Symptom profile of persons self-reporting whiplash: a Norwegian population-based study (HUNT 2)

Hanne Gro Wenzel · Arnstein Mykletun ·
Tom Ivar Lund Nilsen

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Abstract The aetiology of chronic whiplash associated disorder (WAD) is unclear and the condition has been perceived both as a chronic pain disorder, based on the injury to the neck, and as a functional somatic disorder. Based on the hypothesis that chronic WAD should be perceived as a functional somatic syndrome, we compared the symptom profile of persons with chronic WAD with the profile of persons with a functional somatic disorder, and with the profile of persons with an organic pain disorder. A sample of 55,046 persons participating in a Norwegian

population-based health study (HUNT 2) was divided into four study groups: chronic WAD, fibromyalgia, rheumatoid arthritis, and controls (none of these disorders). Symptoms were categorized as pain and stiffness, cardiopulmonary and gastrointestinal symptoms, and mental disorders. Odds ratios (ORs) with 95% confidence intervals (CIs) from logistic regression were used to compare the prevalence of symptoms among the groups. The chronic WAD group had a significantly higher prevalence of symptoms from all body parts, across organ systems and also mental symptoms, compared to the control group. The fibromyalgia group had an even higher prevalence of all symptoms, while the rheumatoid arthritis group showed an increase in the prevalence of particularly pain and stiffness symptoms and also a minor increase in the prevalence of other symptoms compared to the control group. We conclude that this study provide evidence in favour of the hypothesis that chronic WAD should be perceived as a functional somatic syndrome. Persons with chronic WAD had a symptom profile more similar to people with a functional somatic disorder than an organic pain disorder, consisting of a wide array of symptoms, not only predominantly pain symptoms.

H. G. Wenzel
Department of Public Health and General Practice,
Faculty of Medicine, Norwegian University of Science
and Technology, 7006 Trondheim, Norway

H. G. Wenzel (✉)
Division of Psychiatry, Orkdal Department,
St Olav University Hospital,
7300 Orkanger, Norway
e-mail: hanne.g.wenzel@ntnu.no

A. Mykletun
Research Centre for Health Promotion,
Faculty of Psychology, University of Bergen,
5015 Bergen, Norway

A. Mykletun
Division of Mental Health,
Norwegian Institute of Public Health,
0462 Oslo, Norway

T. I. L. Nilsen
Human Movement Science Program,
Norwegian University of Science and Technology,
7491 Trondheim, Norway

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Introduction

The term ‘whiplash associated disorders’ (WAD) was introduced in 1995 by the Quebec Task force as a grading system for whiplash associated disorders ranging from grade 0 with no symptoms to grade IV with neck pain or stiffness associated with cervical dislocation or fracture [39]. Grades I

and II which include only soft tissue injuries represent almost 90% of whiplash injuries and represent what is usually associated with the term WAD [22]. The incidence of WAD has increased rapidly during the last 20 years and is now estimated to be approximately 4 per 1,000 persons in Western countries [2, 11, 14, 26].

Several studies have investigated the course and the prognosis of whiplash, and it has been reported that 14–50% of acute WAD progress to chronic WAD [2, 12, 21, 35] with 28% of residual symptoms being intrusive and 12% being severe [19, 21]. Typically the symptoms also change character, from symptoms located to the neck and head, to more complex somatic symptoms as well as several problems of a psychosocial character often accompanied by gross disability [4, 11, 17, 40].

To explain the wide variety of symptoms, without clear objective findings, their long-lasting character as well as varying prevalence of chronic WAD in different cultures it has been necessary to take a biopsychosocial perspective on the disorder, suggesting that symptoms arise from and are modulated by pathology, psychological factors, and social context [18, 28]. Some authors have perceived the condition as a chronic pain condition [27, 28, 33, 34] based on the injury to the neck and surrounding structures, while others suggest that chronic WAD should be considered a functional somatic syndrome.

The chronic pain disorder could be described by a biopsychosocial pain model: nociceptive stimuli reach the brain through affective pathways, are evaluated and interpreted in the central nervous system, and then relayed back through efferent pathways in the peripheral nervous system. The pain threshold may vary with psychological and cultural factors as indicated by the gate control theory and the effect of different neurotransmitters. However the pain experience has a distinct quality, and should not be mistaken as other kind of sensations or symptoms [20, 28].

