

Stress and medicine use for headache: does sense of coherence modify the association?

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Background: Medicine use as a strategy for coping with daily stressors is an under-studied issue. Studies show that stress is associated with use of over-the-counter medicine, but the underlying mechanisms are not well understood. The aim of this study was to examine whether sense of coherence (SOC) modifies the association between perceived stress and medicine use for headache. **Methods:** National cross-sectional study in Denmark. Study population: men and women aged 25–44 years, $n=990$. The survey was conducted by web-based questionnaires and telephone interviews. The outcome measure was medicine use for headache. The independent variable was perceived stress. SOC and gender were investigated as moderators. Social class, headache prevalence and severity, and response method were included as co-variables. **Results:** Our study showed that SOC modified the association between stress and medicine use for headache (only statistically significant among women). The odds for medicine use among women who felt stressed were 2.30 (1.39–3.79) compared to women who did not feel stressed; among men who felt stressed the equivalent odds were 1.46 (0.80–2.66). In analysis stratified by SOC, the odds for medicine use when stressed were 2.09 (0.71–6.21) among women with high SOC, 2.21 (1.10–4.41) among women with medium SOC and 3.69 (1.09–12.47) among women with low SOC. The equivalent odds for men were 1.29 (0.33–5.04), 1.33 (0.59–3.04) and 2.47 (0.57–10.64), respectively. **Conclusion:** SOC modifies the association between stress and medicine use especially among women. Individuals with fewer coping resources may be more likely to use medicine beyond indication to treat stress.

Keywords: coping, medicine use, over-the-counter analgesics, pharmacoepidemiology, sense of coherence, stress

Introduction

Medicine use may reflect a general strategy for coping with daily stressors.^{1–3} A high level of perceived stress is associated with use of over-the-counter (OTC) medicine, primarily analgesics.^{2,4,5} Although the primary reason for using analgesics is headache symptoms,^{4,6,7} the association between stress and OTC analgesic use is not explained by headache or other stress-related symptoms alone.^{8,9}

Use of OTC analgesics to cope with stress must be considered inappropriate, as these types of medicines are not indicated for this purpose. Overuse of OTC analgesics is a concern because use is widespread and may have adverse health effects e.g. medicine-induced headache,¹⁰ gastrointestinal bleeding, liver and kidney failure.¹¹ The role of OTC analgesic use as a coping mechanism to overcome daily stressors is an under-studied issue. Knowing the mechanisms underlying medicine use is important in order to minimize inappropriate use.

Antonovsky^{12,13} proposed that sense of coherence (SOC) is an individual attribute that protects the individual against the harmful consequences of stressors. SOC is a measure of an individual's capacity to use an appropriate variety of coping mechanisms and resources when faced with a stressor. SOC has three components—comprehensibility, manageability and

meaningfulness. Adults with high SOC generally handle daily stressors better and remain healthier than adults with low SOC, who seem to be more vulnerable and have more health problems.^{14–18} High SOC is associated with good self-rated health,¹⁹ low risk of psychological despair²⁰ and absence of disease.^{18,19} A prospective study showed that SOC was correlated negatively with life stress and symptoms and mitigated the impact of life stress.²⁰ Findings also support a relationship between SOC and a range of health behaviours.^{21–23} The stronger the SOC, the healthier the behaviour in general.

One study showed that adolescents with low SOC used medicine to cope with the stressor headache to a greater extent than adolescents with high SOC.²³ The association between stress, symptoms and medicine use was not examined in this study but the observations suggest that the association between stress and medicine use may depend on an individual's SOC status, i.e. that high SOC reduces the tendency to use medicine when experiencing stress in general or stress-related symptoms such as headache.

According to Antonovsky, SOC is developed during childhood and adolescence and remains stable throughout life from around the mid-1920s.¹² Cross-sectional surveys show that respondents aged 25–44 years have the lowest

SOC scores²⁴ and the highest levels of stress²⁵ on population level. The highest use of OTC medicine, including analgesics, is also seen in this age group.²⁵ It is this time in life where many become focused on gaining stability in their lives and starting families. Young adults are often faced with handling multiple roles such as parenting and employment and insecurities of daily existence including job stress and marital stress.^{26,27} For these reasons, young adults seem to be an important target group for the study of how stressors, stress and coping influence use of medicines. We have not been able to identify any previous studies on how SOC influences the association between stress and medicine use.

