | range |
| | *Model 1* | | | | | | | | | |
| X18 | WHOQOL-BREF physical domain | 0.71 | 0.50 | 0.97 | 1.39 | 0.01 | 0.00005 | 0.71 | 118.39 | 14.28 |
| X19 | WHOQOL-BREF psychological domain | 1.37 | 1.01 | 1.93 | 0.72 | 89.07 | 1.31 | 10600 | 0.01 | 14.00 |
| X28 | HADS-M anxiety | 4.60 | 1.45 | 16.28 | 0.21 | 4.60 | 1.45 | 16.2 | 0.21 | 1.00 |

Legend: OR - odds ratio, CI - 95% confidence interval for OR

## Discussion

This is the first Polish research study to examine selected variables potentially affecting the enhancement of primary health services provided to CVD patients living in urban and rural areas who experience increased levels of anxiety and depression.

Previous research has found that CVDs disproportionately affect females [30]. The results prove the conclusion above as women were the majority of respondents both in cities (71.7%; n = 81) and villages (65.8%; n = 50). The study does not include an analysis of anxiety and depression occurrence in relation to sex, however, the results favour the conclusion that these conditions affect women more than men regardless of place of residence. The results achieved are compatible with other studies conducted in Poland [16].

Researchers have found that the emotional state of patients, together with other standard factors, constitute a crucial prognostic element for the course of a disease. The circulatory system is sensitive to psychic stimuli and its functioning affects the emotional state and central nervous system. The reverse relationship also exists—emotional disturbances related to the diagnosis of a CVD might negatively influence the general quality of patients' life [23, 31]. Anxiety and depression are common in CVD patients [2, 4, 32]. The results of this study correlate with these findings. The study found anxiety disorders in 66.1 % (n =

72) of patients living in cities and 68.9% (n = 51) of these living in villages. Depression was observed in 68.8% (n = 75) of urban respondents and 68% (n = 51) of rural respondents. No statistically significant differences between city and village residents were found.

Anxiety has a negative influence on the prognosis of diagnosed CVD patients as relating to the increased risk of series of cardiovascular incidents such as stroke or death caused by cardiovascular failure [7-9]. In analysing the results of the study, we noted that the number of family nurse visits and visits in cardiological clinics among village residents correlated positively with the HADS-M Anxiety scale. Proper emotional support is one of the most essential elements in preparing a patient for the information about their condition as it decreases anxiety and stress and consequently increases quality of life [33]. Among various care situations CVD patients have, systematic self-control and check-ups in medical clinics or carried out at patients' homes seem to be the most important. The form of education depends on the opportunities of a medical institution. However, the more interactive and diverse it is, the higher its effectiveness. When patients are fully aware of their condition and possess proper knowledge about it, anxiety decreases [34]. It is worth highlighting that living in rural areas offers fewer possibilities, limits access to health services, support groups, educational programmes, thus, lowering the safety level in the patients [35]. The results gathered in the study indicate the necessity for more attention while creating programmes aimed at early prevention of anxiety and education among village patients who visit cardiological clinics more often and receive more nurse's interventions at home.

Circulatory diseases are very common and thus constitute a specific area of research attention on the quality of life. Determining physical, psychological and social consequences of CVDs on the life of an individual should remain a core interest. Numerous studies confirmed that Qol assessment is as important in this group of patients as physical, laboratory and clinical tests [36]. Living in a rural environment is believed to be a strong identification of the quality of life connected with health [37]. It was proved in this study that the risk of anxiety among CVD patients living in villages is related to a higher score of Qol in physical, psychological and environmental domains and a lower score in social domain. While higher risk of depression is indicated by a lower score in the physical

domain and a higher score in the psychological domain of Qol. Among city patients the higher risk of anxiety was determined by a lower score in physical domain and a higher score in the psychological domain of Qol. It is notable that CVD patients evaluating their mental state higher are more prone to anxiety disorders and depression and need psychological support.

