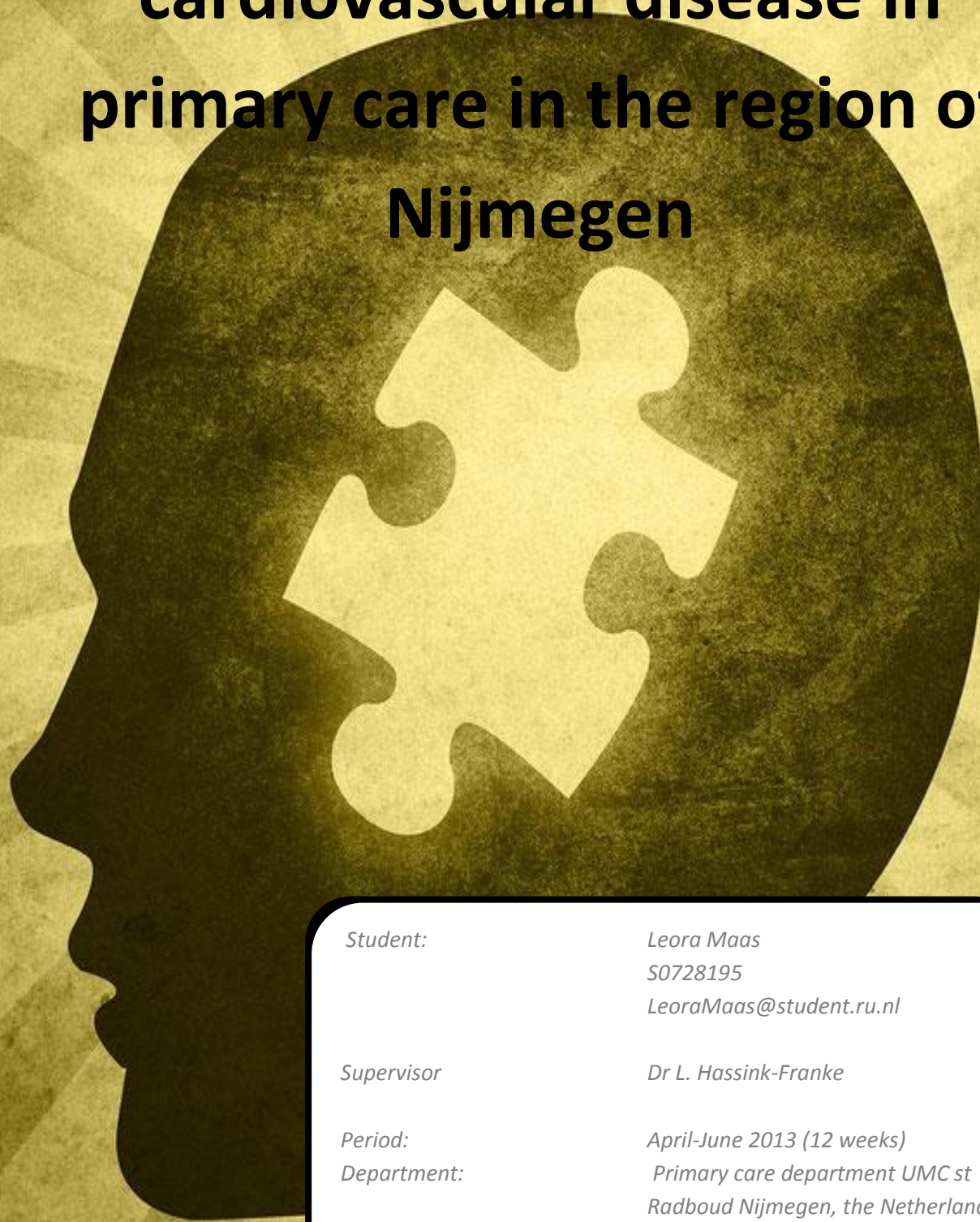


Prevalence of mental disorders in patients with cardiovascular disease in primary care in the region of Nijmegen



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Summary

Background: cardiovascular disease (CVD) and mental disorders are both common in the general population. The prevalence of mental disorders in patients with CVD is higher than in the general population. Mental disorders have a negative effect on morbidity and mortality of patients with CVD. The exact prevalence of mental disorders in CVD patients in primary care is unknown. Also, it is not entirely clear how outcome measurements such as cholesterol, smoking and blood pressure differ between primary care CVD patients with and without mental disorders.

Objective: to identify the prevalence rates of CVD, mental disorders and mental disorders in patients with CVD and to check whether there are differences in outcome measurements in CVD patients with and without mental disorders.

Methods: the study population consisted of 47.278 patients in the database of the Nijmegen monitoring project (NMP), a research network consisting of 11 primary care practices. The statistical program SPSS 20.0 was used to examine the prevalence of CVD, mental disorders and mental disorders in patients with CVD in the period July 2011 until June 2012. Prevalence was based on ICPC codes concerning CVD and mental disorders. We conducted chi-square tests and independent sample t-test to identify differences in outcome measurements in CVD patients with and without anxiety and/or depression. We corrected for age and gender.

Results: the prevalence of CVD was 8.3%; the prevalence of mental disorders was 24.0%. The prevalence of mental disorders in CVD patients was 31.6%, significantly higher than in the whole patient population ($p=0.0001$). Prevalence rates varied between practices. Patients with anxiety/depression and CVD were significantly younger and more often female ($p=0.001$). T total cholesterol ($p=0.031$, cholesterol/HDL ratio ($p=0.022$)) and a positive smoking status ($p=0.004$) were significantly higher among patients with anxiety and/or depression and CVD. For more than half of the patients important outcome measurements were incomplete.

Discussion: primary care patients with CVD more often have a mental disorder diagnosed than patients without CVD. Differences in prevalence rates between practices might be due to their location or to differences in registration. Furthermore, there were many missing outcome measurements. Further research should disclose why these - annually required - values are missing. Registration of mental disorders and CVD outcome measurements should be improved in order to longitudinally evaluate and improve the course of CVD combined with mental disorders.

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Background

In the Netherlands cardiovascular disease (CVD) is the main cause of death in women and the second leading cause of death in men. In 2009 more than 40.000 Dutch people died from CVD. This is 30% of all death.¹

Mental disorders are also a common problem. About 1 in 10 people will at some point in his/her life have to deal with this. The prevalence of depression in general practice in 2007 was 15/1000 men and 31/1000 women.² The world health organization (WHO) estimates that by 2030 depression alone will be the second most common disease/limitation worldwide after CVD.³

The prevalence of anxiety disorders in the whole population is high (7.7% of men and 12.5% of women), but not everyone with an anxiety disorder goes to the general practitioner so the prevalence of anxiety disorder in general practice is lower. The prevalence in the general practice is about 7/1000 men and 14/1000 women.⁴

Mental disorders such as anxiety and depression are common in patients with chronic disease such as diabetes and/or CVD and are increasingly part of multimorbidity. Multimorbidity is the general term for the occurrence of more than one (chronic) disease in an individual during a certain period. The combination of multiple diseases can lead to problems such as constraints and loss of quality of life, more and longer hospitalizations. For the care given to these patients multimorbidity is also important. A treatment advice for one condition may be contradictory for the treatment of another condition. Receiving care from several medical specialists and other health care providers at the same time can also lead to not well coordinated care.⁵

As mentioned above, mental disorders such as anxiety and depression are more common in people with CVD.^{6,7} The figure below shows that mental disorders are significantly more common in people with CVD in comparison with healthy people. This study evaluated the prevalence of anxiety, depression and hostility in older people with CVD being treated in hospital.⁶

