ABSTRACT

Background

Neck and shoulder pain (NSP) is very common in the general population. However, little is known about the epidemiology of this condition. The purpose of this study was to investigate the characteristics and the risk factors associated with NSP, and to reveal its effect on health-related quality of life (HRQOL).

Methods

Medical checkups were conducted among the residents of a mountain village, where agroforestry and tourism are the main industries. The participants consisted of 863 residents, including 308 males and 555 females. NSP was defined as the symptoms of muscle tension, stiffness, pressure or dull pain extending from the neck to the scapular arch. The participants completed a questionnaire including information on the presence of NSP, age, gender, musculoskeletal pain at other anatomical sites and medical complications. The NSP-associated factors obtained by the questionnaire were investigated using univariate and multivariate analyses. The EuroQol (i.e., EQ-5D and EQ-VAS) was also assessed.

Results

The prevalence of NSP was 48.3%, and NSP was more common in females than males.
The prevalence was higher in the generation from 20 to 60 years of age, and decreased with age. NSP was associated with pain in the upper extremities and lower EuroQol scores, but not with pain in the lower extremities or medical complications. A multivariate logistic regression analysis showed that female gender and pain in the upper extremities were independently associated with NSP.

**Conclusions**

We used a general concept of NSP, which allowed us to collect the unified data about this condition among the participants. NSP was a prevalent health problem that led to deterioration of the HRQOL in the general population. Female gender and pain in the upper extremities were the risk factors associated with NSP. The characteristics of NSP clarified in this study may provide a basis for the prevention and/or effective management of NSP.
Introduction

Neck and shoulder pain (NSP) is a very common symptom among the general population. To date, NSP has been described using various terms, such as neck pain [1, 4, 7, 23, 26, 34], nonspecific neck pain [2, 11] and chronic neck and shoulder pain [3] in Western countries, and “Katakori” [9, 11, 16, 20-22] in Japanese.

Among European and North American populations, two-thirds of people experience neck pain at some point during their lives [4]. In Japan, a comprehensive survey reported that NSP was the most common subjective symptom in Japanese females and males [5]. A recent multicenter study reported the visual analog scale (VAS) scores for pain or stiffness in the neck or shoulders and its prevalence among healthy Japanese volunteers [6]. However, there continues to be little information available regarding the epidemiology and clinical characteristics of NSP in the general population. Moreover, there exist only a few studies that describe the anatomical region most frequently involved in NSP and provide a definition of this condition. Hurwitz et al. [7] reported that neck pain is located in the region from the upper thoracic spine to the occiput and surrounding musculature. Bliss et al. [8] reported that neck pain may be a feature of virtually every disorder and disease that occurs above the shoulder blades. Until now,
whether the painful condition called “Katakori” in Japan is similar to the conditions reported in Western countries has not yet been clarified. To reveal the clinical pathology and characteristics of “Katakori”, it is important to uniformly define its clinical symptoms and the specific anatomical region(s) affected. Therefore, Takagishi et al. [9] reviewed previous studies published in the English literature and suggested that neck and shoulder pain or chronic nonspecific neck pain are similar to “Katakori” in terms of the clinical symptoms. Importantly, Takagishi et al. [9, 10] also defined the general concept of NSP. Here, we use the term and definition of “Neck and shoulder pain (NSP)” to represent “Katakori”. The purpose of this study was to investigate the characteristics of NSP, and to reveal its effects on the health-related quality of life (HRQOL) in the Japanese general population.

**Materials and methods**

This study was approved by the review board of our institute. All participants were given an explanation of the study, and their written informed consent was obtained. Cancer screening and preventive health medical checkups were conducted for the residents of a mountain village, where agroforestry and tourism are the main industries. In the present study, NSP was defined as the symptoms of muscle tension, stiffness, pressure or dull
pain extending from the neck to the scapular arch [9, 10]. A schematic drawing showing
the localization of NSP is presented in Figure 1 [11].

We randomly picked 863 of the participants, including 308 males and 555 females,
with an average age of 63.5 years (range, 28-94 years) for the present study.