The term functional somatic syndrome is defined as a condition, which involve disturbance of function without physical abnormality [5]. Several different functional somatic syndromes have been described among these fibromyalgia and chronic whiplash [3]. All these syndromes are characterized by a great array of different and diffuse symptoms. On the basis of a literature review, Wessely et al. [41] concluded that a substantial overlap exists between the individual syndromes and that the similarities between them outweigh the differences. Similarities were apparent in case definition, reported symptoms, and non-symptom associations.

For a long time researchers have tried to find structural changes in the neck suspecting that occult lesions in discs, ligaments, and joints were the cause of WAD symptoms [24]. Improvements in medical imaging techniques have

made it possible to visualize small lesions in the cervicocranial junctions, although these findings may not differ from those found in persons without whiplash trauma [8, 16]. Thus, it has not been possible to document any causal connection between these findings and the symptoms of WAD [30]. Moreover, symptoms arising from the neck constitute only a small part of the wide variety of symptoms described for WAD [4, 17].

Given these findings, we hypothesised that chronic WAD should be perceived primarily as a functional somatic syndrome. To explore this hypothesis we used information from a large health study that was conducted in Norway between 1995 and 1997 to compare the symptom profile of persons with chronic WAD to that of people with either a functional somatic syndrome (fibromyalgia), an organic pain disorder (rheumatoid arthritis), or a control group without any of these disorders.

Materials and methods

Study population

Between 1995 and 1997, all inhabitants aged 20 years or more who lived in the county of Nord-Trøndelag, Norway, were invited to participate in the second wave of the Nord-Trøndelag Health Study (HUNT 2). The Nord-Trøndelag Health Study (The HUNT Study) is a collaboration between the HUNT Research Centre, Faculty of Medicine, Norwegian University of Science and Technology, The Norwegian Institute of Public Health, and Nord-Trøndelag County Council.

Among the 92,936 persons who were eligible to participate, 65,604 (70.6%) accepted the invitation, filled in questionnaires, and attended a clinical examination. The clinical examination included standardized measures of height, weight, hip and waist circumference, blood pressure, and heart rate. Additionally, a blood sample was drawn and stored in a freezer for later analysis. Briefly, information was collected on a range of lifestyle and health-related factors. Included in this study were persons who had answered questions concerning whiplash, fibromyalgia, and rheumatoid arthritis. For the purpose of the present study, we were interested in persons reporting either chronic WAD (defined as the report of a whiplash trauma and long-term neck pain) or fibromyalgia or rheumatoid arthritis or none of these disorders. Consequently only persons answering these questions were included, cases of comorbidity were excluded, and persons reporting whiplash but no long-term neck pain were also excluded. This left us with 55,046 persons (26,599 males and 28,447 females) who were available for statistical analysis (Fig. 1).

Fig. 1 Flow diagram of inclusion and exclusion of participants to the study

Study variables

Whiplash trauma was self-reported and defined by the question “Have you ever had neck injury (whiplash)?” Those who responded confirmatively on this question and who further reported neck pain and stiffness for at least three consecutive months during the last year were defined as having chronic WAD and were included in the present study. The participants were also asked to report physician diagnosed fibromyalgia and rheumatoid arthritis. Based on their response, the participants were classified into four mutually exclusive groups: (a) a reference group with none of these disorders, (b) chronic WAD, (c) fibromyalgia, and (d) rheumatoid arthritis.

Symptoms were self-reported and classified into three groups: (a) pain and stiffness in different body areas; (b) other symptoms, including gastrointestinal symptoms, palpitations, and breathlessness; and (c) mental health.

Participants were asked: “During the last year, have you had pain and/or stiffness in the muscles and limbs, which has lasted for at least three consecutive months?” and if YES: “Where did you have these complaints?” and

“Please, indicate the region for which the complaints lasted longest”. The participants were also asked “Have you been troubled by headaches in the last 12 months?” (both attacks (migraines) and “other types of headaches”). Only “other types of headaches” were included in this study.

Other symptoms were registered by asking: “To what degree have you had these disorders in the last 12 months?” with “not at all”, “slightly”, and “very much” as response options. For analytical purposes, the two latter categories were collapsed.

