

Somatization in women and men with non-cardiac chest pain compared to the general Swedish population

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ABSTRACT

We compare the prevalence of somatization in women and men with NCCP in relation to the general Swedish population, analyze the overlap between somatization, cardiac anxiety, and depressive symptoms, and explore variables associated with somatization. A cross sectional design is implemented with data collected between late October 2013 and early January 2014 from 552 patients with NCCP (mean age of 64 ± 17 years, 51% women) from four hospitals in southeast Sweden. Somatization was measured with the Patient Health Questionnaire-15, cardiac anxiety with the Cardiac Anxiety Questionnaire, and depressive symptoms with the Patient Health Questionnaire-9. Data were self-reported. The general population consists of 1898 females and 1508 males. Compared to the general population, somatization was significantly ($p < .001$) more common in both women and men with NCCP. Women with NCCP had significantly ($p = .003$) higher prevalence of somatization than men with NCCP. In patients with NCCP, 12% had only somatization, whereas 39% also reported cardiac anxiety and depressive symptoms. Younger age in women tended to be associated with somatization ($OR = 0.98$, $p < .073$), but also being non-worker ($OR = 0.40$, $p = .024$). In men, somatization tended to be associated with increased healthcare contacts ($OR = 1.82$, $p = .051$). Furthermore, in both women and men, number of co-morbidities ($OR = 9.69$ $p < .001$ and $OR = 3.45$, $p = .002$), cardiac anxiety ($OR = 2.93$ and $OR = 2.09$, $p < .001$), and depressive symptoms ($OR = 8.71$ and $OR = 4.44$, $p < .001$) were significantly associated with somatization. Our study demonstrates that somatization is very common among patients with NCCP, especially in women. Patients with NCCP have higher somatization and greater overlap with psychological distress compared to the general population.

1. Introduction

Somatization can be defined as the physical expression of psychological distress and is used interchangeably with the term medically unexplained symptoms since there is often no medical condition behind (Nordin et al., 2013). The most frequent symptoms are sleep problems, fatigue, back pain, headache, unspecific chest pain and gastrointestinal problems (Hinz et al., 2017; Kroenke et al., 2010; Nordin et al., 2013). Somatization is common worldwide with prevalence rates of about 20% (Barsky et al., 2005; Haller et al., 2015; Nordin et al., 2013), with higher rates in women compared to men (Hinz et al., 2017; Kocalevent et al., 2013; Nordin et al., 2013). Patients with somatization often present with

anxiety and depressive disorders (Heinrich, 2004), use healthcare resources to a higher extent and incur significantly higher healthcare-related costs compared to patients with no somatization (Barsky et al., 2005; Heinrich, 2004; Kroenke et al., 2010). Barsky et al. report more than double the healthcare costs in patients with somatization (\$6354) compared to those without (\$2762) (Barsky et al., 2005).

There is wide documentation regarding the fact that patients with non-cardiac chest pain (NCCP) present elevated psychological distress and somatization (Hadlandsmayth et al., 2013; Webster et al., 2012; Webster et al., 2014). We demonstrated in our previous studies that patients with NCCP suffer from psychological distress, such as anxiety and depressive symptoms, and use high amounts of healthcare resources,

Abbreviations: CAQ, Cardiac Anxiety Questionnaire; CBT, Cognitive Behavioural Therapy; NCCP, Non-Cardiac Chest Pain; PHQ-9, Patient Health Questionnaire-9; PHQ-15, Patient Health Questionnaire-15.

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resulting in high societal costs (Mourad et al., 2013; Mourad et al., 2012; Mourad et al., 2016). We also found that somatization was related to psychological distress (Mourad et al., 2018) and had negative impact on health-related quality of life (Mourad et al., 2020). However, the prevalence of somatization and its difference between women and men in NCCP has not been studied in detail before. Barsky et al. (Barsky et al., 2001) highlight the different styles of symptom reporting between women and men, and the importance of exploring this difference in order to give individual care. Therefore, it is warranted to investigate how women and men with NCCP differ regarding reporting of symptoms since research has shown that women with NCCP do not report more chest pain despite being twice as likely as men to experience chest pain (Dumville et al., 2007). It has been suggested that recognition of the somatic complaints and their negative impact on the patients are important aspects in order to manage and reduce somatization (Heinrich, 2004). Therefore, it can be of importance to increase knowledge about the prevalence of somatization and the differences between the sexes in patients with NCCP compared to the general population. Furthermore, anxiety and depressive disorders seem to overlap with somatization, and therefore there is a need to analyze this association in patients with NCCP. This knowledge can be of importance to tailor future interventions aiming to reduce somatization with regard to sex and psychological distress. Consequently, the aim of this study was to compare the prevalence of somatization in women and men with NCCP in relation to the general Swedish population. Further, to analyze the overlap between somatization and psychological distress, and to explore variables associated with somatization in women and men with NCCP.

2. Materials and methods

2.1. Study design and procedure

A cross sectional, explorative and descriptive design was conducted. The prevalence of somatization in relation to sex and different age groups is presented and compared to normative Swedish data (Nordin et al., 2013). The overlap between somatization and psychological distress is described. In addition, variables associated with somatization, such as age, marital status, educational level, work status, number of healthcare contacts, number of co-morbidities, and psychological distress are explored. In order to determine these associations, partly published data on psychological distress (Mourad et al., 2016) was used. In that previous study, data on psychological distress were presented in association to healthcare use. The study was conducted in accordance with the Declaration of Helsinki. All participants signed an informed consent before study inclusion. The study was approved by the Regional Ethical Review Board in Linköping, Sweden (code 2013/223-31).