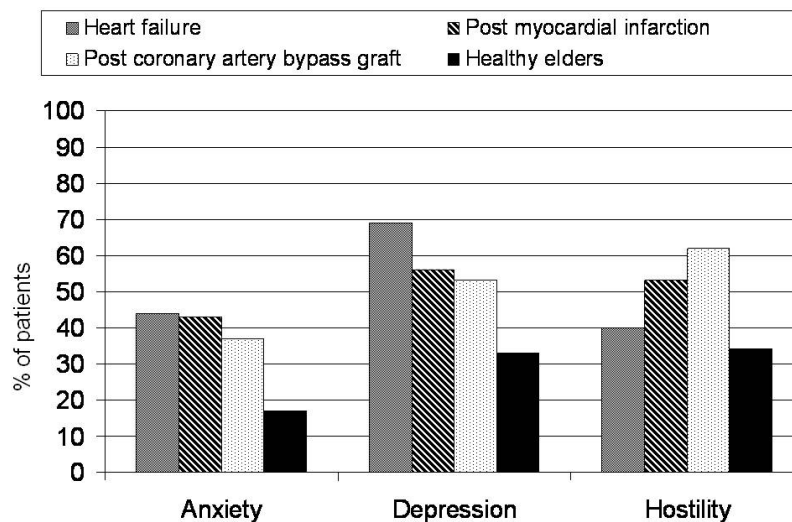


Figure 1: percent of patients in each group exceeding the published threshold for anxiety, depression and hostility⁶

The prevalence of mental disorders differs between various studies. Depression is more often studied than anxiety disorders in people with CVD. The majority of the studies are limited to a subpopulation within the group of patients with CVD, particularly heart failure is often investigated. An overview of the available literature on the prevalence of anxiety and depression in heart failure is given by *Yohannes et al.*⁸ This article shows that the prevalence of depression in heart failure varies between 10 and 60% and the prevalence of anxiety between 11 and 45%.

As explanation for this large variance the authors gave several possible reasons. The first is the use of different diagnostic tools. Second is the different degree of illness severity. Third is the setting of the studies (e.g. hospital of community based patients). The last reason is the fact that both heart failure and depression have the same symptoms such as fatigue, loss of energy and sleep disturbances making it difficult to know what belongs to the depression and what to the heart failure. Similar variation in prevalence rates have been found by other investigators^{9,10}. The prevalence of mental disorders in patients with CVD other than just heart failure is less well known. *Cimpean et al.*¹¹ showed that the prevalence of depression in patients with CVD is between 16 and 23%.

It is important to know what mental disorders are registered in patients with CVD because it can have consequences for the outcome and survival of this group of patients. There is evidence that mental disorders and CVD affect each other negatively.

Firstly, the literature shows that people with both a mental disorder and CVD have an unhealthier life style: they smoke more often and are more inactive which can lead to a higher BMI^{12,13,14,16} than patients with CVD but without a mental disorder. Depression is also associated with non-compliance. Treatment compliance in CVD includes taking medication, following a diet and following lifestyle recommendations. The result of non-compliance can be a higher BMI, a higher blood pressure and higher cholesterol values^{15,16}.

Secondly the presence of mental disorders leads to greater risk of developing CVD, about 2 times.^{12,17,18} People with both CVD and mental disorders have a greater risk of morbidity and mortality compared to patients with CVD but without mental disorders. This is also reflected in the article by *Hammer et al.*¹⁹ who concluded that hypertension and mental disorders are independently of each other associated with a higher risk of CVD and mortality. These two risk factors add to each other. So, the risk of CVD and mortality is even higher. However, not all literature shows that the co-occurrence of mental disorders and CVD are associated with a negative outcome. *Kornerup et al.*²⁰ showed that there is no association between anxiety and depression and adverse clinical outcomes in secondary care patients with CVD.

Thirdly, the presence of both mental disorders and CVD has negative effect on the quality of life and patients have more health complaints than healthy people^{9,12,13}

Earlier research showed that interventions for people with co-morbid medical illness and anxiety/depression produced improvements in the psychiatric co-morbidity, but the improvement wasn't seen in the chronic physical conditions. Most of the interventions used focused exclusively on the mental health aspect of the co-morbidity. So, focusing exclusively on the mental disorders didn't automatically improve the course of the chronic medical problems^{12,13} However, another study showed improvement in cardiac outcomes and mortality rates among cardiac patients receiving psychological interventions.⁹ The mortality in the group of patients receiving psychological interventions reduced by 27-34% and the reduction of the recurrence of cardiac events was 29-43%.^{21,22}

Mental disorders are more common in patients with CVD and have a negative effect on the prognosis of CVD. It is not yet sufficiently clear whether the prognosis improves when primary care patients receive specific care for the combination of these problems. A Dutch primary care research network, called the Nijmeegs Monitoring Project (NMP), aims to improve care for patients with multimorbidity, for instance CVD combined with mental disorders. Before investigating what specific care can improve the prognosis for these patients, it is essential to know the characteristics of this group of patients within the network.

Therefore, the main goal of this research is to investigate the prevalence of mental disorders in patients with CVD in the primary care research network NMP. We also aim to examine whether there are differences between CVD patient with and without mental disorders.

Research question

The examination of the literature reveals that the exact prevalence of mental disorders in people with CVD is not clear. In addition, it appears that there is a relationship between CVD and mental disorders but the literature is not completely unanimously. Therefore this study will examine what the prevalence is of mental disorders in people with CVD and if there is a relationship between patients with CVD and mental disorders.

The main research question of this study is:

What is the prevalence in 2012 of mental disorders in patients with cardiovascular disease in primary care in the Nijmegen region?

Secondary research questions of this study are:

1. What is the prevalence of mental disorders in patients from the participating general practices in 2012?
2. What is the prevalence of cardiovascular disease in patients from the participating general practices in 2012?
3. Are there differences in outcome measures, such as BMI, blood pressure, cholesterol levels, smoking status and use of alcohol, between CVD patients with anxiety/depression and CVD patients without anxiety/depression?

Methods

Patient data

We examined the prevalence of CVD, mental disorders and mental disorders in patients with CVD from 1 July 2011 until 30 June 2012 using the database of the Nijmegen Monitoring Project (NMP). This database was developed in 1985 to monitor the management of hypertension, diabetes mellitus, and chronic obstructive pulmonary disease. Eleven general practices in the Eastern part of the Netherlands participated in this project. Since 2008 CVD is completely registered. Since 2008 standard dataset is extracted from the General Practice Information System (GPIS) including demographic information, consultations, prescriptions, and episodes of disease. The episodes are coded according to the International Classification of Primary Care (ICPC).

ICPC codes concerning CVD

- Angina pectoris→K74/K74.01/K74.02
- Acute myocardial infarction→K75
- Other/chronic ischemic heart disease→K76/K76.01/K76.02
- Decompensatio cordis→K77/K77.1/K77.02
- Atrial fibrillation→K78
- Other/not specified stroke→K90.3
- Claudicatio intermittens→K92.1
- Aneurysm aortae→K99.1

ICPC codes concerning mental disorders

- Anxiety→P01, P02, P74, P79/P79.01/P79.02
- Depression→P03, P76/P76.01
- Sleeping disorder→P06
- Chronic alcohol abuse→P15/P15.01/P15.02/P15.03
- Dementia→P70/P70.01/P70.02
- Psychosis→P71, P73, P98
- Surmenage→P78
- Personality disorder→P80/P80.01/P80.02
- Other→P29, P99

We selected those P-codes that are relevant within primary care. For all P-codes see appendix 1.

After examining the prevalences we checked whether there were differences between CVD patients with anxiety and/or depression and CVD patient without anxiety and/or depression. We specifically chose for this comparison because anxiety and/or depression are the largest and most important group of all patients with mental disorders within primary care. There is great overlap between anxiety, depression and surmenage. Separation between these different diagnoses would therefore be arbitrary. Also, we wanted to leave out sleeping disorders, because sleeping disorders are not always related to emotional problems.

The ICPC codes used in this group are P01, P02, P03, P74, P76, P76.01, P78, P79, P79.01 and P79.02.

We checked 23 variables to see if there were differences between CVD patients with and without anxiety and/or depression. When more than one outcome measurement was found in the database between July 2011-June 2012, we took the last measurement. When no values were known in that period it was reported as a missing value. In association/cooperation with Methodology, Information Management & Statistics (MIMS) the data is extracted from the database.