Mental health was recorded by the ‘Hospital Anxiety and Depression Scale’ (HADS), which is a self-report questionnaire consisting of 14 four-point Likert-scaled items, 7 for anxiety and 7 for depression. No somatic items are included. According to a recent literature review, the HADS showed good case-finding properties for anxiety and depression in primary care and somatic patient sample. A cut-off score of 8 on both subscales was found to give an optimal balance between sensitivity and specificity at about 0.80 for, respectively, depression and anxiety according to DSM-III, DSM-IV, ICD-8, and ICD-9 [7]. Case-finding properties of HADS are found to be comparable to or better than that of general practitioners in clinical examinations [31]. Further, the psychometric properties in terms of factor structure and internal consistency of sub-scales are found to be good [29]. In accordance with previous studies using HADS, a valid HADS subscale rating was defined as at least five completed items, one or two missing responses substituted by the individual’s own mean score on valid responses [23].

There are some missing responses to variables on different symptoms as is indicated in the tables. In the analyses these values are not included, and only valid responses are considered.

Statistics

We used logistic regression analyses to compute odds ratios (ORs) and 95% confidence intervals (CIs) for symptoms in the different study groups (fibromyalgia, rheumatoid arthritis, and chronic WAD) using the control group as the reference group. The analyses were performed with two different adjustments in addition to the crude analyses. First we adjusted for the effect of demographic factors (i.e. age and gender) and secondly, we adjusted for social factors (i.e. marital status and education).

In supplementary analyses we excluded all cases of arthrosis, morbus Becterew, or muscle disease from the material and then performed all analyses again to explore the potential effect these other musculo-skeletal disorders may have had on the results. SPSS 14.0 for Windows (Copyright (c) SPSS Inc., 1989–2005) was used in the analyses.

Ethics

The study was approved by the Regional Committee for Medical Research Ethics. All participants gave their written informed consent.

Results

In this population-based study of 55,046 individuals, we identified 785 persons with chronic WAD, 1,095 with fibromyalgia, 958 with rheumatoid arthritis, and a control group of 52,208 persons with none of these disorders. Characteristics of the study population are presented in Table 1. Overall, the rheumatoid arthritis group was older than the other groups; the proportion of females was higher in the fibromyalgia group than in the other groups, and the educational level seemed to be lower in the fibromyalgia group and the rheumatoid group than in the other groups.

The chronic WAD group had higher prevalence of reported pain and stiffness in various body parts, compared to the control group (adjusted OR = 6.87, 95% CI 5.62–8.41 for pain in the elbows to adjusted OR = 9.58, 95% CI 7.91–11.60 for lumbar pain) (Table 2). This also included body parts, which should have no relation to the whiplash trauma, e.g. the hips (adjusted OR = 7.03, 95% CI 5.81–8.51). Compared to the control group, people with fibromyalgia reported an even higher prevalence of pain and stiffness than people with chronic whiplash (adjusted OR = 17.09, 95% CI 14.60–20.01 for thoracic pain to adjusted OR = 17.93, 95% CI 15.08–21.32 for hip pain). People with rheumatoid arthritis also showed a higher prevalence of pain and stiffness compared to the control group, however, less than the chronic WAD group (adjusted OR = 3.62, 95% CI 3.10–4.21 for lumbar pain to adjusted OR = 4.90, 95% CI 4.19–5.73 for hip pain) except for pain in the elbow where the OR was equal to the OR for chronic WAD. The findings were only marginally confounded by age, gender, education, and marital status.

All three study groups had a higher prevalence of gastrointestinal symptoms and symptoms related to the cardiopulmonary system than the control group (Table 3),

although the associations were weaker than for the pain and stiffness symptoms (Table 2). The ORs for the chronic WAD group and the fibromyalgia group were the most elevated. Compared to the control group, people with chronic WAD had an adjusted OR = 1.73 (95% CI, 1.46–2.06) for diarrhoea and an adjusted OR = 3.22 (95% CI, 2.66–3.91) for palpitations. The adjusted ORs for people with fibromyalgia were 2.65 (95% CI, 2.30–3.04) for diarrhoea and 3.30 (95% CI, 2.79–3.89) for dyspnoea, while the ORs for rheumatoid arthritis were somewhat lower (adjusted OR = 1.53, 95% CI 1.31–1.79 for palpitations to adjusted OR = 2.12, 95% CI 1.75–2.57 for dyspnoea). Adjustments for age, gender, education, and marital status had only marginal influence on the results.