2.2. Study participants vs the general Swedish population

In total, 2271 patients who were discharged from four hospitals in the southeast of Sweden were approached between late October 2013 and early January 2014. These patients were ≥ 18 years of age and had chest pain as the main reason for their medical consultation, but this chest pain was classified as non-cardiac. NCCP was determined based on the ICD 10-codes R07.2, precordial chest pain; R07.3, other chest pain; R07.4, chest pain unspecified; and Z03.4, observation for suspected myocardial infarction (Socialstyrelsen, 2022). Written information with an informed consent form, a battery of questionnaires, and a pre-paid response envelope were sent to the patients' homes within one month from discharge. Patients were informed to contact the research team for more information. Patients finally agreed on participation by signing and returning the written informed consent form together with the completed questionnaires. In total, 552 patients agreed to participate, Fig. 1. Non-responders were significantly younger (54 ± 20 years, $p < .001$), but those who declined participation were significantly older (70 ± 17 years, $p < .001$) than those who agreed to participate.

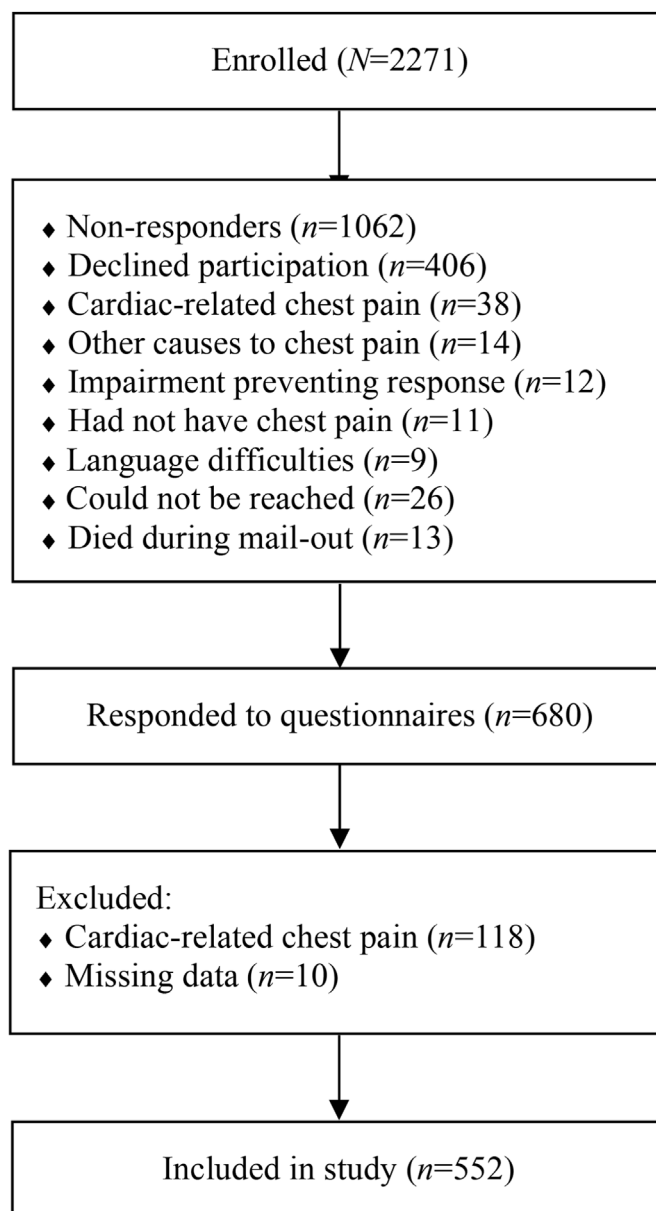


Fig. 1. flow chart over the recruitment process.

Data regarding the Swedish population used as the norm for comparison in the present study has been published by Nordin et al. (2013). Data from this publication was used for comparison since we had no access to raw data. This norm population consists of inhabitants in the county of Västerbotten, Northern Sweden, which has similar age and sex distribution compared to Sweden in general. A random sample of 8520 individuals aged between 18 and 79 years were drawn from the municipal register and invited to participate. In total, 3406 individuals (40.0%) were included. Of these, 1898 were women (45.2% of the women) and 1508 were men (34.9% of the men). The mean age in the norm population was 50 ± 17 years in women and 53 ± 17 years in men. Non-responders were mostly men between 18 and 29 years (Nordin et al., 2013).

2.3. Data collection and measurements

Data was self-reported and included demographic data (such as age, sex, marital status, educational level, and work status), number of co-morbidities, and number of healthcare contacts related to NCCP.

The Patient Health Questionnaire-15 (PHQ-15) was used to assess somatization in both our study participants and the general Swedish population (Nordin et al., 2013). The PHQ-15 is a valid and reliable questionnaire, that assesses 15 somatic symptoms on a scale from 0 to 30. Scores under 5 indicate no somatization, 5–9 low, 10–14 moderate, and 15–30 high somatization (Kroenke et al., 2002; Kroenke et al., 2010; Nordin et al., 2013). In this study, the cut-of score of 10 is used indicating at least moderate levels of somatization. To note, the questionnaire contains one question regarding menstrual cramps or other problems with periods. The Cronbach's α coefficient in this study was 0.85.