Family nurse visits are essential in the course of care of CVD patients. Van Spall *et al,* while evaluating the effectiveness of home visits in patients with heart failure and cared by nurses, found that visits were the most powerful strategy to decrease mortality and readmissions after hospitalization caused by heart failure [38]. Thereby, they confirmed earlier findings made by Felter *et al* [39]. This study showed unequivocally that more home visits are associated with a lower risk of anxiety occurrence in CVD patients.

Healthcare behaviours are viewed as the main element in CVD prevention. The World Health Organization [40], the American Heart Association (AHA) [41] and European guidelines related to the prevention of CVD in clinical practice [42] underline the value of healthcare behaviours in preventing and decreasing CVD morbidity. The study showed that lower intensity of pro-health behaviours might foster the risk of anxiety disorders as in patients living in cities who differed in the intensity of the behaviours by 1 degree. Those with a lower score have a 1.79 higher chance of anxiety occurrence than those with a higher score.

It was also confirmed that the presence of anxiety and depression among patients, especially elderly ones, is more common in rural than urban areas [43]. It was observed in the study that younger age and village residence determines higher risk of anxious behaviours.

The relationship between the level of met needs and the risk of anxious behaviours might also be interesting. The analysis of healthcare systems concerning primary health care over the chronically ill emphasises the issue of health needs. It is believed to be an outcome of the level of a clinical condition and factors deriving from it such as the quality of life, healthcare behaviours and the evaluation of medical services. It is assumed that recognition

of a need is equal to the identification of a problem and allows for proper intervention [27, 44]. In the process of shaping primary health systems, determining individual biopsychosocial needs of patients is becoming more and more essential [44]. We found here that when the level of needs met in patients living in rural areas decreases, the risk of the occurrence of anxiety increases.

Examining the relationship between anxiety and depression requires particular attention in the discussion about select variables affecting the improvement of primary health care over CVD patients who experience these abnormalities. We found that a higher score in HADS-M Depression scale is related to a higher risk of anxiety occurrence in CVD patients regardless of the place of residence. What is more, a higher score in HADS-M Anxiety scale increases the risk of depression in rural patients.

The characteristics presented here might constitute the basis for deeper research into the concepts and shows a huge need for professional support. Patients who fit the characteristics ought to be targeted with medical and social programmes that ensure their stable condition and improve the quality of their lives.

## Limitations

This study may be limited by a small sample size. It could significantly limit the possibility of the results' generalization to the whole population of CVD patients in Poland. The findings discovered in the study, however, remain valuable and might be used in the course of interventions supporting the development of a systemic model of home care over chronically ill patients. Research using a greater number of CVD patients and healthcare institutions in urban and rural areas is encouraged.

## Conclusions

The programmes of early anxiety prevention in diagnosed CVD patients should embrace patients living in rural areas who might be characterised by younger age, greater number of visits to cardiological clinics, greater number of family nurse interventions, fewer home visits, lower assessment of met needs and a higher score in physical, psychological and

environmental domains as well as lower score in the social domain of Qol. The programme of early depression prevention should be targeted at CVD patients living in rural areas whose score in physical domain is lower but higher in psychological domain. Urban residents whose score in physical domain is lower but higher in psychological domain and also display lower assessment of pro-health behaviours (health practices category) and depression have a higher risk of anxiety.

# Declarations

### Abbreviations:

CVD - Cardiovascular disease

C – City

V – Village

### Ethics approval and consent to participate

The study was approved by the Bioethical Commission at Wroclaw Medical University (No KB -86/2016). Participation in the study was voluntary and anonymous. All participants gave oral consent to participate in the study, were informed about the study's aims, methods, and the possibility of study withdrawal at any stage. The Bioethical Commission approved the procedure for obtaining oral consent from study participants, because the study only used anonymous surveys.

### Consent for publication

Not applicable in this section.

### Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

### Competing interests

The authors declare that they have no competing interests. Co-author Donata Kurpas is an Associate Editor of the journal Medical Science Pulse.

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**Author's contributions**

ESC contributed to preparation of the study design, collection of data, statistical analysis, data interpretation, creation of final version of the article, and literature review. MG, AP, DEB, AŁ, PP contributed to basic data collection. DK contributed to preparation of the study design, data interpretation, and preparation of the final manuscript. All authors read and approved the final version of the manuscript.

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