Use of over-the-counter analgesics and perceived stress among 25–44-year olds†

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SUMMARY

Purpose To examine the association between perceived stress and use of over-the-counter analgesics in a representative sample of 25–44-year old adults, and to examine the association across various socio-demographic strata. Furthermore, to examine whether an association between perceived stress and use of over-the-counter analgesics attenuates when controlled by potential stress-related pain and discomfort.

Methods National representative cross-sectional study in Denmark. The study population consisted of men and women aged 25–44 years, n = 4739. The survey was conducted by face-to-face interviews. The outcome measure was use of over-the-counter analgesics (OTCA). The independent variable was perceived stress. Demographic variables and pain and discomfort symptoms were included as covariates.

Results Analyses stratified by socio-demographic factors (gender, education, cohabiting status and whether or not the respondents had children) all showed a significant and graded association between stress and OTCA use. The odds for OTCA use mounted with increasing stress. In analyses adjusted for socio-demographic variables and pain or discomfort the association between stress and OTCA use attenuated somewhat, but remained significant and graded. The crude odds ratio (OR) for OTCA use was 1.36 (1.19–1.55) among participants who sometimes felt stress, and 1.91 (1.58–2.30) among participants who often felt stress, compared to participants without stress.

Conclusion There was a significant and graded association between perceived stress and OTCA use. The association was robust across all the examined socio-demographic strata and could not be explained by potential stress-related pain and discomfort. The results indicate that OTCA are used inappropriately to treat feelings of stress. Copyright © 2009 John Wiley & Sons, Ltd.

INTRODUCTION

The primary reason for using analgesics is headache symptoms,1–5 but not all analgesic use can be explained by the prevalence of symptoms.1,4–6 Several researchers have suggested that medicine use may be a behaviour reflecting a general coping strategy to overcome daily stressors over and above formal therapeutic indications.7–9

Since the 1980s, there has been a significant increase in the use of analgesics.10 Over-the-counter analgesics (OTCA) are among the most widely used medications worldwide, with prevalence of use ranging from 7 to 37% within a 2-week period in various settings.2,3 This common illness behaviour may have potentially serious side effects, e.g. medicine-induced headache, gastrointestinal bleeding, liver and kidney failure, myocardial infarction and death,11–14 which makes it important to know the reasons for OTCA use. Most studies on analgesics are based on highly selected populations,8,15,16 Few population studies have been performed and our knowledge about psychosocial factors that may affect the use of OTCA is limited.

High levels of OTCA medicine use are associated with psychiatric illness, particularly depressive symptoms, and the use of alcohol, nicotine and caffeine.1 Abbott & Fraser conclude that OTC medicines may be
used to treat feelings of stress, anxiety and depression, as well as to relieve pain and discomfort in daily life.\textsuperscript{1} Several studies have shown an association between stress, defined in different ways, and various types of health behaviour.\textsuperscript{1,5,16–18}

Since the first Danish national health survey in 1987, there has been a significant increase in the number of people who report often having feelings of stress in their everyday lives.\textsuperscript{10} A constant level of perceived stress is a general health hazard and seems to reduce the individual’s immune competence.\textsuperscript{18} Perceived stress affects physiological processes that may permanently lower the threshold for experiencing subjective health complaints,\textsuperscript{19} and stress has been mentioned as the most frequent trigger of headache.\textsuperscript{20} Similarly stress has been related to a variety of other symptoms, e.g., muscle pain.\textsuperscript{18,20,21}

There is already some evidence that life stress and psychological distress may be related to the use of non-prescription medications in selected populations\textsuperscript{1,5,9} i.e., among Danish slaughterhouse workers,\textsuperscript{22} young women\textsuperscript{8} or Finnish female conscripts.\textsuperscript{16} A national Danish study found the highest levels of stress among men and women aged 25–44 years, with more women than men reporting feelings of stress. It is this time in life where many become focussed on gaining stability in their lives and starting families, thus handling multiple roles such as e.g. parenting and employment and possibly facing insecurities of daily existence including job stress and marital stress.\textsuperscript{5,18} The highest use of OTC medicine, including analgesics, is seen among 25–44-year-olds.\textsuperscript{10} To our knowledge, no studies have examined whether the relatively high use of OTCA among adults may be related to perceived stress. The first aim of this study is to examine whether OTCA use is associated with perceived stress among a representative sample of 25–44-year-old Danish men and women. Perceived stress is defined as an individual condition characterised by discomfort and arousal.\textsuperscript{23}

It is possible that there may be various levels of perceived stress as well as various attitudes to medication use in different socio-demographic groups.