The Cardiac Anxiety Questionnaire (CAQ) was used to assess cardiac anxiety. The CAQ comprises 18 items with a score range between 0 and 72. Higher scores indicate greater cardiac anxiety (Eifert et al., 2000). In this study, the cut-of score for cardiac anxiety is set to 24, which was the median score in one of our previous studies (Mourad et al., 2016). Besides from a total score based on all items, the CAQ consists of three subscales; i.e. fear, avoidance, and heart-focused attention, but these are not presented in the present analysis. The total scale has demonstrated adequate reliability and validity (Eifert et al., 2000). The Cronbach's α coefficient in the present study was 0.90.

The Patient Health Questionnaire-9 (PHQ-9) was used to assess the prevalence and severity of depressive symptoms. The PHQ-9 comprises 9 items with a score range between 0 and 27. Scores between 5 and 9 indicate mild, 10–14 moderate, 15–19 moderately severe, and 20–27 severe depressive symptoms. In this study, the cut-of score of 10 is used indicating at least moderate depressive symptoms. The PHQ-9 has demonstrated high internal consistency (Kroenke et al., 2001), with Cronbach's α coefficient of 0.87 in the present study.

2.4. Statistical analysis

The study variables are presented in numbers and percentages, mean values and standard deviations where suitable (See Table 1). Crosstabs and Chi-Square tests were used to compare differences regarding demographic variables and somatization prevalence and severity. In our data set 38 (13.5%) of the women with NCCP reported that they were bothered with the PHQ-15 item regarding menstrual cramps and periods. To allow comparison between the sexes, this item was omitted. Student's t-test was used to assess differences between women and men regarding age and number of healthcare contacts, and Mann-Whitney *U* test was used to compare psychological distress and somatization. Medcalc comparison of means and proportions calculator (<https://www.medcalc.org/calc/>) was used to compare the different mean values and proportions of somatization between patients with NCCP and the general Swedish population (Nordin et al., 2013).

In order to describe the overlap between somatization, cardiac anxiety and depressive symptoms in patients with NCCP, five groups were created. These were patients with no somatization nor cardiac anxiety or depressive symptoms, only somatization, somatization and cardiac anxiety, somatization and depressive symptoms, and somatization with cardiac anxiety and depressive symptoms. To determine the variables associated with somatization in women and men, binary logistic regression analysis was used. For this analysis, variables from Table 1 with significant correlations based on Pearson Chi-Square test were entered in the regression analysis. All analyses were performed for women and men separately. The IBM SPSS version 25 was used for data analysis. Significances were determined using *P*-values < .05.

3. Results

3.1. Study participants

Demographic data of the study participants is presented in Table 1. The study participants were equally divided into women and men who were 63 ± 17 and 65 ± 17 years old, and the majority were retired/non-workers. A significantly greater proportion of men ($p = .001$) were

Table 1

Descriptive data of the study participants and comparisons in relation to sex.

	All (N = 552)	Women (n = 281)	Men (n = 271)	df	p-value
Age year (mean\pmSD)	63.8 \pm 16.6	62.6 \pm 16.5	64.9 \pm 16.6	550	.105
Marital status n (%)				1	.001
Married/cohabiting	370 (67.3)	170 (60.7)	200 (74.1)		
Single	180 (32.7)	110 (39.3)	70 (25.9)		
Educational level n (%)				2	.256
Up to compulsory school	185 (33.6)	94 (33.6)	91 (33.6)		
High school	216 (39.2)	102 (36.4)	114 (42.1)		
University	150 (27.2)	84 (30.0)	66 (24.4)		
Work status n (%)				1	.305
Workers	152 (27.5)	72 (25.6)	80 (29.5)		
Non-workers	400 (72.5)	209 (74.4)	191 (70.5)		
Number of healthcare contacts n (%)				2	.035
≤ 1 contact per year	331 (60.0)	165 (58.7)	166 (61.3)		
2-3 contacts per year	145 (26.3)	85 (30.2)	60 (22.1)		
>3 contacts per year	76 (13.8)	31 (11.0)	45 (16.6)		
Number of co-morbidities (mean\pmSD)	3.5 \pm 2.2	3.5 \pm 2.1	3.4 \pm 2.3	550	.542
Cardiac anxiety					
CAQ total score (mean \pm SD)	24.6 \pm 13.0	24.7 \pm 12.2	24.6 \pm 13.8	NA	.768
CAQ-score ≥ 24 , n (%)	283 (51.3)	144 (51.4)	139 (51.5)	1	.990
Depressive symptoms					
PHQ-9 total score (mean \pm SD)	6.4 \pm 5.9	6.7 \pm 5.8	6.0 \pm 5.9	NA	.079
PHQ-9 score ≥ 10 , n (%)	141 (25.5)	79 (28.1)	62 (23.0)	1	.166
Somatization					
PHQ-15 total score (mean \pm SD)	9.9 \pm 5.3	10.6 \pm 5.4	9.1 \pm 5.1	NA	<.001
PHQ-15 score ≥ 10 , n (%)	290 (52.5)	165 (58.7)	125 (46.1)	1	.003

CAQ Cardiac Anxiety Questionnaire

PHQ-9 Patient Health Questionnaire-9.

PHQ-15 Patient Health Questionnaire-15

NA due to Mann-Whitney *U* test.

married/cohabiting compared to the women (74% vs 61%). There was a significant difference ($p = .035$) regarding number of healthcare contacts between women and men. Male participants were significantly older than male non-participants (65 ± 17 vs 56 ± 19 years, $p < .001$), but female participants and female non-participants did not differ significantly in age (63 ± 17 vs 61 ± 20 years, $p = .164$).