Women are more prone to stress than men²⁵ and have a higher use of analgesics.^{6,28} Some studies suggest that women have lower SOC than men^{15,24,29} although not all studies have found gender differences in SOC.^{13,30,31} It is possible but unknown if a modifying effect of SOC on medicine use for headache in relation to stress varies for men and women.

Aims

The aim of this study is to examine whether SOC modifies the association between perceived stress and medicine use for headache (hereafter medicine use) among men and women aged 25–44 years.

Methods

Design and study population

We used data from a national cross-sectional survey 'The Danish Lifestyle and Medicine Use Study' (DLMS). The survey was conducted by SFI-SURVEY, an independent department at the Danish National Centre for Social Research. A random representative sample of 4000 Danish men and women from 18 to 66 years of age was drawn from the Danish Civil Registration System; 1553 of them were from 25- to 44-year old. The research centre sent a letter to the sampled individuals in December 2008 with information about the study and an invitation to participate. During the first 6 weeks of the survey, people wishing to participate had the option of answering a web-based questionnaire. After 6 weeks the web data collection was closed and phone numbers were sought for the entire sample. Where a phone number was available, trained interviewers then attempted contact up to 12 times with those who had not answered the questionnaire on the web. The response rate among those from 25 to 44 years of age was 66.1% ($N = 1026$).

The share of responses from the 25- to 44-year olds was 27.0% for the web-based questionnaire and 73.0% for the telephone interview.

There is no formal agency for ethical approval of questionnaire-based survey studies in Denmark. The study was registered with the Danish Data Protection Agency, and confidentiality and privacy requirements were met. The study complies with the Helsinki 2 declaration on ethics.

Measurements

The dependent variable was medicine use measured by the item: 'within the last 14 days have you taken OTC analgesic medicine for headache?' This item was chosen in order to isolate the effect of stress-related OTCA use independently of its association with pain.

The responses were dichotomized into (i) 'Yes, several times' + 'Yes, once' and (ii) 'No'. The study focuses on behavioural medicine use, and does not include data about kind of medicine.

SOC was measured by the use of Lundberg's three-item version (SOC-3)³² of Antonovsky's SOC scale translated into Danish. The three-item SOC scale has shown acceptable reliability³² and inter-correlation with the validated 13- and 29-item SOC scales.^{15,33} The scale consists of one question for each dimension: (i) 'Do you usually see a solution to problems and difficulties that at first seem hopeless?' ('Manageability'); (ii) 'Do you usually feel that your daily life is a source of personal satisfaction?' ('Meaningfulness') and (iii) 'Do you usually feel that the things that happen to you in your daily life are hard to understand?' ('Comprehensibility'). The response keys were (i) 'Almost always' (ii) 'Usually' (iii) 'Rarely' and (iv) 'Never'. For a SOC value to be calculated, the respondents had to answer all three items. In order to construct a SOC scale, each response alternative was given a score, and a summed index was computed. For manageability and meaningfulness, 'Almost always' was given 0 point, 'Usually' was given one point, 'Rarely' 2 points and 'No' 3 points. The scoring was reversed for comprehensibility. The resulting index ranged from zero to nine, where a higher value indicates a lower SOC. The participants were then divided into three groups from low to high SOC after careful conceptual considerations and sensitivity analysis, which demonstrated that choice of cut-off point did not result in major changes of the observed associations: High SOC = 0, medium SOC = 1 + 2 and low SOC > 2.

Perceived stress was measured by the item: 'Do you feel stressed in your everyday life?' The responses were dichotomized to maintain sufficient statistical power. After sensitivity analysis, which showed that choice of cut-off point did not change the observed associations substantially, we chose the following dichotomy: (i) 'Yes, often' + 'Yes, sometimes' and (ii) 'No, (hardly ever)'. This question has previously been included in the Danish Health Interview Surveys carried out several times since 1987 by the National Institute of Public Health.²⁵

The selection of covariates was based on variables that empirically have shown an association with the dependent variable medicine use and the independent variable stress, and that were not considered part of a causal chain between the independent variable and medicine use: SOC, headache prevalence, headache severity, social class.