A few studies have shown an association between gender and stress, women being more prone to stress than men.\textsuperscript{5,10} Furthermore, several studies have shown a higher use of analgesics among women than men.\textsuperscript{2,24}

In previous studies, low-education level has shown associations with a high level of medicine use\textsuperscript{25} and stress.\textsuperscript{26} Svarstad\textsuperscript{5} found that unmarried people tended to use a larger number of drugs than married people. In contrast, handling multiple roles such as marriage and employment has been associated with stress among women.\textsuperscript{5} Parenting is one of the multiple social roles mentioned as a potential source of stress among women.

It is possible yet unknown whether an association between perceived stress and OTCA use appears differently across socio-demographic groups. Our second aim is therefore to examine the pattern of this association across various socio-demographic strata based on gender, education, cohabiting status and whether or not the respondents have children.

Finally, if there is an association between perceived stress and OTCA use, it is important to examine whether this association may be explained by potential stress-related pain and discomfort. Our study is cross-sectional and will therefore not reveal any causal direction between stress, pain and discomfort, and OTCA use. Nevertheless, our third aim is to examine whether an association between perceived stress (hereafter stress) and OTCA use attenuates in analyses adjusted for various potential stress-related symptoms: Pain or discomfort in shoulder or neck; pain in back or lower back; pain in arms, hands, legs, knees, hips or joints; headache; stomach ache and cold and cough symptoms.

\section*{METHODS}

\textbf{Design and study population}

We used data from the fourth national cross-sectional survey of health and morbidity in the Danish population, the Danish Health Interview Survey 2005, which was carried out by the National Institute of Public Health, University of Southern Denmark. The survey was conducted by face-to-face interviews with a representative sample of the adult Danish population. A random sample of 21,832 Danish citizens aged 16 years and above was invited to participate. The sample was stratified to include approximately 3000 respondents from each of the five Danish regions. A total of 14,566 persons participated, resulting in a response rate of 66.7\%. Our study population comprised the 4831 participants in the age group 25–44 years minus 92 who lacked information on stress or the applied covariates, \( n = 4739 \) (2313 men and 2426 women). Response rate in this age group was 68.0\%.

\textbf{Data collection}

Data were collected continuously from May 2005 until mid-March 2006. The respondents were interviewed in their homes by trained interviewers. The response rate was similar for men and women, and married men and
women were slightly over-represented. Persons living in the metropolitan area of Copenhagen including suburbs had a somewhat lower response rate than other parts of Denmark. Despite the unequally distributed non-response, the respondents are estimated to be representative of the Danish population.10

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

Measurements

The dependent variable was OTCA use measured by the item: ‘Within the last 14 days have you taken . . .?’ There were two types of indications for over-the-counter analgesic medicine: (1) Over-the-counter analgesic medicine for discomfort and pain in muscles, bones, tendons or joints, and (2) Other over-the-counter analgesic medicine. Analyses were conducted separately for the two types as well as for the two types combined. The variable was dichotomized for use or no use. The study focuses on the behaviour OTCA use, and does not include data about which kind of medicine.

The independent variable stress was measured by the item: ‘Do you feel stressed in your everyday life? The responses were: (1) Yes, often; (2) Yes, sometimes; (3) No, (hardly ever).

Education was assessed using the International Standard Classification of Education (ISCED) (UNESCO 1997). For this study we re-coded education into two categories in order to maintain adequate statistical power. (1) Short: less than 13 years; (2) long: 13+ years.

Cohabiting status was coded as (1) Yes: respondents who answered yes to being married, cohabiting or in a registered partnership and (2) No: individuals who had not answered yes to any of the above.

We included the dichotomized variable children in our analyses to examine potential differences in relation to stress and OTCA use between individuals with and without children.