Approximately 15% of the population of the village was included in this study. None of
the participants had any history of surgical treatment in their neck and shoulder region.

Any suspected cases of cervical diseases (e.g., cervical spondylotic radiculopathy and
cervical disc herniation) were excluded from this study. We first interviewed the
participants regarding whether they had experienced NSP during the past one month
using the definition of NSP as mentioned above [9, 10], and they next answered a
questionnaire: the questionnaire asked the participants to provide demographic data,
including their age, gender, medical diseases (diabetes mellitus, hypertension,
hyperlipidemia, cardiac disease, arrhythmias, stroke, kidney and liver disease) and
musculoskeletal pain at other anatomical sites (shoulder joint, elbow, wrist, hand, back,
lumbar, hip, knee and ankle).

The participants were also asked to complete all of the questions on the EuroQol
(EQ-5D/EQ-VAS) questionnaire. The EuroQol consists of two parts: a health-status
descriptive system (EQ-5D) and a visual analogue scale (EQ-VAS). The EQ-5D records
the level of self-reported problems in five dimensions (i.e., mobility, self-care, usual activities, pain/discomfort and anxiety/depression). Each of the dimensions is divided into three levels of perceived problems: no problem (Level 1), some problems (Level 2) and extreme problems (Level 3). Furthermore, the EQ-5D states can be converted to a single summary index. The scores on the EQ-5D index range from -0.171 to 1, where 1 indicates no problem, zero indicates death and negative values indicate a health status worse than death. The participants then describe their own health status using a VAS score ranging from zero (worst imaginable health) to 100 (best imaginable health) [12].

Initially, an univariate statistical analysis was carried out using Student’s t-test, the Chi-squared test, Fisher’s exact probability test and the Kruskal-Wallis test to evaluate the influence of age, gender, medical diseases and musculoskeletal pain at other anatomical sites on NSP, and to assess the effects of NSP on the health-related quality of life (HRQOL). Specifically, we dichotomized the EQ-5D levels into ‘no problems’ (i.e., level 1) and ‘problems’ (i.e., levels 2 and 3), and changed the health profiles in the participants into frequencies of reported problems to reveal which dimensions were associated with NSP. Then, the EQ-5D index and EQ-VAS were also computed for the statistical analysis. To identify the factors associated with NSP, a multivariate logistic regression analysis was also performed with comparably associated factors ($p < 0.2$)
identified in the results of a univariate analysis, in addition to the important confounders of age and gender, which were always included, and prevalence odds ratios (ORs) with 95% confidence intervals (95% CI) were calculated. All statistical analyses were conducted using the IBM SPSS Statistics 19 software program (IBM Japan, Ltd, Tokyo, Japan). The level of significance was set at \( p < 0.05 \).

Results

The prevalence of NSP was 48.3% (417 of 863), and NSP was more common in females (males: 26.1% vs. females: 73.9%, \( p < 0.001 \)). Interestingly, the participants with NSP (NSP+) were younger than those without NSP (NSP-) (NSP+: 61.0 y.o. ± 11.9 vs. NSP-: 64.9 y.o. ± 10.9, \( p < 0.001 \)). No correlations were found between the presence of NSP and other medical diseases (Table 1). In the different generations, the prevalence of NSP was 64.7% (11 of 17), 58.6% (51 of 87), 55.7% (112 of 201), 45.9% (118 of 257), 42.6% (106 of 249) and 36.5% (19 of 52) among the participants in their 20’s and 30’s, 40’s, 50’s, 60’s, 70’s and 80’s, respectively (Fig. 2). The results showed that the highest prevalence was observed in the participants 30 years of age and younger, while over half of the middle-aged participants still complained of NSP. Thereafter, the prevalence of NSP decreased with age (\( p = 0.003 \)).
With respect to other sites of pain, NSP was associated with musculoskeletal pain in
the shoulder joint (NSP+: 40.8% vs. NSP-: 20.0%, p < 0.001), elbow (NSP+: 10.6% vs.
NSP-: 5.6%, p < 0.01), wrist (NSP+: 7.9% vs. NSP-: 1.8%, p < 0.001), hand (NSP+:
10.1% vs. NSP-: 2.5%, p < 0.001), back (NSP+: 8.4% vs. NSP-: 2.0%, P < 0.001) and
lumbar region (NSP+: 46.5% vs. NSP-:29.8%, P < 0.001), whereas pain in the lower
extremities (hips, knees, ankles and feet) showed no statistically significant association
(Table 1).