'Headache prevalence' was measured by the item: 'Have you had a headache within the last 14 days?' The responses were: (i) 'Yes' and (ii) 'No'. This question has been included in many European countries' health interview surveys for several decades.

'Headache severity' was measured by the item: 'To what extent were you bothered by the headache?' The responses were categorized as 'Very' vs. 'Somewhat'; 'A little'; 'Not bothered'.

Social class was derived from five items on the occupation of participants: 'Are you in paid work?', 'What is or was your latest position and line of business exactly?', 'Are or were you a public servant, employed in the private sector or self-employed?', 'Do you or did you manage or are or were you responsible for the work of others?', 'How many employees are or were you responsible for or managed?'. We coded the responses by two criteria, (i) educational qualifications required and (ii) control measured by number of subordinates. This coding is in accordance with the social class classification of the National Danish Institute of Social Research, a classification similar to the Registrar General coding often used in the UK. Each respondent was categorized into four levels: I–II (high), III–IV (middle), V (low) and other e.g. students, conscripts and unemployed.

Statistical procedures

We used SAS software version 9.1 for all analyses. Our study population comprised the 1026 participants minus 36 whose information on one or more of the applied variables was lacking. The final analyses were based on $n=990$ individuals (531 women and 459 men). All the main variables in the analysis were distributed differently among men and women. For this reason, we decided to run all analyses stratified by sex, even if the interaction term was not statistically significant.

There was a significantly different distribution of medicine use in relation to response method ($P \leq 0.001$); 48.9% of the respondents answering the web-based questionnaire had used medicine within the last 14 days compared with 33.4% answering the phone interview and therefore analysis was adjusted by response method—web-based questionnaire or telephone interview

First, we inspected the distribution of the employed variables stratified by gender. Differences between men and women were analyzed using Chi-square test.

Then, we studied associations by means of logistic regression analyses. We first estimated the crude association between stress and medicine use. Then, we studied the association adjusted for headache prevalence and severity, social class and response method. To examine whether SOC modifies the association between stress and medicine use, we conducted analysis adjusted for the above-mentioned covariates and stratified by SOC. Analyses testing for interaction between variables were performed.

Associations were reported as odds ratios (ORs) with 95% confidence intervals (CIs). Figure 1 shows the analytical model with stress as determinant, medicine use as outcome, gender and SOC as potential effect modifiers, and social class, headache prevalence and severity as potential confounders.

Results

Table 1 illustrates that all the applied variables were significantly differently distributed between men and women apart from SOC ($P=0.0658$) and response method ($P=0.2981$). Significantly more women than men had used medicine within the last 14 days; 24.5% of the women had used medicine several times compared with 15.0% of the men. Low SOC was reported by 21.5% of the women and 17.2%

of the men. Among the women, 14.9% reported often feeling stressed compared with 9.4% of the men.

As seen in table 2, the crude OR for medicine use in relation to stress was 1.88 (1.27–2.80) among men who felt stressed and 2.00 (1.41–2.84) among women who felt stressed compared with those who did not feel stressed (Model I). The interaction between stress and gender was not significant, $P=0.8269$. In analysis adjusted for headache prevalence and severity, social class and response method, the odds for medicine use among men who felt stressed were 1.46 (0.80–2.66), among women the equivalent odds for medicine use were 2.30 (1.39–3.79) (Model II), and P for interaction = 0.2549.

When stratified by SOC (table 2, Model III), the adjusted odds for medicine use when stressed were 1.29 (0.33–5.04) among men with high SOC, 1.33 (0.59–3.04) among men with medium SOC and 2.47 (0.57–10.64) among men with low SOC. The interaction between SOC and stress was not significant, $P=0.9971$. The equivalent odds for women were 2.09 (0.71–6.21), 2.21 (1.10–4.41) and 3.69 (1.09–12.47), respectively, P for interaction = 0.7327.

Discussion

Interpretation of findings

Our results showed that SOC modified the association between stress and medicine use among women with a tendency to a similar observation among men. The association between stress and medicine use became increasingly stronger with decreasing SOC. The study was cross-sectional and does not reveal how stress may contribute to medicine use or what role SOC plays in this association, but there are several possible explanations.