3.2. Somatization in women and men with NCCP compared to the general Swedish population

Table 2a and Table 2b show the mean values of somatization according to PHQ-15 in different age groups (i.e. 18–34, 35–54, 55–79, and 80–98 years) of women and men in our study in comparison with the general Swedish population. The study participants, both women and men, report significantly higher somatization ($p < .001$) than the general Swedish population in all age groups.

The different somatization levels are presented in Fig. 2a for women and Fig. 2b for men with NCCP and the general Swedish population. At

Table 2a

PHQ-15 scores in different age groups of women with non-cardiac chest pain compared to normative data from a general Swedish population.

	18–34 years		35–54 years		55–79 years		80–98 years		All women	
	Study (n = 21)	Norm (n = 441)	Study (n = 61)	Norm (n = 597)	Study (n = 158)	Norm (n = 860)	Study (n = 33)	Norm (No data)	Study (n = 273)	Norm (n = 1898)
Mean	12.0*	7.8	11.9*	6.8	10.3*	7.1	10.3	–	10.8*	7.2
SD	6.2	4.4	6.2	4.6	5.4	6.2	5.4	–	5.5	4.8

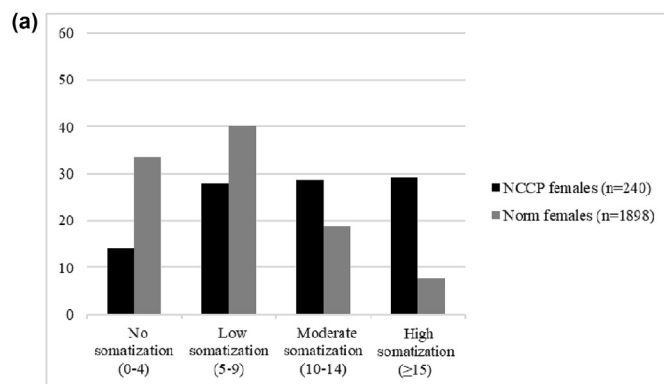
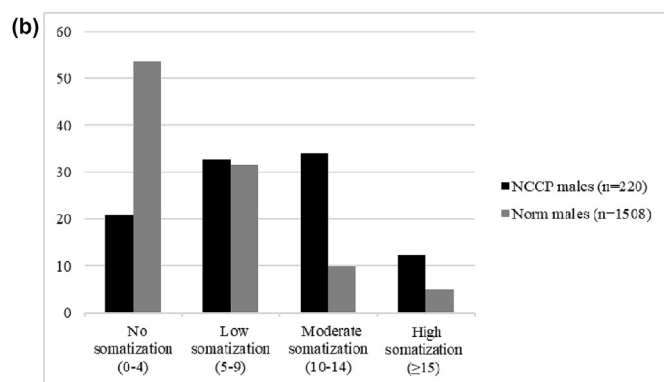
* $p < .0001$ PHQ-15 Patient Health Questionnaire-15.**Table 2b**

PHQ-15 scores in different age groups of men with non-cardiac chest pain compared to normative data from a general Swedish population.

	18–34 years		35–54 years		55–79 years		80–98 years		All men	
	Study (n = 16)	Norm (n = 265)	Study (n = 51)	Norm (n = 455)	Study (n = 153)	Norm (n = 788)	Study (n = 42)	Norm (No data)	Study (n = 262)	Norm (n = 1508)
Mean	10.2*	4.7	8.4*	5.1	9.4*	5.5	8.4	–	9.1*	5.3
SD	6.4	3.5	4.7	4.1	5.2	4.8	4.9	–	5.1	4.4

* $p < .0001$

PHQ-15 Patient Health Questionnaire-15.

**Fig. 2a.** Somatization severity in women with non-cardiac chest pain (NCCP) compared to Swedish norm data, ages 18–79 years. NCCP women had significantly ($p < .0001$) higher somatization levels than their norm.**Fig. 2b.** Somatization severity in men with non-cardiac chest pain (NCCP) compared to Swedish norm data, ages 18–79 years. NCCP men had significantly ($p < .0001$) higher somatization levels than their norm.

least moderate somatization (i.e. scores ≥ 10) was reported by 59% of all women and 46% of all men participating in the present study, which was significantly ($p = .003$) higher in women than in men. The corresponding numbers regarding somatization in the general Swedish population are 26% for women and 15% for men. These proportions are significantly ($p < .0001$) lower compared to the proportions in our study population (i.e. 59 % vs 26% in women and 46% vs 15% in men).

3.3. Overlap of somatization, cardiac anxiety and depressive symptoms

The mean scores cardiac anxiety and depressive symptoms are reported in Table 1. Cardiac anxiety was reported by 51% of all women and men. Depressive symptoms were prevalent in 28% of the women and 23% of the men. Fig. 3 shows 5 different combinations of overlap regarding somatization, cardiac anxiety and depressive symptoms in women and men. A total of 42% of women and 56% of men reported no psychological distress. Somatization only was prevalent in 13% of the women and 10% of the men. Somatization and cardiac anxiety were prevalent in 19% and 16% respectively, whereas a combination of somatization and depressive symptoms was prevalent in 6% and 3% respectively. Finally, a combination of all three conditions was reported by 20% of the women and 15% of the men.