All of the 863 participants responded to the EuroQol questionnaire. Figure 3 shows
the distribution of EQ-5D states among the participants with and without NSP in the
general population. Notably, the participants with NSP reported more problems in four
dimensions (self-care, usual activity, pain/discomfort and anxiety/depression), although
the dimension of “mobility” was equally impaired among the groups. Specifically,
“pain/discomfort” was most closely associated with NSP (p = 0.0002), and the presence
of NSP also had an impact on “self-care” (p = 0.0019), “usual activity” (p = 0.016) and
“anxiety/depression” (p = 0.002). Furthermore, the presence of NSP was related to
unsound EuroQol scores on both the EQ-5D index (p < 0.001) and in the EQ-VAS
portions (p < 0.01) (Table 1): the EQ-5D index (mean ± SD) was 0.800 ± 0.209 and 0.881
± 0.193; the EQ-VAS was 68.0 ± 17.9 and 71.6 ± 17.8 in the participants with and without
A multivariate logistic regression analysis showed that female gender and pain in the shoulder joint, elbow, wrist, hand, back and lumbar region were significantly associated with NSP. On the other hand, age was not significantly associated with NSP (Table 2).

Discussion

Generally, the causes of NSP are multifactorial, which makes it difficult to provide a diagnosis and treatment for the condition. In the previous papers, several pathologies of NSP have been reported, including discogenic pain [13], higher contractility of muscle fibers under physiological sympathetic activation [14], scapulothoracic bursitis [15] and sagittal spinal malalignment [16]. Moreover, the definition of NSP is still being debated, and it has been inconsistent in the previous reports. To collect unified data about NSP in different regions and countries, it is very important to define a general concept.

Additionally, such a concept should be easy to understand and should make it easy to recognize the anatomical area of NSP. Therefore, we used the general concept defined by Takagishi et al. [9, 10] to more accurately recruit and assess participants with NSP. In terms of the localization of NSP, the superior portion of the trapezius muscle should be considered to be the essential region involved in NSP, as shown in Fig. 1. Recent studies
have demonstrated a lack of a sufficient muscle-pump function in the trapezius muscle [17], an insufficient muscle blood flow and oxygenation in the trapezius muscle during psychophysiological stress and repetitive work [18] and a lower pain threshold in the upper region of the trapezius muscle [19]. These findings may suggest that the trapezius muscle plays a crucial role in the pathogenesis of NSP.

To date, the presence of neck and shoulder pain (NSP) has been well documented among various types of workers [1, 20, 21]. For instance, some researchers have investigated the prevalence of NSP among nursing staff members [20, 21]. Yabuki et al. [20] reported that the rate of NSP was 71%, and Iizuka et al. [21] also revealed a similar prevalence (68.1%). However, there is a little information available regarding the epidemiology and characteristics of NSP in the general population. Yokogushi et al. [22] reported that the prevalence of NSP was 83.4% (females: 77.6%; males: 87.5%).

Hogg-Johnson et al. [23] reviewed previous studies and examined the prevalence of NSP for the past one month in the general population. In that study, the rates of NSP ranged from 15.4% to 45.3%. The present study showed a somewhat similar prevalence to these previous studies (48.3% overall), and NSP was more common in females. These results suggest that the studies in the general population have shown large variations in the prevalence of NSP. The underlying reason for these variations is that few studies have
uniformly defined the clinical condition and the anatomical area of NSP. In addition, there
have been differences in the age groups, industry/occupation and race of the participants.
To solve this problem, we used a concept based on the report by Takagishi et al. [9, 10].
To our knowledge, the present study is the first report to clearly demonstrate and apply
this general concept and the anatomical area of NSP to the general population survey.