Antonovsky (1993) argued that SOC is not primarily a stress buffer variable, instead the stress buffering effects of SOC may be due to its influence on the choice of coping strategies. While SOC is not a coping strategy in itself, individuals with a high SOC may be more likely to flexibly adopt adaptive strategies, appropriate to the needs of the specific situation.¹³ In this perspective, individuals with high SOC are more likely than

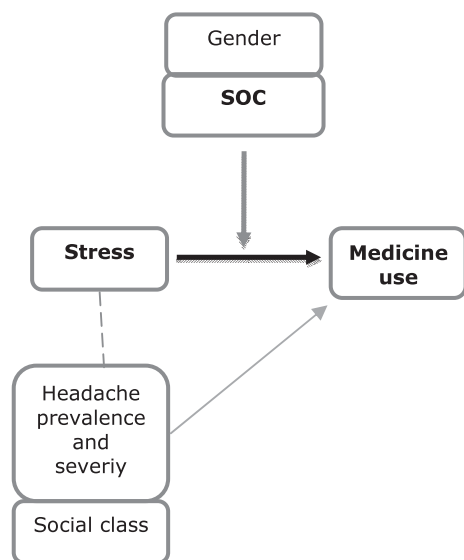


Figure 1 SOC and gender as effect modifiers on the association between perceived stress and medicine use for headache

Table 1 The prevalence of the applied variables by gender in percent

	Men (n=459)	Women (n=531)	P-value from Chi-square test for gender differences
Medicine use for headache past 14 days			0.0003
On one occasion	16.6	18.3	
Several times	15.0	24.5	
SOC			0.0658
High	33.8	27.7	
Medium	49.0	50.9	
Low	17.2	21.5	
Stress			0.0061
Sometimes	34.4	37.5	
Often	9.4	14.9	
Headache past 14 days	37.7	49.2	0.0003
Headache severity			<0.0001
Severe	4.6	10.9	
Moderate	12.0	19.6	
Social class			0.0014
High	24.4	23.9	
Middle	46.6	49.7	
Low	19.8	12.1	
Other	9.1	14.3	
Response method			0.2981
Web-based questionnaire	25.5	28.4	
Interview	74.5	71.6	

Table 2 OR (95% CI) for medicine use for headache in relation to stress

	Model I	Model II	Model III		
	Crude	Adjusted ^a	High SOC ^a	Medium SOC ^a	Low SOC ^a
Men					
No stress	1.0	1.0	1.0	1.0	1.0
Stress	1.88 (1.27–2.80)	1.46 (0.80–2.66)	1.29 (0.33–5.04)	1.33 (0.59–3.04)	2.47 (0.57–10.64)
Women					
No stress	1.0	1.0	1.0	1.0	1.0
Stress	2.00 (1.41–2.84)	2.30 (1.39–3.79)	2.09 (0.71–6.21)	2.21 (1.10–4.41)	3.69 (1.09–12.47)

a: Adjusted for headache prevalence, severity, response method, SES

Model I, Unadjusted; Model II, Adjusted model; Model III, Stratified by SOC

OR-values in bold are statistically significant, $P < 0.05$

individuals with low SOC to find an efficient strategy for dealing with stress, and are therefore less inclined to use medicine in order to cope.

The primary reason for using analgesics is headache symptoms.^{4,7} Headache is a common complaint that often has a psychosomatic aetiology, and cognitive stress has been suggested as the most common trigger of headache.³⁴ Larsson and Kallenberg¹⁶ found a significant association between headache and SOC. Antonovsky¹² suggested that SOC may affect the equilibrium of the physiological system. Perceived stress as well as negative coping expectations and inappropriate coping responses affect physiological processes that may permanently lower the threshold for experiencing subjective health complaints.^{16,35} McSherry and Holm³⁶ found an association between SOC and physical reactions to stress. When they adjusted for stress Torsheim *et al.*³⁷ found a strong association between SOC and symptoms among adolescents. They suggested that this may be due to individuals with high SOC showing resistance to such sensitization. In order to isolate the effect of stress-related medicine use independently of its association with pain, we measured medicine use by the item: 'Within the past 14 days have you taken OTC analgesic medicine for headache?' In analyses adjusted for headache prevalence and headache severity, the association between stress and medicine use attenuated among men. Headache, both prevalence and severity, may be an important confounder of the association between stress and OTCA use, but headache may also be a mediating factor between stress and OTCA use. In analyses adjusted for headache prevalence and severity among women the association between stress and medicine use became seemingly stronger (the confidence intervals of the crude OR and the adjusted OR overlap) suggesting that headache does not explain the association between stress and medicine use.