3.4. Variables associated with somatization

Among the demographic variables, younger age in women tended to be associated with somatization (OR = 0.98, CI 95% 0.96–1.00, $p < .073$), but also being non-worker was significantly associated (OR = 0.40, CI 95% 0.18–0.88, $p = .024$), see Table 3a. Somatization tended also to be associated with number of healthcare contacts, but only in men (OR = 1.82, CI 95% 1.00–3.34, $p = .051$), i.e. men with higher somatization levels had three or more healthcare contacts, Table 3b. Furthermore, women with two co-morbidities had a fourfold increased OR for somatization (OR = 4.13, CI 95% 1.38–12.36, $p = .011$), whereas women with three or more co-morbidities had almost a tenfold OR (OR = 9.69, CI 95% 3.62–25.91, $p < .001$). In men only those with three or more co-morbidities had an increased OR for somatization (OR = 3.46, CI 95% 1.58–7.57, $p = .002$). There were also significant associations between somatization and cardiac anxiety in both women (OR = 2.93, CI 95% 1.56–5.51, $p < .001$) and men (OR = 2.09, CI 95% 1.14–3.85, $p < .001$). Regarding somatization and depressive symptoms, women had almost a double OR (OR = 8.71, CI 95% 3.44–22.03, $p < .001$) compared to men (OR = 4.44, CI 95% 2.05–9.61, $p < .001$).

4. Discussion

We found that somatization was more common in women and men with NCCP, compared to the general Swedish population. This despite the fact that the somatization scores in the general Swedish population could have been even lower if they did not have as many young non-responders among men, as normative data for young men have relatively low scores (Nordin et al., 2013). Similar to the general Swedish

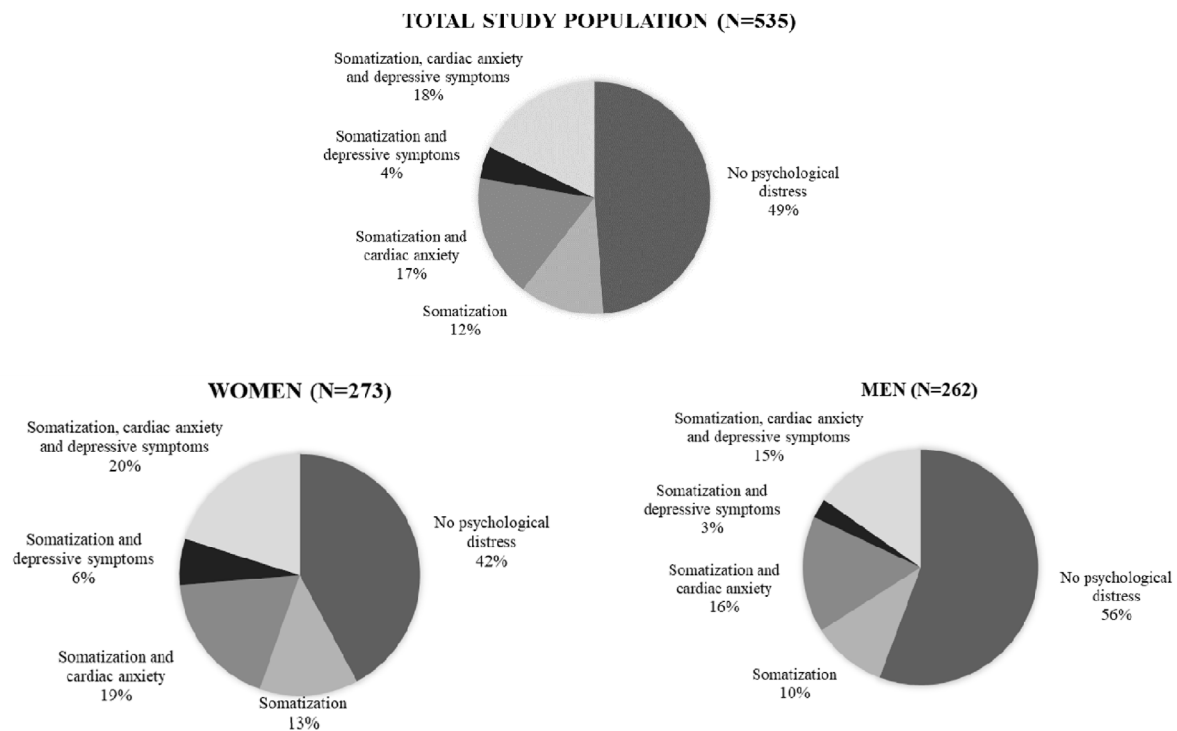


Fig. 3. Prevalence of somatization, cardiac anxiety, and depressive symptoms in the total study population and divided between women and men.

Table 3a

Binary logistic regression analyzing variables associated with somatization in women ($n = 273$) with non-cardiac chest pain.

Explanatory variables	β	SE	df	p-value	OR	95% CI Lower	95% CI Upper
Age	-.021	.012	1	.073	.98	.96	1.00
Married/cohabiting vs single	-.034	.328	1	.919	.97	.51	1.84
Educational level \leq high school vs university	.280	.339	1	.409	1.32	.68	2.57
Worker vs non-worker	-.916	.405	1	.024	.40	.18	.88
Number of healthcare contacts ≤ 1 vs ≥ 2 contacts per year	.415	.330	1	.209	1.51	.79	2.89
Number of co-morbidities ≤ 1 vs 2 co-morbidities	1.418	.560	1	.011	4.13	1.38	12.36
2 vs ≥ 3 co-morbidities	2.271	.502	1	<.001	9.69	3.62	25.91
CAQ-score ≥ 24	1.075	.322	1	<.001	2.93	1.56	5.51
PHQ-9 score ≥ 10	2.165	.474	1	<.001	8.71	3.44	22.03

CAQ Cardiac Anxiety Questionnaire, PHQ-9 Patient Health Questionnaire-9.

population we found higher levels of somatization in women than in men. We also found strong overlap among somatization, cardiac anxiety and depressive symptoms. The most common combinations were somatization and cardiac anxiety, or somatization, cardiac anxiety and depressive symptoms, which were present in approximately 40% of the women and 30% of the men. Somatization tended in women to be associated with younger age ($p = .073$) and being non-worker ($p = .024$), and in men we found a tendency in those with two or more healthcare contacts ($p = .051$). Both in women and men, higher number of co-morbidities, and higher levels of cardiac anxiety and depressive symptoms were associated with somatization.