Some researchers have reported that the prevalence of NSP peaks during middle-age
and declines later in life [1, 23]. Our study showed that the age of peak prevalence of NSP
was in the 30’s and younger, while over half of participants in their 40’s and 50’s also
experienced NSP. Similarly, Rekola et al. [24] documented that the peak prevalence of
NSP coincides with young and middle-aged groups, peaking at ages 35 to 44. Moreover,
the prevalence of NSP declined as the participants grew older in our study. The reason for
this finding may be that NSP is associated with occupational strain [24], but not
age-related degenerative conditions [6]. Therefore, NSP is the most common
musculoskeletal complaint for the younger group in the prime of life, whereas NSP
decreases among the older group with other, more significant, health concerns.

A gender difference in the prevalence of NSP is one of the most significant features of
this condition. As previously reported, NSP is more prevalent among females, in both the
general population and in workers [1, 3, 23]. Using a logistic regression analysis, we
confirmed that gender was independently associated with NSP, thus indicating that there
is a higher risk ratio in females compared to males (OR = 2.46). Recent studies have
shown biological differences of the trapezius muscle between males and females. For
example, Elcadi et al. [25] reported gender differences in the oxygen saturation level in
the trapezius muscle. Binderup et al. [19] indicated that the pressure and pain thresholds
of the trapezius muscle are lower in females. Interestingly, it has also been reported that
females feel more stress and have more concerns than males [5], and this mental stress
has negative effects on the hemoglobin dynamics in the trapezius muscle among females
[18]. Although the issue of the gender difference is still controversial, both the
psychosocial and biological differences between males and females may affect the
occurrence of NSP. Thus, the gender differences may be a common risk factor for the
development of NSP in both Western countries and Japan.

A relationship between NSP and back pain has been reported in a previous study [26],
however, there is little information regarding any correlations between NSP and other
anatomical sites of pain. We performed a logistic regression analysis and revealed that
pain in the upper extremities was an independent factor associated with NSP, whereas we
found no correlations between NSP and pain in the lower extremities. Repetitive hand and
arm movement may be an important component of everyday occupational and
recreational activities [27], and such excessive movements may lead to the development of muscle fatigue and pain in the upper extremities, neck and shoulder blade (e.g., trapezius muscle) [28, 29]. This may suggest that the relationship between NSP and the pain in the upper extremities is caused by repetitive daily activities.

Some studies have reported an association between NSP and the health-related quality of life (HRQOL) in clinical populations using self-reported questionnaires, such as the SF-36 [30]. In the present study, we measured the HRQOL using the EQ-5D in the participants with and without NSP, because the EQ-5D is a rapid and simple method to evaluate not only five general health profiles (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) but also the effects on the EQ-5D index, which has been standardized and validated [12]. The EQ-5D index has been widely used to measure the HRQOL among various patients (e.g., those with anterior cruciate ligament (ACL) injury [31], osteoarthritis of the knee [32] and rheumatoid cervical spine [33]). For example, the mean EQ-5D score was 0.77 ± 0.22 among the patients with ACL injury. Although the EQ-5D score of the overall health status associated with NSP in this study was relatively preserved compared to patients with such orthopedic diseases, the mean score was significantly lower among the participants with NSP than in those without NSP. This result suggests that the presence of NSP may be related to a lower HRQOL.
Next, we specifically assessed the general health profiles of the EQ-5D to clarify how NSP negatively affected the activities of daily life and the mental status in the general residents. The participants with NSP reported more problems in four dimensions (self-care, usual activity, pain/discomfort and anxiety/depression), with only the dimension of “mobility” being equally impaired between the two groups. One of the reasons may be the association between NSP and pain in the upper extremities, as mentioned above. Therefore, they may experience some difficulty in washing/dressing themselves (i.e., self-care), their work, study, housework and leisure activities (i.e., usual activities) which demand repetitive arm movements and the postural control of their shoulder blades. The present study also revealed that the presence of NSP was associated with “anxiety/depression”. Previously, poor psychological health has been identified to be both a risk factor for and a factor associated with neck pain, and the patients with NSP had an inferior physical and mental status [34]. Additionally, Ektor-Anderson et al. [35] reported that the level of self-experienced health decreases in association with increasing pain in the shoulder and neck area. Thus, NSP may also negatively affect the mental health of subjects, and vice versa.