The variables we checked were

- BMI
- Systolic and diastolic blood pressure
- Blood levels of
 - Fasting glucose
 - Total cholesterol
 - Cholesterol/HDL ratio
 - LDL
 - MDRD (kidney function)
- Smoking status
 - Smoking
 - Advice given to quit smoking
 - Motivation to quit smoking
- Use of alcohol
 - Five shot 1 (how many times drinking of alcohol?)
 - Five shot 2 (amount of alcoholic drinks per day?)
 - Amount of alcohol
- Physical exercise
 - Physical exercise in accordance to standard healthy exercise
 - Advice given over physical exercise
- Family history of CVD
- Risk score for CVD as indicated by the risk table¹
- Main therapist for treatment CVD
- Treatment and medication
 - Enabling care/referring to
 - Checking CVD
 - Compliance to therapy

Statistical procedure

We investigated the prevalence of CVD, mental disorders and mental disorders in patients with CVD with the program SPSS 20.0. We checked the prevalence for the whole population and also in the different practices by using the descriptive and frequency function of the program. We conducted a chi-square test to see if the prevalence of mental disorders in patients with CVD was higher than in the whole patient population.

Secondly we conducted chi square tests and independent sample t-tests to see whether there were differences between outcome measurements in CVD patients with and without anxiety/depression. The most important outcome measurements (BMI, blood pressure, LDL, cholesterol/HDL ratio, use of alcohol, smoking status) were corrected for age and gender within the study population. Outcomes with many missing data were not corrected.

¹ The risk table shows the risk of disease or death from CVD in 10 years. There are two risk tables being used, based upon which guideline GPs are using. In 2012 a new guideline of cardiovascular risk management was developed with a new risk table. Because not all GPs are already using this new table both the old and new table are included in this research.

Results

Mean age of the study population was 47.5 years (SD =17.0), 49.4% of the population were male. In table 1 an overview is given of the different outcome measurements in the whole study population in the period 1 July 2011– 30 June 2012.

In appendix 2 more detailed information about the individual practices is given.

	N	% of patients with data available	Mean	SD
Age (years)	47278	100	47.5	16.992
Gender, male	23342	49.4		
BMI (kg/m²)	7215	15.3	28.5	5.3067
Systolic blood pressure (in mmHg)	11336	24.0	137	16.9804
Diastolic blood pressure (in mmHg)	11323	23.9	80	10.1128
LDL-cholesterol	8421	17.8	3.2	1.0384
Total cholesterol	8588	18.2	5.2	1.1588
Cholesterol/HDL ratio	8429	17.8	4.0	1.3751
Fasting glucose	8504	18.0	6.1	1.6272
MDRD (ml/min)	10272	21.7	69.9	20.4739
Alcohol (amounts/day)	2046	4.3	0.7	1.3858
	Total N	N	%	
Smoking status	6475		13.7	
➤ Never		1587	24.5	
➤ Ex-smoker		2317	35.8	
➤ Current		2571	39.7	
Motivation quit smoking	817		1.7	
➤ Motivated		183	22.4	
➤ Considering		422	51.7	
➤ Unmotivated		182	22.3	
➤ Unclear		30	3.7	
FiveShot1: how many times drinking alcohol?	872		3.2	
➤ Never		497	32.4	
➤ 1 or less/month		262	17.1	
➤ 2-4 times/month		220	14.4	
➤ 2-3 times/week		209	13.6	
➤ 4 or more times/week		344	22.5	
FiveShot2: Amount of alcoholic drinks/day	872		1.8	
➤ 1-2 units		698	80.0	
➤ 3-4 units		124	14.2	
➤ 5-6 units		33	3.8	
➤ 7-9 units		12	1.4	
➤ > 10 units		5	0.6	
Compliance to therapy	1688		3.6	
➤ Sufficient		1598	94.7	
➤ Insufficient		43	2.5	
➤ Unclear		47	2.8	
Physical exercise in accordance with standard healthy exercise	197		0.4	
➤ Complies with standard		116	58.9	
➤ Less than standard		77	39.1	
➤ Inactive		3	1.5	
➤ Unclear		1	0.5	

Table 1: characteristics of the study population, N = 47278

The prevalence of CVD was 8.3% (n=3929) in the total study population. In figure 2 the prevalence of CVD is specified per ICPC-code and in figure 3 the prevalence is displayed for the various practices. In appendix 3 the different ICPC codes concerning CVD were specified per practice.

Figure 2 shows that the main groups of CVD patients consist of angina pectoris (2.5%), myocardial infarction (2.2%) and atrial fibrillation (2.1%).

Figure 3 shows that the prevalence of CVD differs between the different practices (range 2.4%-10.4%). The two practices with the lowest prevalence had few elderly in their population (see appendix 2 for age distribution per practice).