Table 3b

Binary logistic regression analyzing variables associated with somatization in men ($n = 262$) with non-cardiac chest pain.

Explanatory variables	β	SE	df	p-value	OR	95% CI Lower	95% CI Upper
Age	.008	.011	1	.469	1.01	.99	1.03
Married/cohabiting vs single	.120	.333	1	.718	1.13	.59	2.17
Educational level \leq high school vs university	-.371	.345	1	.283	.69	.35	1.36
Worker vs non-worker	-.085	.403	1	.834	.92	.42	2.02
Number of healthcare contacts ≤ 1 vs ≥ 2 contacts per year	.601	.308	1	.051	1.82	1.00	3.34
Number of co-morbidities ≤ 1 vs 2 co-morbidities	.339	.463	1	.464	1.40	.57	3.48
2 vs ≥ 3 co-morbidities	1.240	.400	1	.002	3.46	1.58	7.57
CAQ-score ≥ 24	.738	.311	1	.018	2.09	1.14	3.85
PHQ-9 score ≥ 10	1.491	.394	1	<.001	4.44	2.05	9.61

CAQ Cardiac Anxiety Questionnaire, PHQ-9 Patient Health Questionnaire-9.

Our results showed that more than half of the women and almost half of the men with NCCP had levels of at least moderate somatization and this was significantly different. These proportions were significantly higher compared to the general Swedish population with somatization prevalence rates of 26% and 15% respectively. In addition, the NCCP proportions were also higher compared to normative data for two German populations of 9250 and 5031 individuals (Hinz et al., 2017; Kocalevent et al., 2013). In these two populations 19.9% and 10.3% of all women and 9.6% and 8.1% of all men reported at least moderate somatization (Hinz et al., 2017; Kocalevent et al., 2013).

As expected (Hinz et al., 2017; Kocalevent et al., 2013), we also found that somatization was more common in females, and we found a tendency regarding association to younger age. This despite the fact that our study population was older than the general Swedish population. However, in other studies somatization has been reported to both decline or increase along with age (Kocalevent et al., 2013; Wijeratne, 2011). One explanation to the higher rate of somatization in women is that they tend to report more somatic symptoms (Nordin et al., 2013). Wijk and Kolk (van Wijk and Kolk, 1997) found that adult women reported more, more frequent and more intense physical symptoms, but in many studies symptoms were measured in retrospect in healthy subjects. They concluded that the differences between women and men are more likely to derive from the way women interpret, perceive and report their symptoms (van Wijk and Kolk, 1997). Barsky et al. (2001) emphasize that the differences between women and men are not because women overreport their physical symptoms, but rather because men ignore, suppress, or are unaware of their symptoms.

We also found a big overlap between somatization, cardiac anxiety, and depressive symptoms. A literature review of somatization in older people (Wijeratne, 2011) concluded that somatization can be distinguished from anxiety and depressive symptoms, even though these conditions often increase somatization, especially in women as we found almost a tenfold OR between depressive symptoms and somatization. Few studies have reported the extent of the overlap of somatization with psychological distress (Wijeratne, 2011). In our study population ($N = 535$), 12% had somatization only, whereas 39% had different combinations of somatization, cardiac anxiety, and depressive symptoms. Although the prevalence differs between women and men, the pattern of the overlap between somatization and psychological distress is similar. In our patients with NCCP, the overlap between somatization and psychological distress seems to be large compared to Barsky et al. (2005). They assessed the extent of the overlap of somatization with psychological distress in patients recruited from two primary care practices ($N = 1426$) and reported comparable amount of somatization only in approximately 12% of their population. However, they reported much lower overlap between somatization and psychological distress of approximately 8% of the total population (i.e. somatization and panic disorder in 2%, somatization and depression in 4%, and somatization in combination with panic disorder and depression in 2%).

In our study we have demonstrated that somatization and its overlap with psychological distress is very common in women and men with NCCP, and also tend to be associated with increased healthcare use in men, as shown in other studies (Barsky et al., 2005; Heinrich, 2004; Kroenke et al., 2010), which needs to be approached. Hence, interventions aiming at reducing somatization in patients with NCCP should also take the overlap with psychological distress into consideration. Katon et al. (Katon et al., 2007) concluded that recognition and treatment of comorbid anxiety and depressive symptoms lead to decreased somatization and less healthcare use. A Cochrane review found cognitive behavioural therapy (CBT) useful and moderately successful, despite the multifaceted aetiology in NCCP. The effects were though restricted to the first three months after the intervention (Kisely et al., 2015). A meta-analysis of randomized controlled trials (Liu et al., 2019) showed that CBT significantly reduced somatization, anxiety, and depression. This study reported somewhat heterogenic results regarding treatment where somatic symptoms were relieved better by group treatment, whereas individual treatment had better effect on anxiety and depressive symptoms. Furthermore, treatment was more effective if provided over long time, i.e. more than 10 sessions during at least 12 weeks with a session duration of at least 50 min, and when it emphasized body-directed, affective and interpersonal techniques. However, all studies in the Cochrane review and the meta-analysis provided CBT on a face-to-face basis. Thereof, having in mind the lack of CBT experts, the existing burden on the healthcare system, and the great proportion of patients with NCCP in need of CBT, one can discuss if face-to-face treatment is the most effective way of delivering CBT. Hence, Internet-delivered CBT has shown great potential in the treatment of

patients with various psychological distress including anxiety and depression with or without chronic somatic disease (Andrews et al., 2018; Johansson et al., 2019).

