A Shoulder Health Survey: Correlating Behaviors and Comorbidities With Shoulder Problems

Steven Kane, MD,*† Sean Conus, MD,‡ Douglas Haltom, MD,‡ Kurt Hirshorn, MD, MPH,† Youngju Pak, PhD,‡ and Jonathan Vigdorchik, MD‡

Shoulder pain and loss of shoulder function are common complaints reported by a variety of patients. This article suggests that shoulder pain and loss of function are directly proportional to lifestyle choices, including smoking and obesity. To investigate possible relationships between lifestyle choices and shoulder health, the authors conducted an online survey combining the Oxford Shoulder Questionnaire, the Shoulder Rating Questionnaire, and the Subjective Shoulder Rating System. Data were collected from 166 respondents. Statistical significance was set at \( P < .05 \). The data show a statistically significant correlation between decreased shoulder function and cigarette smoking and a similar correlation between decreased shoulder function, elevated cholesterol, and obesity.

**Keywords:** shoulder; pain; smoking; alcohol

**Materials and Methods**

**Hypothesis**

A direct relationship exists among negative lifestyle choices, shoulder pain, and loss of function.

**Shoulder Questionnaire**

The survey combined 3 previously used and validated patient-response shoulder surveys: the Oxford Shoulder Questionnaire, the Shoulder Rating Questionnaire, and the Subjective Shoulder Rating System. These surveys, along with others that were considered, provide a subjective assessment of shoulder function. The current survey also collected information regarding perceived active range of motion (using picture examples for guidance, as seen in Figure 1) as well as epidemiologic information, such as age, gender, race, and hand dominance. Tobacco and alcohol habits were registered, as were the participant’s current level of activity, workout habits, past and present involvement in a variety of sports, occupation, and any current medical conditions. Previous shoulder injuries and shoulder surgeries were also noted (Figure 2).

**Study Population**

The voluntary survey was administered online and made available to random visitors to the 2 institutions’ respective Websites. Data were collected between 2007 and 2008. Participants elected to follow the provided link and answer the survey questions. In sum, 166 surveys were collected, and the usable results were analyzed by a biostatistician.

**Statistical Analysis**

For dichotomous explanatory variables, a 2-sample \( t \) test was used to test for significant differences in 3 outcome vari-
53. Indicate the maximum motion you are able to achieve with the indicated arm.

Figure 1. Picture guide for shoulder range of motion.

A

1. Age
   - 10 - 15
   - 16 - 20
   - 21 - 30
   - 31 - 40
   - 41 - 50
   - 51 - 60
   - 61 - 70
   - Greater than 80

2. Gender
   - Male
   - Female

3. Hand dominance
   - Right
   - Left

4. If you have any shoulder problems at all, which side is problematic?
   - Right
   - Left
   - Both
   - Not Applicable

5. Do you smoke?
   - Yes
   - No

6. If you smoke, how many packs per day?
   - Not applicable
   - 0 - 1
   - Greater than 1, less than 2
   - Greater than 2, less than 3
   - Greater than 3

   How long have you smoked?
   - 0 - 1 year
   - 1 - 2 years
   - 2 - 5 years
   - 5 - 10 years
   - 10 - 15 years
   - Greater than 15 years

7. Did you play or do you play?
   - Little league football
   - Junior or intermediate school football
   - High school football
   - College football
   - Not applicable

8. What kind of work have you primarily done in your life?
   - Sedentary (no lifting or occasional lifting of light objects)
   - Active (frequent lifting of heavy objects)
   - Normal (occasional lifting of light to moderately heavy objects)
   - Strenuous (constant lifting of heavy objects)
   - Moderately active (occasional lifting of heavy objects)

9. Do you workout with upper body weights?
   - Never
   - Once a week
   - Twice a week
   - Three times a week
   - More than three times per week

10. Have you ever sustained a shoulder injury that prevented you from working or participating in activities of daily living or recreation?
    - Yes
    - No

Figure 2. A, survey questions, 1-10; B, survey questions, 11-18; C, shoulder pain–related questions.
11. Have you ever had shoulder surgery?
   - Yes  
   - No
   Reason for surgery:
   - Dislocation  
   - Stiffness  
   - Unknown  
   - Rotator cuff tear  
   - Shoulder replacement  
   Other: ________________

12. Do you drink alcoholic beverages?
   - Yes  
   - No

13. How much alcohol do you drink per week?
   - bottles of beer: None  
   - 1-2  
   - 3-5  
   - Greater than 5
   - mixed drinks: None  
   - 1-2  
   - 3-5  
   - Greater than 5
   - glasses of wine: None  
   - 1-2  
   - 3-5  
   - Greater than 5