Compared to the control group, there was a marked increase in prevalence of anxiety and depression in the chronic WAD group (adjusted OR = 2.03, 95% CI 1.66–2.48 for depression to adjusted OR = 2.13, 95% CI 1.78–2.55 for anxiety) and in the fibromyalgia group (adjusted OR = 2.96, 95% CI 2.56–3.41 for depression to adjusted OR = 3.09, 95% CI 2.65–3.61 for anxiety) (Table 4). The rheumatoid arthritis group had a somewhat smaller increase in the prevalence of symptoms compared to the control group (adjusted OR = 1.38, 95% CI 1.14–1.67 for depression to adjusted OR = 1.39, 95% CI 1.14–1.69 for anxiety). Adjustment for age and gender slightly attenuated the results, while adjustment for education and marital status did not change the results.

In a supplementary analysis, we adjusted for a variable indicating time since the trauma (0–2, 3–5, 6–10, 11–20, >20 years, and no time period indicated), but we observed no material change in the estimated associations (data not shown).

Discussion

We hypothesised that chronic WAD should be perceived primarily as a functional somatic syndrome and expected to find that the profile of the chronic WAD was more similar to the profile of fibromyalgia with symptoms from all body regions, including regions that could not be directly related

Table 1 Demographic characteristics of study groups

	Control group	Chronic WAD	Fibromyalgia	Rheumatoid arthritis
No. of participants	52,208	785	1,095	958
Mean age at baseline, years (SD)	47.9 (16.7)	47.6 (14.9)	50.4 (12.3)	58.0 (17.5)
Percent females	50.7	48.4	87.9	63.6
Percent married	59.9	62.2	69.5	62.1
Percent with higher ^a education	20.9	18.9	12.0	11.1

WAD Whiplash associated disorders

^a Defined as college or university

Table 2 Odds ratio (OR) and 95% confidence interval (CI) for reporting pain and stiffness in different parts of the body

	No. with symptoms	No. without symptoms	Model a		Model b		Model c	
			OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Elbow pain								
Control group	3,430	37,681	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Chronic WAD	167	277	6.62	(5.45–8.05)	6.77	(5.56–8.24)	6.87	(5.62–8.41)
Fibromyalgia	518	293	19.42	(16.76–22.51)	18.51	(15.93–21.51)	17.38	(14.90–20.28)
Rheumatoid arthritis	318	378	9.24	(7.93–10.77)	7.91	(6.77–9.25)	7.77	(6.62–9.13)
Thoracic pain								
Control group	2,060	38,256	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Chronic WAD	117	286	7.60	(6.10–9.46)	7.77	(6.23–9.69)	7.84	(6.26–9.82)
Fibromyalgia	374	371	18.72	(16.11–21.76)	17.85	(15.30–20.82)	17.09	(14.60–20.01)
Rheumatoid arthritis	136	483	5.23	(4.30–6.36)	4.42	(3.62–5.39)	4.37	(3.56–5.36)
Lumbar pain								
Control group	10,357	34,826	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Chronic WAD	415	152	9.18	(7.61–11.07)	9.55	(7.91–11.53)	9.58	(7.91–11.60)
Fibromyalgia	810	146	18.66	(15.62–22.28)	17.31	(14.48–20.70)	17.32	(14.41–20.83)
Rheumatoid arthritis	421	330	4.29	(3.71–4.96)	3.64	(3.14–4.22)	3.62	(3.10–4.21)
Hip pain								
Control group	7,192	36,283	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Chronic WAD	264	215	6.20	(5.17–7.43)	6.90	(5.72–8.33)	7.03	(5.81–8.51)
Fibromyalgia	752	175	21.68	(18.36–25.60)	18.39	(15.53–21.78)	17.93	(15.08–21.32)
Rheumatoid arthritis	423	339	6.30	(5.45–7.28)	4.97	(4.27–5.78)	4.90	(4.19–5.73)