5. Limitations

The study had a cross-sectional design and data was self-reported. All patients had been diagnosed as non-cardiac and discharged from hospital without planned follow-ups. Off-course some of them might have had cardiac diagnoses, such as coronary microvascular disease. However, we relied on the medical assessment and diagnoses from the medical charts, and therefore we used no objective measures to exclude such diagnoses. We had no other data than age and sex for the non-participants, and therefore we could only compare participants and non-participants based on these variables. Data on somatization was collected with only one instrument, i.e. PHQ-15. Since the data in the general Swedish population was collected with the same instrument, this did not impact our results. The upper age of the sample in the general Swedish population was 79 years, leading to lost possibility to compare the older group of patients with NCCP. One may argue if our study population and the Swedish norm population are comparable. Our population was recruited based on NCCP and cardiac anxiety prevalence, while the norm population was not. Anyhow, also people in the norm population suffer from different complaints. As stated in the article from where we collected the comparison data (Nordin et al., 2013), the norm population had similar age and sex distribution compared to Sweden in general. Furthermore, we performed our comparisons within the same age groups, and we therefore believe that these groups are comparable.

6. Conclusions

Somatization is a common problem among patients with NCCP, especially in women. Compared to the general Swedish population. Both women and men with NCCP had more somatization. Furthermore, the overlap of somatization and psychological distress was much higher than in the general Swedish population. Somatization was also associated with higher healthcare use. Treatment of comorbid psychological distress is therefore important to decrease somatization and healthcare use.

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Authors' contributions

GM, TJ, AS and PJ contributed to the conception and design of the study. GM collected the data. GM and PJ performed the statistical analyses and interpretation of the data. GM, TJ, AS, and PJ contributed to the drafting of the manuscript.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

- Andrews, G., Basu, A., Cuijpers, P., Craske, M.G., McEvoy, P., English, C.L., Newby, J.M., 2018. Computer therapy for the anxiety and depression disorders is effective,