There were several possible limitations associated with this study. First, it may contain some bias, such as that due to industry, and the proportion of participants of each
gender and age, because this study was a cross-sectional study performed in a confined geographical area in a mountain village. This may have underestimated the number of elderly participants with NSP. Second, some participants with an orthopedic disease, such as cervical spondylotic radiculopathy (CSR), may not have been excluded. It has been reported that pain in the neck or scapular regions is generally the initial symptom of CSR [35]. Therefore, we might have overlooked the patients with CSR during the medical interview. Third, we cannot comment on the causality between NSP and the associated factors clarified in this study because of the cross-sectional study design. Our research should be continued longitudinally, and further studies in urban areas should be conducted in the future. Nevertheless, the present study could give the meaningful information about NSP as the population survey included healthy residents who were not being treated as outpatients. Moreover, the characteristics of NSP clarified in this study may also provide a basis for the prevention and the effective management of NSP.

Conclusions

In this study, we used a general concept of NSP, which thus allowed us to adequately interview the residents regarding whether or not they had experienced NSP. We investigated the characteristics of this definition of NSP and the associated factors
(gender, pain in the upper extremities and back/lumbar pain). The results showed that female gender and pain in the upper extremities were independently associated with NSP. This study confirmed that NSP is a prevalent health problem that deteriorates the HRQOL in the general population.


http://www.mhlw.go.jp/toukei/saikin/hw/k-tyosa/k-tyosa10


Figure 1. The defined area of NSP. A schematic drawing shows the localization of NSP.
This figure was modified with permission from Shinozaki et al. [11].
Figure 2. The incidence of NSP in each age group. The highest incidence was observed in the participants in their 20’s and 30’s (Kruskal-Wallis test, p = 0.003). Thereafter, the incidence of NSP decreased with age.
**Figure 3.** The distribution of the EQ-5D scores in the general population. The participants with NSP reported more problems in four dimensions: self-care, usual activity, pain/discomfort and anxiety/depression (Fisher’s exact probability test, *p < 0.05 and **p < 0.01).
### Table 1. The results of the univariate analysis