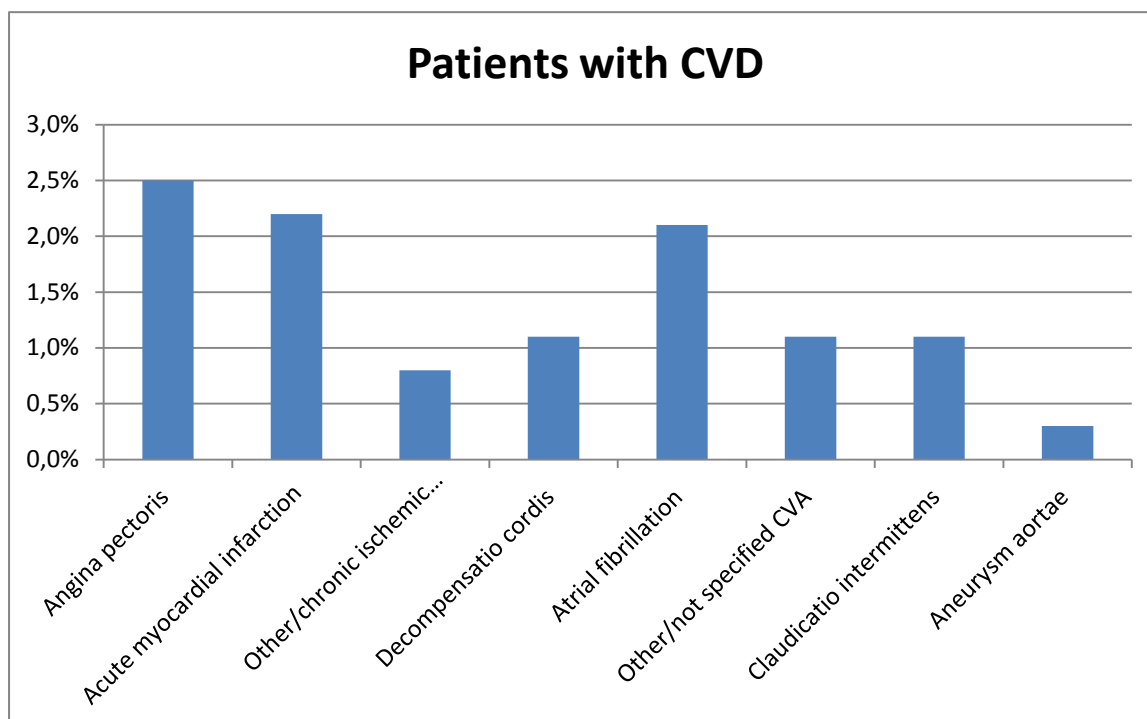


Figure 2: prevalence of cardiovascular disease per ICPC code, N = 47278

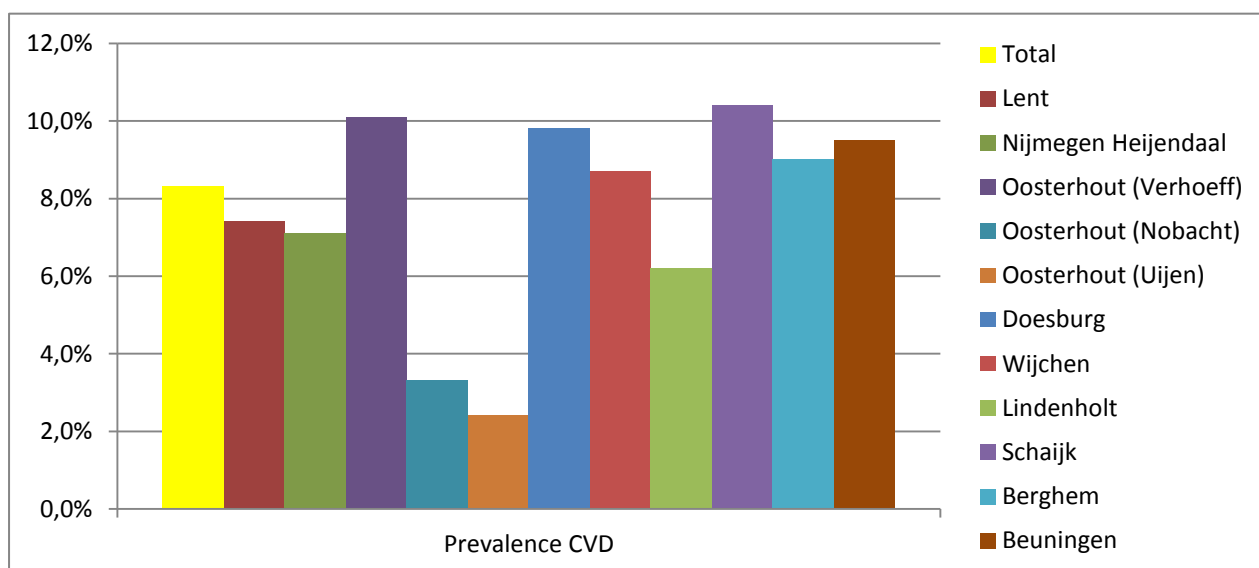


Figure 3: prevalence of cardiovascular disease per practice, N = 47278

The prevalence of mental disorders was 24.0% (n=11.366) in the total study population. In figure 4 the prevalence of mental disorders is shown per ICPC-code concerning mental disorders and in figure 5 the prevalence is displayed for the various practices.

Figure 4 shows that the main groups of mental disorders are anxiety (7.4%), depression (8.2%), sleeping disorder (4.2%) and surmenage (3.6%).

Figure 5 shows that the prevalence of mental disorders in the different practices differs (range 15.3%-31.0%). In appendix 4 the different ICPC codes concerning CVD are presented per practice and in appendix 5 the prevalence of mental disorders in the different practices are standardized for age and gender within the Dutch population. So, we can conclude that the differences in prevalence rates between practices are not caused by differences in gender and age.

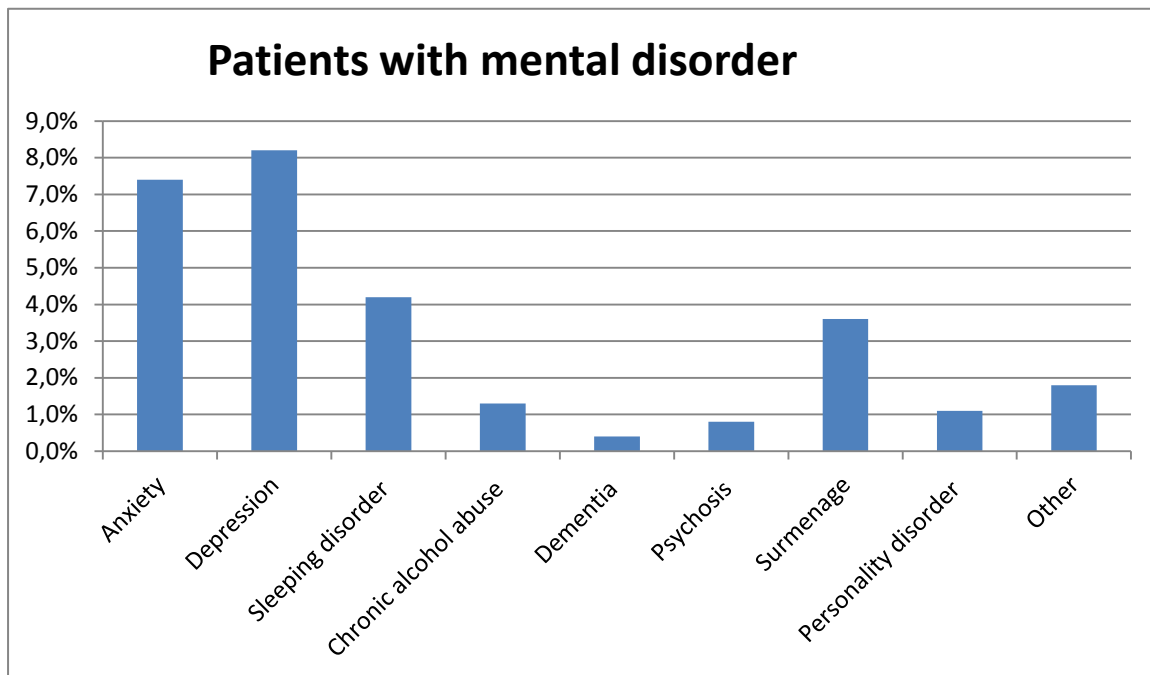


Figure 4: prevalence of mental disorders per ICPC code, N = 47278

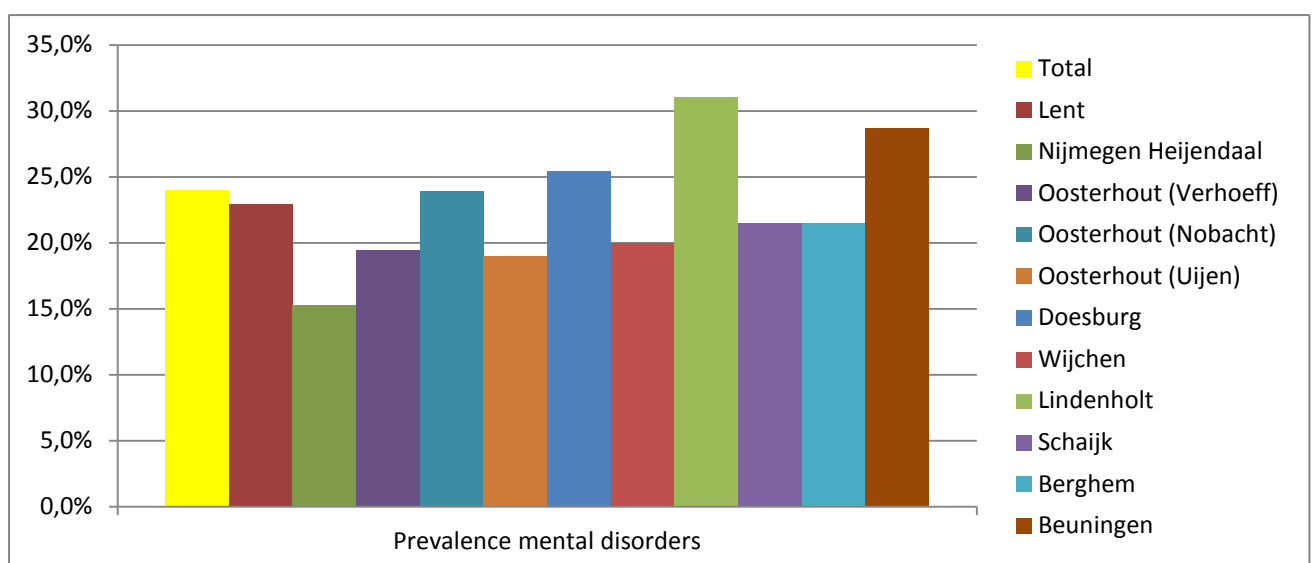


Figure 5: prevalence of mental disorders per practice, N = 47278

The prevalence of mental disorders in patients with CVD was 31.6% (n=1243). In figure 6 the prevalence of mental disorders in patients with CVD is specified per ICPC concerning mental disorders and in figure 7 the prevalence is displayed for the various practices. Figure 6 shows that anxiety (8.4%), depression (10.6%) and sleeping disorder (8.1%) are the main diagnoses in the group with mental disorders. The prevalence of mental disorders in patients with CVD is with 31.6 % significant higher than the 24.0 % in the whole population (p=0.0001). Figure 7 shows that the prevalence of mental disorders in patients with CVD differs between the different practices (range 21.4%-41.4%). The distribution of ICPC codes concerning CVD in patients with mental disorders was similar to the whole population. Depression/anxiety was most prevalent in the group of patients with CVA (24.2%), angina pectoris (22.1%) and decompensatio cordis (21.9%).