CI Confidence interval, WAD whiplash associated disorders

Model a: Crude effect

Model b: Adjusted for demographic variables (age and gender)

Model c: Adjusted for demographic variables (age and gender) and socio-economic variables (marital status and education)

to the injury. Our results were in favour of this hypothesis, showing that the chronic WAD group had a significantly higher prevalence of symptoms from all body parts, across organ systems, and also mental symptoms, compared to the control group. The fibromyalgia group had an even higher prevalence of all symptoms, while the rheumatoid arthritis group showed an increase in the prevalence of particularly pain and stiffness symptoms and also a minor increase in the prevalence of other symptoms compared to the control group.

The findings are in accordance with previous studies which have also reported a wide range of symptoms in WAD. Ferrari et al. [17] found that neck pain was only one of many diffuse and intense symptoms. However, these results were obtained only 1 month post-collision and might thus be influenced by pending litigation. In a population-based survey, Coté et al. [11] found that persons self-reporting a previous whiplash trauma also reported considerable comorbidity of other health complaints, all with frequencies significantly greater than the no whiplash group. Berglund et al. [4] focused specifically on the chronic whiplash syndrome in a cohort study of persons

involved in a rear-end collision, and found increased risks of headache, thoracic, and low back pain, as well as fatigue, sleep disturbance, and ill health.

Subjective health complaints are also common in the general population. Eriksen et al. [15] reported from surveys in the Nordic countries that as many as 75% of the sample had at least some subjective health complaint for the previous 30 days, with headache (42%) and neck pain (32%) as two of the most common complaints. Haug et al. [23] reported from the HUNT study that 22.2% of the population reported at least five somatic symptoms, which could not be related to any known somatic disease. These high prevalences should be taken into account in the interpretation of the results. However, the results from the present study showed that the prevalence of symptoms in the chronic WAD group was significantly higher than in the control group.

The major strength of the study is the large number of participants and the population-based design. The report of symptoms was not linked to the previous whiplash trauma in the questionnaire, which should minimize the risk for attribution and symptom accentuating. Neither was the

Table 3 Odds ratio (OR) and 95% confidence interval (CI) for reporting various symptoms and complaints

	No. with symptoms	No. without symptoms	Model a		Model b		Model c	
			OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Nausea								
Control group	5,873	42,492	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Chronic WAD	204	527	2.80	(2.38–3.30)	2.94	(2.48–3.48)	3.01	(2.54–3.56)
Fibromyalgia	320	677	3.42	(2.99–3.92)	2.87	(2.50–3.29)	2.90	(2.52–3.33)
Rheumatoid arthritis	164	703	1.69	(1.42–2.01)	1.86	(1.56–2.22)	1.81	(1.51–2.17)
Diarrhoea								
Control group	7,629	40,785	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Chronic WAD	176	541	1.74	(1.47–2.07)	1.74	(1.46–2.06)	1.73	(1.46–2.06)
Fibromyalgia	312	676	2.47	(2.15–2.83)	2.60	(2.27–2.98)	2.65	(2.30–3.04)
Rheumatoid arthritis	185	691	1.43	(1.22–1.69)	1.58	(1.34–1.86)	1.56	(1.32–1.85)
Palpitation								
Control group	7,944	40,728	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Chronic WAD	224	501	2.29	(1.96–2.69)	2.36	(2.01–2.77)	2.41	(2.05–2.83)
Fibromyalgia	429	587	3.75	(3.30–4.25)	3.11	(2.74–3.54)	3.09	(2.71–3.52)
Rheumatoid arthritis	240	651	1.89	(1.63–2.20)	1.59	(1.37–1.85)	1.53	(1.31–1.79)
Dyspnoea								
Control group	3,445	44,601	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Chronic WAD	138	572	3.12	(2.59–3.77)	3.16	(2.61–3.82)	3.22	(2.66–3.91)
Fibromyalgia	199	777	3.32	(2.83–3.89)	3.31	(2.81–3.89)	3.30	(2.79–3.89)
Rheumatoid arthritis	140	726	2.50	(2.08–3.00)	2.22	(1.85–2.68)	2.12	(1.75–2.57)