To examine whether an association between stress and OTCA use is affected by stress-related pain and discomfort, we conducted analyses including potential stress-related pain and discomfort. The symptom variables were derived from the question: Within the last 14 days have you been bothered by any of the following kinds of pain or discomfort? (1) Shoulder or neck; (2) back or lower back; (3) arms, hands, legs, knees, hips or joints; (4) headache; (5) stomach ache; (6) cold and cough symptoms (response key ‘yes bothered a lot’, ‘yes, bothered somewhat’, ‘no’). An index for symptoms was made 1 = Yes to at least one symptom, else 2.

Statistical procedures

We used SAS software version 9.1 for all analyses. Taking into account the regional imbalance caused by the way the sample was drawn, all analyses were weighted to ensure national representativeness. The final analyses included 2426 women and 2313 men.

First we inspected the distribution of the employed variables stratified by gender. Differences between men and women were analysed using χ²-test.

Second, we studied associations by means of logistic regression analyses. Initially we estimated the crude association between stress and OTCA use. Analyses were performed separately for the two types of OTCA use as well as for the two types combined. Then we estimated the crude association stratified by the socio-demographic variables—gender, education, cohabiting status and children—one at a time. Using multiple logistic regression analyses, we also studied the association between stress and OTCA use adjusted for the above-mentioned socio-demographic variables.

We conducted analyses to examine any effect that symptom experience might have on the association between stress and OTCA use. We examined the association adjusted for the symptom variables individually as well as for the index for symptoms. Multiple logistic regression analyses for OTCA use were conducted adjusting for all the variables: Stress, the socio-demographic variables and index for symptoms.

Finally, analyses to test for interaction between variables were performed. Analyses to test for interaction between symptoms and stress in relation to OTCA use showed no significant interactions (Pheadache = 0.0739), (Ptongue-ache = 0.2290), (Pshoulder/neck pain = 0.0720), (Pback pain = 0.0730), (Parms etc. = 0.2723 and (Pcold/cough = 0.4649).

Associations were reported as odds ratios (OR) with 95% confidence intervals (CI).

RESULTS

Table 1 shows the gender specific distribution of symptoms, OTCA use, perceived stress and the selected socio-demographic variables i.e. education, cohabiting status, respondents with/without children.

In the study population, 58.0% reported feeling some kind of stress in their daily lives, stress being
significantly more common among women than men ($p < 0.0001$). Among women 13.9% reported often feeling stressed compared to 10.8% of the men. Similarly 46.7% of the female participants reported sometimes feeling stress compared to 44.4% of the male participants. There were significant gender differences for all variables except cold and cough symptoms. Among participants who reported feelings of stress—sometimes or often—77.1% had experienced at least one pain symptom (index for symptoms) within the last 14 days—the most prevalent symptoms experienced by these participants were shoulder/neck pain (38.6%) and headache (34.7%). OTCA had been used by 31.4% of the participants, 7.6% of these reported no pain or discomfort; said differently 9% of the participants reporting no pain still used OTCA. Among participants who had used OTCA ($n = 1487$) 16.1% reported no stress, 48.4% reported sometimes feeling stress, and 35.5% reported often having feelings of stress.

Because the association between stress and OTCA use was significant and graded for both medicine use outcomes, the two types of medicine use were combined. In the unadjusted model, the odds of OTCA use were 1.36 (95% CI 1.19–1.55) for participants who sometimes reported feeling stress, and 1.91 (1.58–2.30) for participants who often reported feeling stress, compared to participants without stress (Model I, Table 2). The association remained graded and significant in the corresponding analyses stratified by gender, education, children and cohabiting status, just as the odds for OTCA use when stressed barely changed when adjusted for these variables (Model II, Table 2).