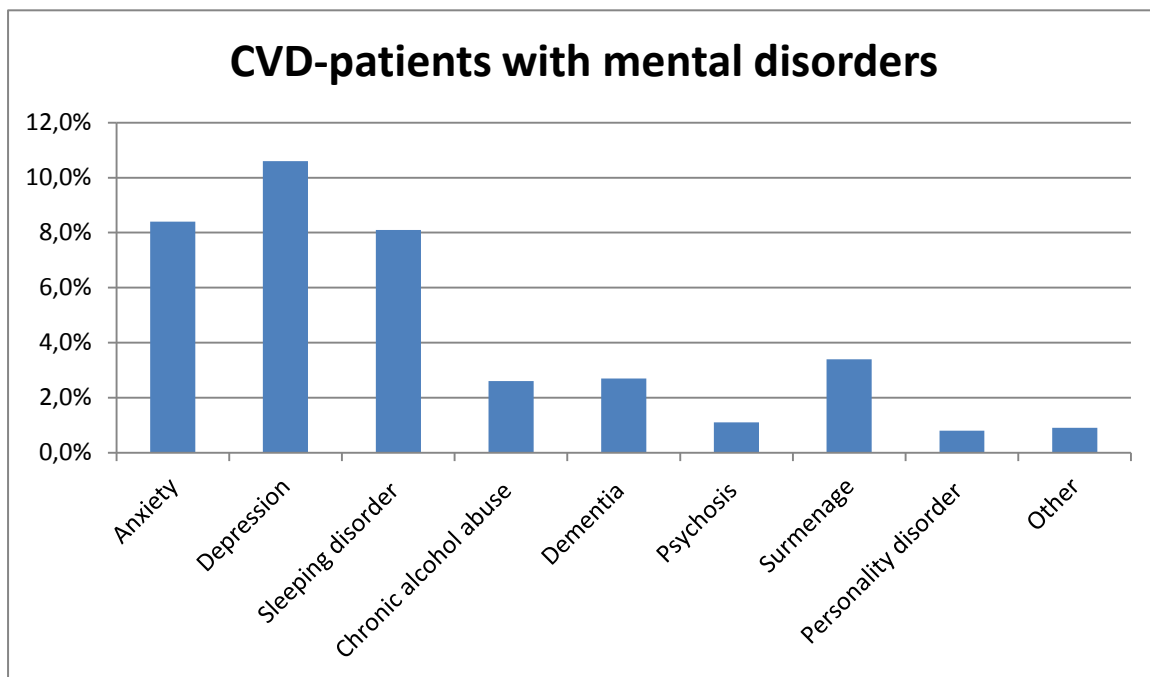


Figure 6: prevalence of mental disorders in patients with CVD per ICPC code, N = 3929

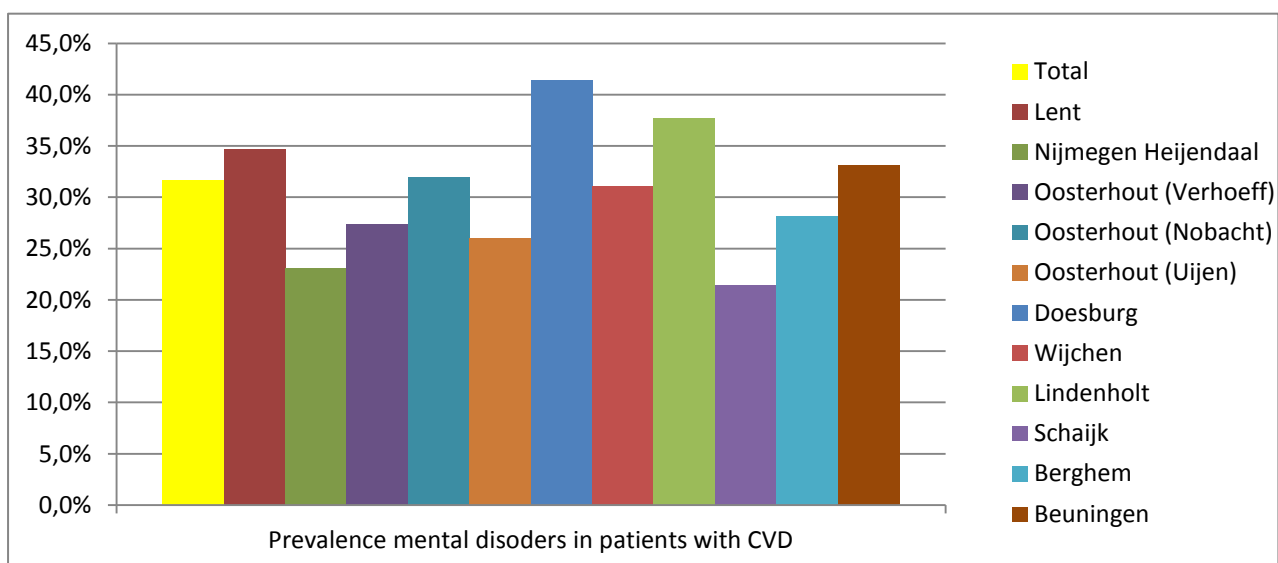


Figure 7: prevalence of mental disorders in patients with CVD per practice, N = 3929

The last research question was to examine differences in outcome measurements between CVD patients with and without anxiety and/or depression. All outcome measurements are shown in table 2 and 3. A chi-square test showed that anxiety and/or depression is significantly higher prevalent ($p=0.0001$) in patients with CVD in comparison with the total study population.

We found that CVD patients with anxiety and/or depression were more often female en younger. Therefore, we corrected in our further analysis for gender and age (if possible). Patients with anxiety and/or depression have a higher total cholesterol, cholesterol/HDL ratio and smoke more often. There was an interaction ($p=0.001$) between the presence of anxiety and/or depression and age for cholesterol/HDL ratio. For older age it didn't matter but younger CVD patients (under the age of 65 years) with anxiety/depression had a higher ratio compared to younger CVD patients without anxiety and/or depression (3.8 vs. 4.5).

Alcohol consumption was a difficult outcome measurement because alcohol was registered in different ways, namely by alcohol (amount of alcohol/day) and the Five Shot question 1 (how many times drinking alcohol) and 2 (amount of alcohol). In order to draw a conclusion about alcohol use, we further investigated this. From a total of 772 CVD patients (19.6%) alcohol consumption was recorded. 545 patients (70.6%) of this group had one outcome measurement registered, 201 patients (26.0%) had two outcome measurements registered en 26 patients (3.4%) had three outcome measurements registered. For all three outcome measurements a cut-off point was determined. For alcohol 15 patients (3.0%) had an alcohol problem and for the Five Shot 1 and 2 was this respectively 76 patients (21.9%) and 7 patients (4.0%). 88 CVD patients (2.2%) in total had an alcohol problem. When this was compared between the two groups it showed that there was no significant difference ($p=0.159$) between CVD patients with and without anxiety and/or depression.

There were many missing values. According to the Dutch guideline cardiovascular risk management every CVD patient should be checked annually including a physical exam and a blood test. The five most important outcomes are BMI, systolic blood pressure, LDL, smoking status and alcohol status. The missing values for these outcome measurements were respectively 60.7%, 40%, 54.6%, 65.7% and 60.4%. In patients with anxiety and CVD, however, BMI, blood pressure, LDL, smoking status and alcohol status were more frequently complete in comparison with CVD patients without anxiety.