CI Confidence interval, WAD whiplash associated disorders

Model a: Crude effect

Model b: Adjusted for demographic variables (age and gender)

Model c: Adjusted for demographic variables (age and gender) and socio-economic variables (marital status and education)

Table 4 Odds ratio (OR) and 95% confidence interval (CI) for reporting anxiety and depression

	No. with symptoms	No. without symptoms	Model a		Model b		Model c	
			OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
HADS-A $\geq$ 8								
Control group	5,954	39,273	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Chronic WAD	166	517	2.12	(1.77–2.53)	2.14	(1.79–2.56)	2.13	(1.78–2.55)
Fibromyalgia	306	621	3.25	(2.83–3.74)	2.92	(2.53–3.36)	2.96	(2.56–3.41)
Rheumatoid arthritis	140	650	1.42	(1.18–1.71)	1.42	(1.18–1.71)	1.38	(1.14–1.67)
HADS-D $\geq$ 8								
Control group	4,409	43,978	1.00	(Reference)	1.00	(Reference)	1.00	(Reference)
Chronic WAD	126	621	2.02	(1.67–2.46)	2.06	(1.69–2.51)	2.03	(1.66–2.48)
Fibromyalgia	241	781	3.08	(2.66–3.57)	3.12	(2.68–3.63)	3.09	(2.65–3.61)
Rheumatoid arthritis	139	724	1.92	(1.59–2.30)	1.49	(1.24–1.80)	1.39	(1.14–1.69)

CI Confidence interval, HADS Hospital And Depression Scale, WAD whiplash associated disorders

Model a: Crude effect

Model b: Adjusted for demographic variables (age and gender)

Model c: Adjusted for demographic variables (age and gender) and socio-economic variables (marital status and education)

study related to any litigation, compensation, or insurance process, which is known to be related to increased symptom reporting [1, 12, 16, 32].

The study also has some limitations. First, information on both the disorders and the symptoms and complaints was self-reported with no objective confirmation. We

further defined chronic WAD as having a previous whiplash trauma and additionally reporting long-term neck pain. However we had no information whether the neck pain was in fact related to the whiplash trauma or whether it was pre-existent or had other causes. Neck pain is very common in the population [15, 38], thus our definition may have contributed to an overestimation of the prevalence of chronic WAD in the data. As a control for the effect of other causes to neck pain we performed all analyses with a material excluding cases of Mb Bectereu, arthrosis, and muscle disease. This did not change our results.

Chronic WAD is defined as symptoms lasting more than 6 months after the trauma, although in this study we included all persons self-reporting a whiplash trauma who also reported long-term neck pain. It is thus possible that some persons were still in the acute WAD phase and could have a pending litigation that in turn might influence the reporting of symptoms [6, 10, 36, 37]. However, 94% of the chronic WAD group reported that the trauma occurred at least 2 years ago. A systematic review and meta-analysis of prospective cohort studies of subjects with acute whiplash injuries found that pain, disability, and recovery stabilize within the first 3 months after the trauma [25].

The work and compensation situation may be important for the symptom report, as the work situation may imply job demands which result in physical strain and mental stress with resulting symptoms, while sickness leave with resulting sickness compensation or disability pension award may reduce this strain and stress. In a best evidence synthesis on the burden and determinants of neck pain in workers Coté et al. [13] found that risk factors associated with neck pain included predominantly psychosocial factors. Moreover, Carroll et al. [9] reported that the prognosis of neck pain was linked to few workplace or physical job demands, and that workers with little influence on their own work situation had a slightly poorer prognosis. Unfortunately, this kind of information was not available in the present study, and could not be taken into account in the analysis presented.

In our analyses we excluded cases of comorbidity between the three disorders in the study groups. Part of this comorbidity may not be incidental. As indicated in the results, the prevalence of symptoms in the fibromyalgia group was very high and would probably have overshadowed the effect of the other comorbid groups. Thus excluding comorbidity means that we were able to observe the effect of the other study groups more clearly. Finally, the potential for residual confounding by other unknown or unmeasured factors cannot be excluded in this kind of study.

Conclusion

We found the hypothesis of chronic WAD as a functional somatic disorder was supported. The symptom profile showed a wide array of symptoms, not only predominantly pain symptoms.

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