- acceptable and practical health care: an updated meta-analysis. *J. Anxiety Disord.* 55, 70–78. <https://doi.org/10.1016/j.janxdis.2018.01.001>.
- Barsky, A.J., Orav, E.J., Bates, D.W., 2005. Somatization increases medical utilization and costs independent of psychiatric and medical comorbidity. *Arch. Gen. Psychiatr.* 62 (8), 903–910. <https://doi.org/10.1001/archpsyc.62.8.903>.
- Barsky, A.J., Peekna, H.M., Borus, J.F., 2001. Somatic symptom reporting in women and men. *J. Gen. Intern. Med.* 16 (4), 266–275. <https://doi.org/10.1046/j.1525-1497.2001.00229.x>.
- Dumville, J.C., MacPherson, H., Griffith, K., Miles, J.N., Lewin, R.J., 2007. Non-cardiac chest pain: a retrospective cohort study of patients who attended a Rapid Access Chest Pain Clinic. *Fam. Pract.* 24 (2), 152–157. <https://doi.org/10.1093/fampra/cmm002>.
- Eifert, G.H., Thompson, R.N., Zvolensky, M.J., Edwards, K., Frazer, N.L., Haddad, J.W., Davig, J., 2000. The cardiac anxiety questionnaire: development and preliminary validity. *Behav. Res. Ther.* 38 (10), 1039–1053. [https://doi.org/10.1016/S0005-7967\(99\)00132-1](https://doi.org/10.1016/S0005-7967(99)00132-1).
- Hadlandsmayth, K., White, K.S., Krone, R.J., 2013. Quality of life in patients with non-CAD chest pain: associations to fear of pain and psychiatric disorder severity. *J. Clin. Psychol. Med. Settings* 20 (3), 284–293. <https://doi.org/10.1007/s10880-012-9347-7> [doi].
- Haller, H., Cramer, H., Lauche, R., Dobos, G., 2015. Somatoform disorders and medically unexplained symptoms in primary care. *Dtsch. Arztebl. Int.* 112 (16), 279–287. <https://doi.org/10.3238/arztebl.2015.0279>.
- Heinrich, T.W., 2004. Medically unexplained symptoms and the concept of somatization. *Wmj* 103 (6), 83–87.
- Hinz, A., Ernst, J., Glaesmer, H., Brähler, E., Rauscher, F.G., Petrowski, K., Kocalevent, R.D., 2017. Frequency of somatic symptoms in the general population: normative values for the Patient Health Questionnaire-15 (PHQ-15). *J. Psychosom. Res.* 96, 27–31. <https://doi.org/10.1016/j.jpsychores.2016.12.017>.
- Johansson, P., Westas, M., Andersson, G., Alehagen, U., Broström, A., Jaarsma, T., Lundgren, J., 2019. An internet-based cognitive behavioral therapy program adapted to patients with cardiovascular disease and depression: randomized controlled trial. *JMIR Ment. Health* 6 (10), e14648. <https://doi.org/10.2196/14648>.
- Katon, W., Lin, E.H., Kroenke, K., 2007. The association of depression and anxiety with medical symptom burden in patients with chronic medical illness. *Gen. Hosp. Psychiatr.* 29 (2), 147–155. <https://doi.org/10.1016/j.genhosppsych.2006.11.005>.
- Kisely, S.R., Campbell, L.A., Yelland, M.J., Paydar, A., 2015. Psychological interventions for symptomatic management of non-specific chest pain in patients with normal coronary anatomy. *Cochrane Database Syst. Rev.* 2015 (6), Cd004101. <https://doi.org/10.1002/14651858.CD004101.pub5>.
- Kocalevent, R.D., Hinz, A., Brahler, E., 2013. Standardization of a screening instrument (PHQ-15) for somatization syndromes in the general population. *BMC Psychiatr.* 13, 91. <https://doi.org/10.1186/1471-244x-13-91>.
- Kroenke, K., Spitzer, R.L., Williams, J.B., 2001. The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med.* 16 (9), 606–613. <https://doi.org/10.1046/j.1525-1497.2001.016009606.x>.
- Kroenke, K., Spitzer, R.L., Williams, J.B., 2002. The PHQ-15: validity of a new measure for evaluating the severity of somatic symptoms. *Psychosom. Med.* 64 (2), 258–266.
- Kroenke, K., Spitzer, R.L., Williams, J.B., Löwe, B., 2010. The patient health questionnaire somatic, anxiety, and depressive symptom scales: a systematic review. *Gen. Hosp. Psychiatr.* 32 (4), 345–359. <https://doi.org/10.1016/j.genhosppsych.2010.03.006>.
- Liu, J., Gill, N.S., Teodorczuk, A., Li, Z.J., Sun, J., 2019. The efficacy of cognitive behavioural therapy in somatoform disorders and medically unexplained physical symptoms: a meta-analysis of randomized controlled trials. *J. Affect. Disord.* 245, 98–112. <https://doi.org/10.1016/j.jad.2018.10.114>.
- Mourad, G., Alwin, J., Jaarsma, T., Strömberg, A., Johansson, P., 2020. The associations between psychological distress and health-related quality of life in patients with non-cardiac chest pain. *Health Qual. Life Outcome* 18 (1), 68. <https://doi.org/10.1186/s12955-020-01297-0>.
- Mourad, G., Alwin, J., Stromberg, A., Jaarsma, T., 2013. Societal costs of non-cardiac chest pain compared with ischemic heart disease—a longitudinal study. *BMC Health Serv. Res.* 13. <https://doi.org/10.1186/1472-6963-13-403>, 403-6963-6913-6403.
- Mourad, G., Jaarsma, T., Hallert, C., Stromberg, A., 2012. Depressive symptoms and healthcare utilization in patients with noncardiac chest pain compared to patients with ischemic heart disease. *Heart Lung : J. Crit. Care* 41 (5), 446–455. <https://doi.org/10.1016/j.hrtng.2012.04.002>.
- Mourad, G., Jaarsma, T., Stromberg, A., Svensson, E., Johansson, P., 2018. The associations between psychological distress and healthcare use in patients with non-cardiac chest pain: does a history of cardiac disease matter? *BMC Psychiatr.* 18 (1), 172. <https://doi.org/10.1186/s12888-018-1689-8>.
- Mourad, G., Stromberg, A., Johansson, P., Jaarsma, T., 2016. Depressive symptoms, cardiac anxiety, and fear of body sensations in patients with non-cardiac chest pain, and their relation to healthcare-seeking behavior: a cross-sectional study. *Patient* 9 (1), 69–77. <https://doi.org/10.1007/s40271-015-0125-0> [doi].
- Nordin, S., Palmquist, E., Nordin, M., 2013. Psychometric evaluation and normative data for a Swedish version of the patient health questionnaire 15-item somatic symptom severity scale. *Scand. J. Psychol.* 54 (2), 112–117. <https://doi.org/10.1111/sjop.12029>.
- Socialstyrelsen, 2022. Internationell statistisk klassifikation av sjukdomar och relaterade hälsoproblem, systematisk förteckning. Retrieved from. <https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/klassifikationer-och-koder/2022-1-7719.pdf>.
- van Wijk, C.M., Kolk, A.M., 1997. Sex differences in physical symptoms: the contribution of symptom perception theory. *Soc. Sci. Med.* 45 (2), 231–246. [https://doi.org/10.1016/s0277-9536\(96\)00340-1](https://doi.org/10.1016/s0277-9536(96)00340-1).
- Webster, R., Norman, P., Goodacre, S., Thompson, A., 2012. The prevalence and correlates of psychological outcomes in patients with acute non-cardiac chest pain: a systematic review. *Emerg. Med. J. : Eng. Manag. J.* 29 (4), 267–273. <https://doi.org/10.1136/emered-2011-200526>.
- Webster, R., Norman, P., Goodacre, S., Thompson, A., McEachan, R.R., 2014. Illness representations, psychological distress and non-cardiac chest pain in patients attending an emergency department. *Psychol. Health* 1–37. <https://doi.org/10.1080/08870446.2014.923885> [doi].
- Wijeratne, C., 2011. Somatization in older people. *Psychiatr. Clin.* 34 (3), 661–671. <https://doi.org/10.1016/j.psc.2011.05.010>.