	Anxiety/depression yes (n=801)			Anxiety/depression no (n=3128)			P -value
	N	Mean	SD	N	Mean	SD	
Age (years)	801	67.4	12.192	3128	69.5	11.331	0.0001
Gender, male	371 (46.3%)			2005 (64.1%)			0.0001
BMI (kg/m ²)	319	28.9	5.5416	1228	28.7	4.8748	0.944 ^a
Systolic blood pressure (in mmHg)	514	137.7	18.7363	1828	138.2	17.7334	0.405 ^a
Diastolic blood pressure (in mmHg)	512	77.6	11.0111	1827	77.0	10.4147	0.561 ^a
LDL-cholesterol	385	2.75	1.01	1400	2.62	0.9026	0.143 ^a
Total cholesterol	390	4.74	1.1904	1425	4.53	1.0354	0.031^a
Cholesterol/HDL ratio	387	3.92	1.4112	1405	3.80	1.2228	0.022^a
Fasting glucose	401	6.5	1.78	1427	6.5	1.7835	0.444 ^a
MDRD (ml/min)	472	65.1	18.3218	1689	65.1	20.2949	0.616 ^a
Alcohol (amounts/day)	100	0.6	1.0793	401	0.7	1.2007	0.597 ^a
	Total N	N	%	Total N	N	%	
Smoking status	275		34.3	1072		34.3	0.004^a
➤ Never		75	27.3		311	29.0	
➤ Ex-smoker		120	43.6		544	50.7	
➤ Current		80	29.1		217	20.3	
Motivation quit smoking	52		6.5	121		3.9	0.564
➤ Motivated		10	19.2		17	14.0	
➤ Considering		31	59.6		77	63.6	
➤ Unmotivated		11	21.2		24	19.8	
➤ Unclear		0	0		3	2.5	
FiveShot1: how many times drinking alcohol?	69		8.6	278		8.9	0.004
➤ Never		32	46.4		99	35.6	
➤ 1 or less/month		19	27.5		40	14.4	
➤ 2-4 times/month		6	8.7		33	11.9	
➤ 2-3 times/wk		3	4.3		39	14.0	
➤ 4 or more times/wk		9	13.0		67	24.1	
FiveShot2: Amount of alcoholic drinks/day	34		4.2	143		4.6	0.318
➤ 1-2 units		31	91.2		111	77.6	
➤ 3-4 units		2	5.9		26	18.2	
➤ 5-6 units		1	2.9		5	3.5	
➤ 7-9 units		0	0		0	0	
➤ > 10 units		0	0		1	0.7	
Compliance to therapy	99		12.4	322		10.3	0.800 ^a
➤ Sufficient		95	96.0		313	97.2	
➤ Insufficient		4	4.0		6	1.9	
➤ Unclear		0	0		3	0.9	
Physical exercise in accordance with standard healthy exercise	10		1.2	30		1.0	0.429
➤ Complies with standard		6	60.0		15	50.0	
➤ Less than standard		4	40.0		15	50.0	
➤ Inactive		0	0		0	0	
➤ Unclear		0	0		0	0	

Table 2: outcome measurement in CVD patients with and without anxiety/depression, N=3929. a= corrected for age and gender within the study population

	Anxiety/depression yes (n=801)			Anxiety/depression no (n=3128)			P -value
	Total N	N	%	Total N	N	%	
Family history CVD	109		13.6	369		11.8	0.284
➤ Yes		45	41.3		130	35.2	
➤ No		47	43.1		191	51.8	
➤ Unclear		17	15.6		48	13.0	
Advice quit smoking	48		6.0	118		3.8	0.005
➤ Yes							
Advice physical exercise	126		15.7	400		12.8	0.701 ^a
➤ Yes							
Main therapist	140		17.5	465		14.9	0.642 ^a
➤ GP		109	77.9		372	80.0	
➤ Specialist		28	20.0		79	17.0	
➤ Other/unknown		3	2.1		14	3.0	
Enabling care/refer to	3		0.4	12		0.4	0.472
➤ Internist		0	0		3	25.0	
➤ Dietician		1	33.3		5	41.7	
➤ Physiotherapist		0	0		1	8.3	
➤ Cardiologist		0	0		1	8.3	
➤ Other		2	66.7		2	16.7	
Checking CVD	56		7.0	165		5.3	0.731
➤ 1x/yr		22	39.3		80	48.5	
➤ 2x/yr		7	12.5		13	7.9	
➤ 3x/yr		2	3.6		5	3.0	
➤ 4x/yr		9	16.0		31	18.8	
➤ 1x/2yr		14	25.0		32	19.4	
➤ No arranged care		2	3.6		4	2.4	
Risk score based on risk table	40		5.0	154		5.1	0.372
➤ 0-4%		5	12.5		18	11.7	
➤ 5-9%		2	5.0		18	11.7	
➤ >10%		5	12.5		30	19.5	
➤ Can't be determined		28	70.0		88	57.1	
Risk score 2012 based on risk table	8		0.8	28		1.0	0.772
➤ 0-9%		4	50.0		12	42.9	
➤ 10-19%		0	0		3	10.7	
➤ 20%		2	25.0		5	17.9	
➤ Can't be determined		2	25.0		8	28.6	

Table 3: outcome measurements in CVD patients with and without anxiety/depression, N=3929. a= corrected for age and gender within the study population.

Discussion

In this study we evaluated the prevalence rates of CVD, mental disorders and mental disorders in CVD patients in primary care. Also, we evaluated differences in outcome measurements between CVD patients with and without anxiety and/or depression.

The prevalence rate of CVD was 8.3% in a total study population of 47278. Prevalence rates varied between the different practices from 2.4% to 10.4%. In all practices except one, the main diagnoses of CVD were angina pectoris, myocardial infarction and atrial fibrillation. The prevalence rate of mental disorders was 24.0%, varying between practices from 19.4% to 31.0%. The main diagnoses of mental disorders were anxiety, depression, sleeping disorder and surmenage. The prevalence rate of mental disorders in CVD patients (n=3929) was 31.6% (range between practices 21.4%-41.1%), with main diagnoses not differing from those in the whole study population.

CVD patients with anxiety and/or depression were more often female and younger. Furthermore, they had higher levels of total cholesterol, cholesterol/HDL ratio and were more often smokers.

The distribution of CVD diagnoses in our study is in line with other sources²³. Differences in CVD prevalence rates between practices may be due to location and population differences. For instance, the age distribution varies greatly between practices. Because CVD are related to higher age, prevalence rates will be lower in practices with a relatively young population. The location of the practice is also important, because lower socioeconomic status is related to more CVD.

The main diagnoses of mental disorders in our study were also the main diagnoses found by the NEMESIS-2 study²⁴. When we compare the prevalence rates found in our study with previous studies, we see that the prevalence of mental disorders in our study is higher (18.0 vs. 24.0%)²⁴. An explanation for this difference is the way mental disorders were diagnosed. We used ICPC codes whereas the NEMESIS-2 study used a questionnaire based on the DSM-IV criteria. The DSM-IV criteria are stricter and do for instance not contain 'surmenage' as a diagnosis. Therefore, lower prevalence rates were found. Prevalence differences in mental disorders may be due to both location and registration differences in the different GPs. For instance, not every general practitioner is equally alert identifying mental disorders and not every general practitioner closes episodes when a period of mental disorders has ended. Furthermore, the choice of ICPC codes differs between GPs. For example, the practice in Nijmegen used the code 'surmenage' often while the practice in Schaijk and Berghem used the codes for depression more often and the code for surmenage less often. The socioeconomic status wasn't evaluated in this study but this has also effect on the prevalence of mental disorders.

Earlier research showed different prevalence rates of mental disorders in CVD patients. Most studies were based secondary care or on heart failure patients. We included also other CVD which makes comparison difficult. But when we look at the patients with heart failure in our population the prevalence of anxiety and/or depression is 21.9%. This is in line with other studies.^{8,11}

The outcome measurements we found are in line with earlier research showing that patients with CVD and anxiety and/or depression are more often younger and female^{9,18}. Other articles^{12, 13, 14} also found that those patients are more frequently smokers. Those articles also found that CVD patients with anxiety and/or depression were more inactive which can lead to a higher BMI. We didn't find higher BMI values and also the physical exercise seemed sufficient in the CVD patients with anxiety and/or depression. Probably these differences could be explained by the fact that we did not only investigate heart failure patients, but the whole range of patients with CVD. Or the differences were caused by the many missing values.

Mental disorders are associated with a lower therapy compliance which can lead to a higher blood pressure, a higher BMI and higher cholesterol levels^{15,16}. We only found that cholesterol levels and cholesterol/HDL ratio were significantly elevated. We found no difference in therapy compliance between the two different groups. However, the compliance to therapy was known for less than 15% of patients.