<table>
<thead>
<tr>
<th></th>
<th>Overall (n = 863)</th>
<th>NSP+ (n = 417)</th>
<th>NSP- (n = 446)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (yrs)</strong></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>63.5±11.4(^a)</td>
<td>61.0±11.9(^a)</td>
<td>64.9±10.9(^a)</td>
<td><strong>p &lt; 0.001</strong></td>
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<tr>
<td><strong>Sex</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>308 (35.7)</td>
<td>109 (26.1)</td>
<td>199 (44.6)</td>
<td><strong>p &lt; 0.001</strong></td>
</tr>
<tr>
<td>Female</td>
<td>555 (64.3)</td>
<td>308 (73.9)</td>
<td>247 (55.4)</td>
<td></td>
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<tr>
<td><strong>Medical disease</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>53 (6.1)</td>
<td>31 (7.4)</td>
<td>22 (4.9)</td>
<td>0.16***</td>
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<tr>
<td>Hypertension</td>
<td>261 (30.0)</td>
<td>122 (29.3)</td>
<td>139 (31.2)</td>
<td>0.55***</td>
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<td>Hyperlipidemia</td>
<td>87 (10.1)</td>
<td>48 (11.5)</td>
<td>39 (8.7)</td>
<td>0.21***</td>
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<tr>
<td>Cardiac disease</td>
<td>67 (7.8)</td>
<td>33 (7.9)</td>
<td>34 (7.6)</td>
<td>0.90***</td>
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<td>Arrhythmia</td>
<td>52 (6.0)</td>
<td>27 (6.5)</td>
<td>25 (5.6)</td>
<td>0.67***</td>
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<tr>
<td>Stroke</td>
<td>35 (4.1)</td>
<td>18 (4.3)</td>
<td>17 (3.8)</td>
<td>0.73***</td>
</tr>
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<td>Renal disease</td>
<td>7 (0.8)</td>
<td>4 (1.0)</td>
<td>3 (0.7)</td>
<td>0.72***</td>
</tr>
<tr>
<td>Liver disease</td>
<td>22 (2.5)</td>
<td>7 (1.7)</td>
<td>15 (3.4)</td>
<td>0.13***</td>
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<tr>
<td><strong>Other sites of pain</strong></td>
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<td></td>
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<tr>
<td>Shoulder</td>
<td>259 (30.0)</td>
<td>170 (40.8)</td>
<td>89 (20.0)</td>
<td><strong>p &lt; 0.001</strong></td>
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<tr>
<td>Elbow</td>
<td>69 (8.0)</td>
<td>44 (10.6)</td>
<td>25 (5.6)</td>
<td><strong>0.008</strong></td>
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<tr>
<td>Wrist</td>
<td>41 (4.8)</td>
<td>33 (7.9)</td>
<td>8 (1.8)</td>
<td><strong>p &lt; 0.001</strong></td>
</tr>
<tr>
<td>Hand</td>
<td>53 (6.1)</td>
<td>42 (10.1)</td>
<td>11 (2.5)</td>
<td><strong>p &lt; 0.001</strong></td>
</tr>
<tr>
<td>Back</td>
<td>44 (5.1)</td>
<td>35 (8.4)</td>
<td>9 (2.0)</td>
<td><strong>p &lt; 0.001</strong></td>
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<tr>
<td>Lumbar region</td>
<td>327 (37.9)</td>
<td>194 (46.5)</td>
<td>133 (29.8)</td>
<td><strong>p &lt; 0.001</strong></td>
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<tr>
<td>Hip</td>
<td>100 (11.6)</td>
<td>53 (12.7)</td>
<td>47 (10.6)</td>
<td>0.34**</td>
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<tr>
<td>Knee</td>
<td>254 (29.4)</td>
<td>133 (31.9)</td>
<td>121 (27.1)</td>
<td>0.14**</td>
</tr>
<tr>
<td>Ankle</td>
<td>40 (4.6)</td>
<td>22 (5.3)</td>
<td>18 (4.0)</td>
<td>0.42**</td>
</tr>
<tr>
<td>Foot</td>
<td>32 (3.7)</td>
<td>15 (3.6)</td>
<td>17 (3.8)</td>
<td>0.99**</td>
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<td><strong>EuroQol</strong></td>
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<td>EQ-5D</td>
<td>0.842±0.205(^a)</td>
<td>0.800±0.209(^a)</td>
<td>0.881±0.193(^a)</td>
<td><strong>p &lt; 0.001</strong></td>
</tr>
<tr>
<td>VAS</td>
<td>69.8±17.9(^a)</td>
<td>68.0±17.9(^a)</td>
<td>71.6±17.8(^a)</td>
<td><strong>p &lt; 0.01</strong></td>
</tr>
</tbody>
</table>

NSP: neck and shoulder pain

\(^a\) Mean±SD

* p by Student’s t-test, ** chi-squared test, *** Fisher’s exact probability test
Table 2. The results of the multivariate analysis

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
<th>p-value</th>
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<tbody>
<tr>
<td>Age</td>
<td>0.98</td>
<td>0.96-0.99</td>
<td>N.S.</td>
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<tr>
<td>Gender</td>
<td>2.36</td>
<td>1.72-3.24</td>
<td>p &lt; 0.01</td>
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<tr>
<td>Shoulder pain</td>
<td>2.82</td>
<td>2.03-3.92</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Elbow pain</td>
<td>1.94</td>
<td>1.09-3.44</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Wrist pain</td>
<td>2.67</td>
<td>1.14-6.24</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Hand pain</td>
<td>2.8</td>
<td>1.35-5.83</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Back pain</td>
<td>3.33</td>
<td>1.50-7.42</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Lumbar pain</td>
<td>1.98</td>
<td>1.45-2.68</td>
<td>p &lt; 0.01</td>
</tr>
</tbody>
</table>

OR = odds ratio; 95% CI = confidence interval at 95%; N.S. = not significant