Interpretation of the role of SOC

The analyses suggest that SOC modifies this association. Women who have a higher use of OTC analgesics than men,^{6,38} are more prone to stress than men,²⁵ and have lower SOC than men,²⁴ but the association between stress and medicine use was the same for men and women and SOC modified this association for both genders although the results were not statistically significant among men.

In more recent years, it has been shown that stratifying on a variable that precedes exposure and disease can induce confounding, even if there is no confounding in the unstratified (crude) estimate.³⁹ In Antonovsky's original theory, SOC influences perceived stress and health in different ways: SOC influences whether a stimulus is considered a stressor or not, to what degree a stressor leads to tension and to what extent these tensions have negative consequences for an individual's health. In this perspective it seems likely that SOC may precede perceived stress. Findings also support a relationship between

SOC and a range of health behaviours including analgesic use.^{21–23} If SOC precedes perceived stress and medicine use, then stratifying on SOC as we have done may have induced confounding. However, Greenland³⁹ argues that the relative magnitude of this type of bias is slight, and we therefore believe the potential bias to be of minor importance to our results.

The SOC scale has been criticized for being contaminated by emotionality.⁴⁰ Studies show significant correlations between SOC and depression and anxiety,^{17,36} and between subjective symptoms and SOC.^{16,19,37} Geyer suggested that measurements of SOC partly reflect negative affectivity.⁴⁰ According to the theory of symptom sensation, negative affectivity is associated with high introspection and a low threshold for symptom sensation.³⁷ High levels of OTC analgesic use are associated with depressive symptoms.⁴ Seen from this perspective, the modifying effect of SOC on medicine use could reflect a mutual influence of negative affectivity. Schnyder *et al.*¹⁷ concluded on the basis of two longitudinal studies of SOC among adults that SOC is not merely a result of psychopathology, but rather a measure of an individual's world view.

SOC-3 does not have the same great variety of strong SOC as SOC-29 and SOC-13.³³ Lundberg and Peck³² concluded that their simplified measure is a useful substitute for the original scale, especially in cases where information on SOC would otherwise have been totally omitted.

Study strengths and limitations

The study was appropriate for the planned analyses since it included a representative sample of 24- to 44-year olds. Data were characterized by a vast exposure contrast that is advantageous when studying potential exposure–outcome associations. Most of the questions used in the present study are standard questions in health surveys.

The study also has limitations. There is a risk of selection bias because individuals with whom contact was not obtained may have lower SOC, a higher prevalence of stress and/or medicine use. In this case, we are likely to have underestimated the associations between SOC, stress and medicine use. The odds for medicine use were significantly higher among participants answering the web-based questionnaire, and social desirability bias may be present in answers stemming from the telephone interviews. It is also possible that those with a high use of medicine merely found the study more relevant and therefore responded immediately on the web.

Conclusion

The study suggests that SOC modifies the association between perceived stress and medicine use, i.e. the association between perceived stress and medicine use becomes stronger the lower the SOC. As OTC analgesics may have potential harmful side effects, healthcare professionals, those in charge

of dispensing medicines and policymakers need to be aware of the sensitivity of medicine use to psychosocial and social circumstances. One example is that individuals with fewer coping resources may be more likely to use medicine beyond indication to treat stress. To gain a deeper understanding of the mechanisms underlying analgesic use, further research concerning medicine-related coping in various age groups would be valuable.

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Conflicts of interest: None declared.

Key points

- It is important for policymakers and health professionals, especially those dispensing medicines, to be aware that medicine use for headaches is common, and may be influenced by many factors other than headaches.
- There is a strong association between stress and medicine use for headache, especially among women, which is not merely explained by presence of symptoms.
- SOC is an individual characteristic hypothesized to protect against harmful exposures. SOC modifies the association between stress and medicine use for headache. The association between stress and medicine use is stronger among individuals with low SOC than among those with high or medium SOC, and stronger among participants with medium SOC compared to those with high SOC.

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