Strengths and weaknesses

Strength of this study is the use of a database with data of a large number of patients. Furthermore, the data is reliable because GPs are a member of a yet long acting research network with regular registration meetings. Also, there is a systematic wash out of data.

Our study also had a few weaknesses. The first limitation is the number of missing values. There are several possible explanations for these missing values. The first is the main therapist of the patient. According to our data 20% of the patients were treated in hospital and those values are not always registered in the GP-record. A second reason is the fact that we took a period of a year for the outcome measurements. Some outcome measurements don't have to be checked annually. A third reason is that there is no annually check-up by the general practitioner. This can be due both to the patient and to the GP. The GP don't recall the patients annually for a check-up or patients don't show up for a check-up. A fourth reason is that this study only provides us with data about registration. It might not exactly reflect what has happened in reality. For instance, more blood pressures might have been taken but not registered correctly in the system. We do not know what under or over estimation of values this underreporting might have caused. Do missing values exist in patients with severe mental disorders or in patients with only mild mental disorders?

The second limitation is the lack of data concerning medication. It is known that CVD medication, especially β -blockers, may lead to depression. Medication for mental disorders can also affect outcome measurements such as cholesterol.

The third limitation is the fact that CVD is completely registered within the network since 2008. This could have led to an underestimation of the prevalence of CVD because the registration was not so strict before 2008. We expect, however, this has had few influence on the data because it is being advised that CVD-patients have regular contact with their GP.

Conclusion

The results of our study show that the prevalence of mental disorders in CVD patients is high and there is a possible relationship between mental disorders and CVD. Further longitudinally research is needed to study the effect of this relationship in time. Reducing the amount of missing data would increase the validity of such research. It is also important to know what co morbidity patients have and what influence co morbidity has. The same counts for medication. Furthermore, it would be interesting to investigate functioning and quality of life of these patients. A better and broader registration method would thereby be desirable.

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Appendix

Appendix 1: P-codes mental disorders

Appendix 2: overview study population

Appendix 3: overview prevalence CVD by practice

Appendix 4: overview prevalence mental disorders by practice

Appendix 5: overview of the prevalence of mental disorders by practice, standardized for age and gender in the Dutch population

Appendix 1: P-codes mental disorders

P-codes mental disorders		P-codes used
P01	Anxious, nervous, tens feeling	X
P02	Acute stress reaction	X
P03	Depressive feeling	X
P04	Irritable/angry feelings / behavior	
P05	Feeling old/acting old	
P06	Sleeping disorder	X
P07	Decreased sexual desire	
P08	Decreased sexual satisfaction	
P09	Concern about sexual preference	
P10	Stammering/stuttering	
P11	Eating disorder with a child	
P12	Enuresis	
P13	Encopresis/problems toilet training	
P15	Chronic alcohol abuse	X
P16	Acute alcohol abuse	
P17	Tobacco abuse	
P18	Drug abuse	
P19	Medication abuse	
P20	Memory impairment	
P22	Behavioral problem child	
P23	Behavioral problem adolescent	
P24	Specific learning problem	
P25	Life problems adult	
P27	Anxiety for a mental disorder	
P28	Disability/handicap	
P29	Other psychological complaints/symptoms	X
P70	Dementia	X
P71	Other organic psychosis	X
P72	Schizophrenia	
P73	Affective psychosis	X
P74	Anxiety disorder	X
P75	Somatization disorder	
P76	Depressive disorder	X
P77	Suicide/suicide attempt	
P78	'Surmenage'	X
P79	Phobia/compulsive disorder	X
P80	Personality disorder	X
P81	Hyperkinetic disorder	
P82	Posttraumatic stress disorder	X
P85	Mental retardation	
P86	Anorexia nervosa/bulimia	
P98	Psychosis not further specified	X
P99	Other psychotic disease	X

Appendix 2: overview study population

Practice	Practice size N	Gender		Age in years		Prevalence CVD	Prevalence mental disorder
		Male N (%)	Female N (%)	Mean	SD	N (%)	N (%)
Lent	4417	2137 (48.4)	2280 (51.6)	46.6	16.464	329 (7.4)	1011 (22.9)
Nijmegen	2740	1269 (46.3)	1471 (53.7)	45.7	18.405	195 (7.1)	420 (15.3)
Oosterhout, Verhoeff	2129	1069 (50.2)	1060(49.8)	48.6	16.141	215 (10.1)	412 (19.4)
Oosterhout, Nobacht	1849	903 (48.8)	946 (51.2)	43.9	11.790	61 (3.3)	442 (23.9)
Oosterhout, Uijen	1156	586 (50.7)	570 (49.3)	39.2	11.710	28 (2.4)	219 (18.9)
Doesburg	7854	3814 (48.6)	4040 (51.4)	50.5	17.586	766 (9.8)	1997 (25.4)
Wijchen	2781	1393 (50.1)	1388 (49.9)	50.4	17.278	242 (8.7)	557 (20.0)
Lindenholt	7292	3610 (49.5)	3682 (50.5)	43.1	15.489	450 (6.2)	2258 (31.0)
Schaijk	5370	2699 (50.3)	2671 (49.7)	49.2	17.492	560 (10.4)	1152 (21.5)
Berghem	6334	3203 (50.6)	3131 (49.4)	47.0	16.955	572 (9.0)	1363 (21.5)
Beuningen	5356	2659 (49.6)	2697 (50.4)	50.3	17.660	511 (9.5)	1535 (28.7)
Total: 11	47278	23342 (49.4)	23936 (50.6)	47.5	16.992	3929 (8.3)	11366 (24.0)