Analyses showed a significant association between stress and all symptoms; headache ($p < 0.0001$), stomach-ache ($p < 0.0001$), shoulder/neck pain ($p < 0.0001$), backache ($p < 0.0001$), pain or discomfort in arms, hands, legs, knees, hips or joints ($p = 0.0003$) and cold/cough symptoms ($p = 0.0221$). In analyses adjusted for stomach-ache, backache, pain or discomfort in arms, hands, legs, knees, hips or joints and cold/cough symptoms the odds for OTCA use when stressed barely changed. However, when individually adjusted for experience of shoulder/neck pain and headache symptoms, the association attenuated somewhat but remained significant (Model III, Table 3). The shoulder/neck adjusted odds for OTCA were 1.28 (1.11–1.46) for those who sometimes felt stress and 1.67 (1.38–2.03) for those who often felt stress. The equivalent headache adjusted odds for OTCA use were 1.18 (1.02–1.37) and 1.46 (1.17–1.81), respectively. In the analyses adjusted for index for symptoms the odds for OTCA use when stressed barely changed. However, when individually adjusted for experience of shoulder/neck pain and headache symptoms, the association attenuated somewhat but remained significant (Model III, Table 3). The shoulder/neck adjusted odds for OTCA were 1.28 (1.11–1.46) for those who sometimes felt stress and 1.67 (1.38–2.03) for those who often felt stress. The equivalent headache adjusted odds for OTCA use were 1.18 (1.02–1.37) and 1.46 (1.17–1.81), respectively. In the analyses adjusted for index for symptoms the odds for OTCA use were 1.26 (1.10–1.45) for those who sometimes felt stress and 1.60 (1.31–1.94) for those

| Table 1. Descriptive information on the studied variables, in % |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | Men $n = 2313$  | Women $n = 2426$ | Chisq $p$-value |
| **Perceived stress** |                 |                 |                 |
| No (hardly ever)  | 44.8            | 39.4            | $<0.0001$       |
| Yes, sometimes    | 44.4            | 46.7            |                 |
| Yes, often        | 10.8            | 13.9            |                 |
| Medicine use      | 25.5            | 37.0            | $<0.0001$       |
| Long education min. 13 yrs | 67.8 | 80.5 | $<0.0001$       |
| With children     | 57.7            | 71.5            | $<0.0001$       |
| Headache          | 22.8            | 38.1            | $<0.0001$       |
| Stomach-ache      | 5.0             | 10.1            | $<0.0001$       |
| Shoulder/neck pain| 27.3            | 40.8            | $<0.0001$       |
| Backache          | 25.9            | 32.1            | $<0.0001$       |
| Pain in arms, hands, legs, knees, hips or joints | 23.1 | 27.6 | 0.0003 |
| Cold or cough     | 19.2            | 18.7            | 0.6732          |
| Any pain/discomfort | 68.4           | 78.3            | $<0.0001$       |

*aCohabiting = married, cohabiting or in a registered partnership.*

| Table 2. Multiple logistic regression models for use of OTCA in relation to stress. Unadjusted (Model I) and adjusted models (Model II). OR (95% CI) |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                  | Model I         | Gender          | Education       | Cohabit.stat.   | Children        | All socio-demographic variables |
| **Stress**       | Crude OR        |                 |                 |                 |                 |                               |
| Sometimes        | 1.38 (1.20–1.57) | 1.35 (1.18–1.54) | 1.37 (1.20–1.57) | 1.37 (1.20–1.57) | 1.37 (1.20–1.56) | 1.32 (1.16–1.51) |
| Often            | 1.94 (1.60–2.34) | 1.86 (1.54–2.25) | 1.91 (1.57–2.31) | 1.94 (1.60–2.34) | 1.93 (1.59–2.33) | 1.83 (1.51–2.21) |
| Gender           |                 |                 |                 |                 |                 |                               |
| Women            | 1.66 (1.47–1.88) |                 |                 |                 |                 | 1.63 (1.43–1.84) |
| **Education**    |                 |                 |                 |                 |                 |                               |
| Long min. 13 yrs | 1.14 (0.98–1.31) |                 |                 |                 |                 | 1.06 (0.92–1.23) |
| Cohabiting Status|                 |                 |                 |                 |                 |                               |
| Cohabiting       | 1.03 (0.88–1.19) |                 |                 |                 |                 | 0.92 (0.78–1.09) |
| Children         |                 |                 |                 |                 |                 |                               |
| Yes              | 1.23 (1.08–1.40) |                 |                 |                 |                 | 1.17 (1.02–1.35) |

*aCohabiting = married, cohabiting or in a registered partnership.*
who often felt stress. In the multiple logistic regression analyses for OTCA use adjusted for all the variables simultaneously (Model IV, Table 4) the odds for OTCA use were 1.23 (1.07–1.41) among participants who sometimes felt stressed and 1.54 (1.27–1.88) among participants who often felt stressed.

**DISCUSSION**

There was a significant and graded association between level of stress and OTCA use, and this association was the same across the various socio-demographic strata. Use of OTCA in relation to stress was not merely explained by potential stress related pain and discomfort. After adjusting for pain and discomfort, the association between stress and OTCA use remained significant and graded. Our study is cross-sectional and does not allow causal interpretation, but there are several possible explanations for how stress may contribute to OTCA use.

Perceived stress is associated with physiological processes that may permanently lower the threshold for experiencing health complaints.\(^19\) Hence the association between stress and OTCA use may be mediated by stress-related symptoms. We know that OTCA are used primarily to treat headaches.\(^1,3\) Headache is a common complaint that often has a psychosomatic aetiology, and cognitive stress has been suggested as the most common trigger of headache.\(^20\) In analyses adjusted individually for symptoms, headache was the symptom that most notably attenuated the association between stress and OTCA use. Headache may be an
important confounder of the association between stress and OTCA use, but we cannot exclude that headache may be a mediating factor between stress and OTCA use. Shoulder and neck pain also attenuated the association between stress and OTCA use, and may similarly be either a confounder or a potential mediating factor. Even after adjusting for pain and discomfort, and socio-demographic variables the association between stress and OTCA use remained significant and graded. This suggests that the association between perceived stress and OTCA use is real and not only caused by stress-related symptoms.

Abbott & Fraser\(^1\) found that to a large extent OTC medicines—primarily analgesics—were used to relieve feelings of stress. Turunen \etal\(^6\) identified a group of individuals who reported using analgesics frequently, but simultaneously reported having pain symptoms very rarely. Chrischilles \etal\(^7\) found that the vast majority of elderly men and women who used OTCA reported mild or no pain at all. In our study 9% of the participants who reported no pain or discomfort had used OTCA within the last 14 days. In epidemiological studies of OTC medicine, primarily analgesics, exposure to bullying,\(^7\) alcohol and illegal drug use,\(^1,8,29\) and psychological symptoms such as depression and anxiety have been associated with medicine use.\(^28\) Andersen \etal\(^29\) found medicine use to cluster with smoking and drunkenness among adolescents, and suggested that medicine use is part of a behavioural pattern of substance use to relieve stress.

Previous studies have suggested that men and women may use different coping strategies when faced with a stressor, e.g. when faced with the stressor musculoskeletal pain.\(^50\) We found that the association between stress and OTCA use was the same for men and women, but that significantly more women than men felt stress in their daily lives. Numerous studies have shown that women use analgesics more often than men\(^2,7,24\) and that women in general suffer more frequently from headaches and other subjective health complaints.\(^10\) A possible interpretation could be that more women than men use analgesics because they experience stress to a larger extent, which in turn might also result in more headaches and other subjective health complaints.

The study was appropriate for the planned analyses since it included a large nationally representative sample. Data were characterised by a vast exposure contrast that is advantageous when studying potential exposure-outcome associations. Most of the questions used in the present study are validated standard questions in health surveys.

The study also has limitations. Cross-sectional surveys have limitations concerning causal explanation. There is a risk of selection bias because individuals with whom contact was not obtained may have a higher prevalence of stress and/or OTCA use. In this case, we are likely to have underestimated the associations between stress and OTCA use. Problems remembering symptoms and use of medicine are often considered a major validity problem when using data from cross-sectional surveys and we cannot exclude that recall bias may be present. Recall bias in relation to medicine use increases with increasing recall period.\(^31\) Future studies might reduce potential recall bias by reducing the recall period. Also in order to estimate the financial and social implications frequency and duration of OTCA use in relation to stress needs to be known. Finally we can not rule out that there may be residual confounding because perceived stress and the use of OTCA may be influenced by a variety of exposures not included in this study, e.g. exposure to noise.

Further research is needed to study the association between stress and OTCA in other age groups. A longitudinal study would be appropriate for examining causal mechanisms.

Healthcare professionals and policymakers need to be aware that OTCA are used inappropriately to treat stress and that this pattern is not unique to women or individuals with less education. In a long-term perspective, inappropriate OTCA use to alleviate stress may not have implications for only the individual. There may also be implications on a collective level in relation to general public health and the activities of our healthcare services, where the consequences are financial, social, and ethical.

### REFERENCES