Table 4: characteristics study population, N = 47278

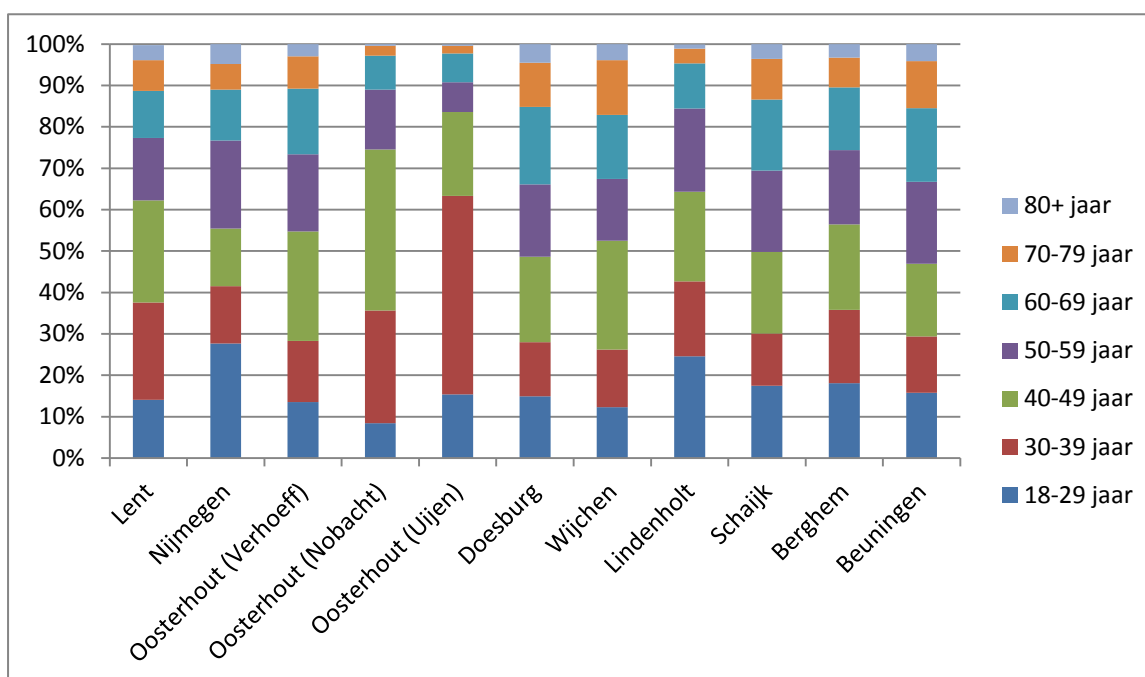


Figure 8: age distribution by practice

Appendix 3: overview of the prevalence of CVD by practice

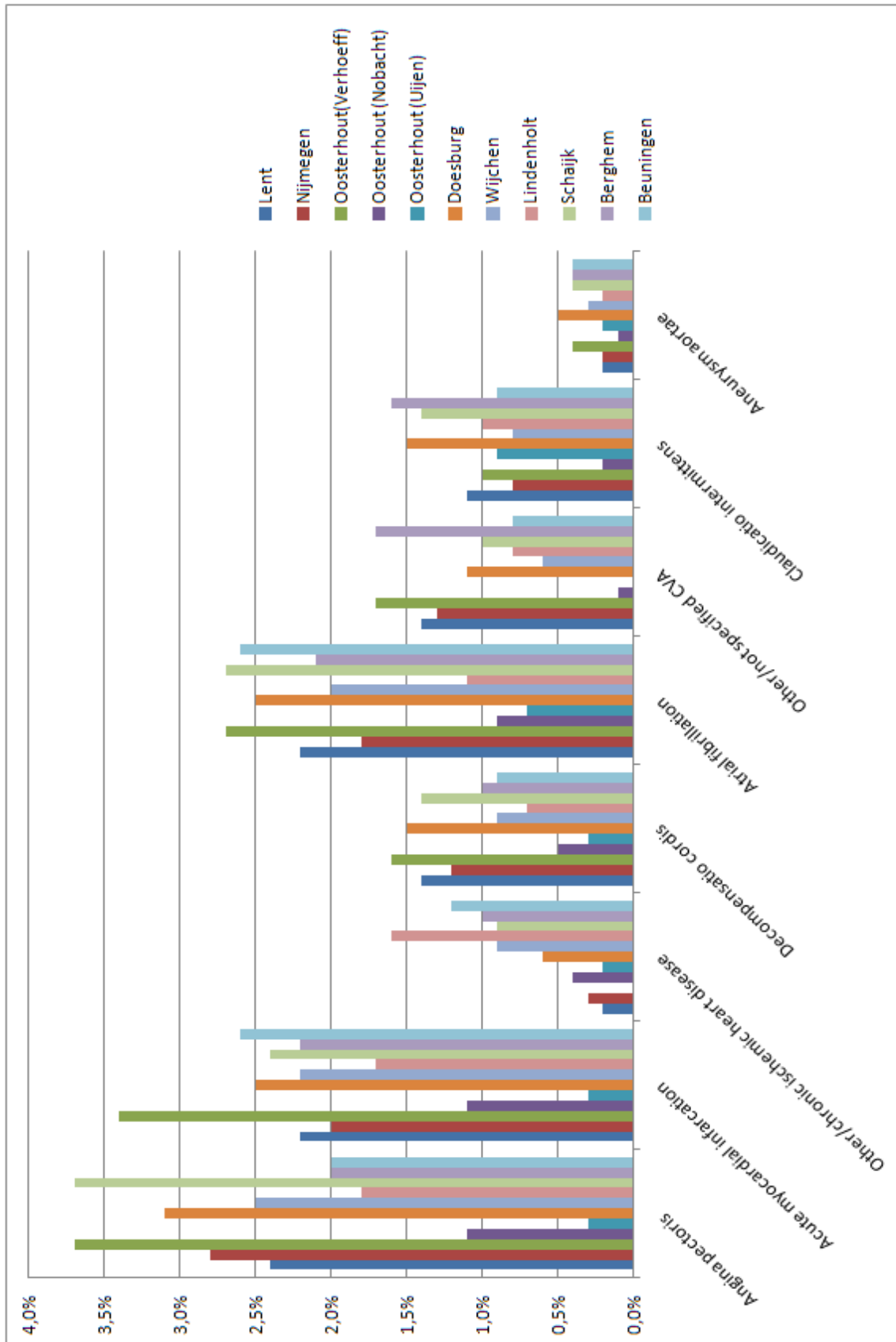


Figure 9: prevalence of CVD in the different GPs divided by ICP codes, N=47278

Appendix 4: overview prevalence of mental disorders by practice

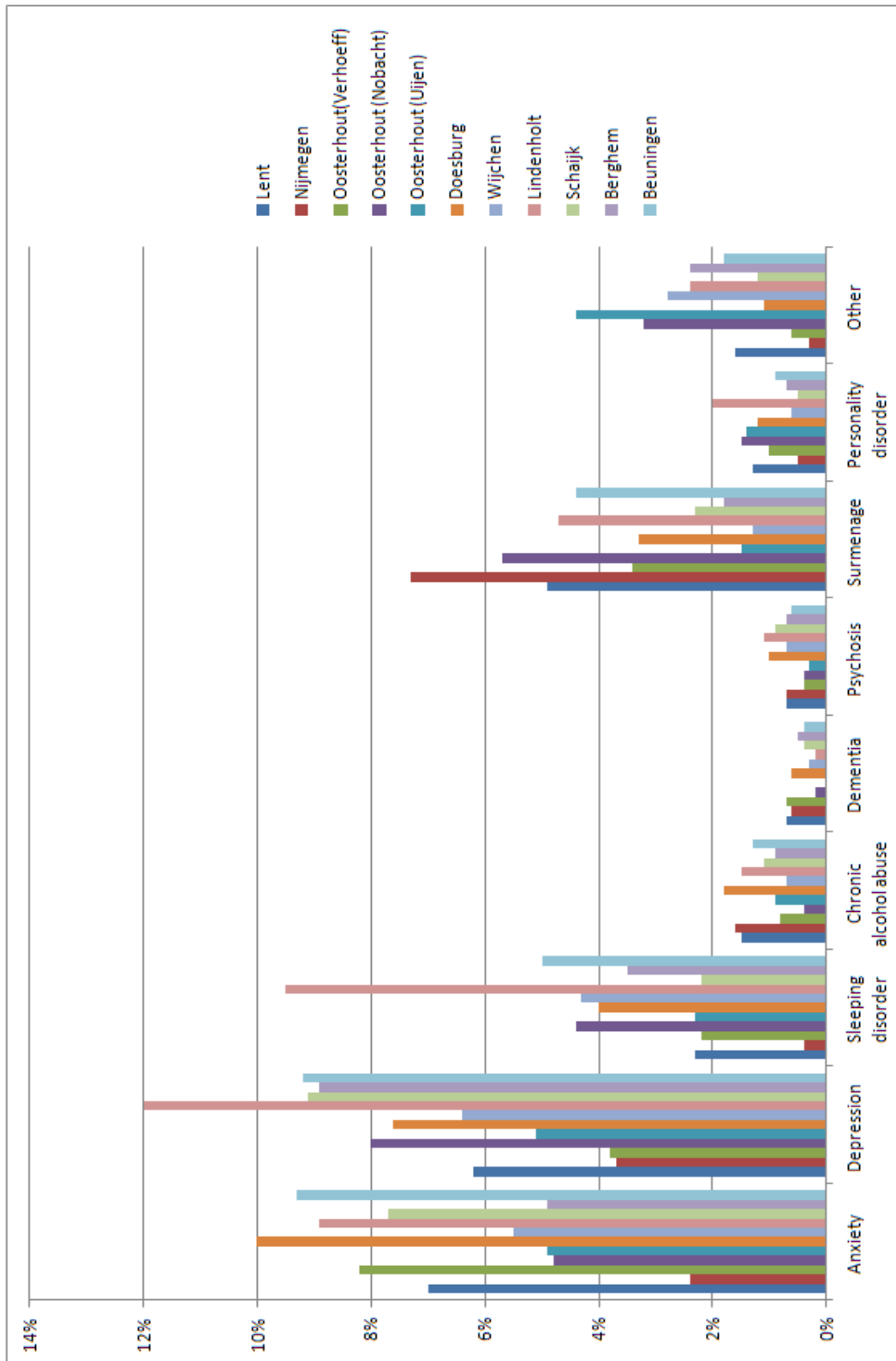


Figure 10: prevalence of mental disorders in the different GPs divided by ICDPC codes, N=47278

Appendix 5: overview of the prevalence of mental disorders by practice, standardized for age and gender in the Dutch population