14. Nationality or race:
   - White Caucasian  
   - Asian  
   - Pacific Islander  
   - African American  
   - American Indian  
   - Middle Eastern  
   - Hispanic  
   - Indian  
   - Other: ________________

15. Do you or have you regularly participated in any of the following athletics or sports (at least once per week for a period of 1 year)?
   - Football  
   - Archery  
   - Tennis  
   - Volleyball  
   - Swimming  
   - Cricket  
   - Boxing  
   - Golf  
   - Martial Arts  
   - Rowing  
   - Skiing/Snowboard  
   - Softball  
   - Rugby  
   - Gymnastics  
   - Fencing  
   - Weightlifting  
   - Basketball  
   - Baseball  
   - Diving  
   - Not applicable  
   - Track & Field throwing events (javelin, discus, shot-put)  
   - Other: ________________

16. If you participated in Football, Baseball, or Fast pitch softball, were you a:
   - Pitcher  
   - Quarterback  
   - Lineman  
   - Linebacker  
   - Not Applicable  

17. You are currently employed or worked more than 10 years as a:
   - Dockworker  
   - Carpenter  
   - Plumber  
   - Construction  
   - Landscaping  
   - Marine  
   - Teaching  
   - Research  
   - Secretarial  
   - Administrative  
   - Professional (MD, PhD, etc)  
   - Sales  
   - Janitorial  
   - Truck Driver  
   - Police  
   - Pilot  
   - Computer/Information Svcs  
   - Housewife, Househusband  
   - Other: ________________

18. Do you suffer from any of the following medical conditions?
   - High blood pressure  
   - Elevated cholesterol  
   - Heart disease  
   - Lung disease  
   - Kidney disease  
   - Peripheral vascular disease  
   - Diabetes requiring insulin  
   - Diabetes not requiring insulin  
   - Parkinson’s disease  
   - Rheumatoid Arthritis  
   - Liver Disease  
   - Cancer  
   - Obesity  
   - Not applicable  
   - Other: ________________

19. How would you describe the worst pain from your shoulder?
   - Unbearable  
   - Severe  
   - Moderate  
   - Mild  
   - None

31. During the past month, how would you describe the usual pain in your shoulder at rest?
   - Very Severe  
   - Severe  
   - Moderate  
   - Mild  
   - None

34. During the past month, how often have you had severe pain in your shoulder?
   - Every day  
   - Several days per week  
   - One day per week  
   - Less than one day per week  
   - Never

Figure 2. (continued)
able; Shoulder Rating Questionnaire, Oxford Shoulder Questionnaire, and Subjective Shoulder Rating System, separately. Equal or unequal variance between 2 groups was assumed on the basis of an $F$ test and applied to a 2-sample $t$ test. For explanatory variables with more than 2 categories, a 1-way analysis of variance was used. When significant differences in each outcome variable were found among multiple groups (such as work pattern and problematic side of shoulder), then multiple pairwise comparisons of means were performed on the basis of the Tukey-Kramer multiple-test procedure. A nominal significance level was set as .05 for all tests, and analyses were conducted using SAS 9.1.

Data Collection

There were 5 outcome variables, as listed in Table 1. The scores for the maximum possible motions of the left shoulder and right shoulder (MPML and MPMR) in Table 1 were the sum of the maximum abduction, forward flexion, internal rotation, and external rotation scores (point scale of 1-4, with a higher score indicating more motion).

In addition, 12 explanatory variables with 2 subquestionnaires were considered—namely, age, gender, hand domain, problematic side (shoulder), smoking (packs per day), work pattern, regular upper body workout, shoulder injury, shoulder surgery, drinking (drinks per week), race, and medical conditions (including hypertension, hypercholesterolemia, and obesity). Questions related to shoulder pain were found in responses 19-22 and 31-34, with a 5-point analogue scale (1-5, with no pain being a response of 5).

RESULTS

Subjective Shoulder Rating System

In a comparison of the Subjective Shoulder Rating System data and other variables, a statistically significant difference was associated with several groups of responses. Associations of note included the relationship between smoking, elevated cholesterol, and obesity with shoulder dysfunction (Table 2). Smokers (n, 30) had a mean Subjective Shoulder Rating System score of 68.43 compared with nonsmokers (n, 135) with a mean score of 78.70 ($P = .005$) (Figure 3). Participants with known elevated cholesterol levels (n, 32) had a mean score of 71.06, compared with 78.21 in those without elevated cholesterol (n, 131) ($P = .049$). In addition, obese patients (n, 18) had a mean score of 66.55 versus nonobese patients (n, 145), who had a mean score of 78.08 ($P = .011$) (Figure 4). The validity of the questionnaire was supported by significantly lower shoulder function scores in individuals claiming previous shoulder injury or shoulder surgery, compared with those reporting no such injury or surgery: Interestingly enough, left-handed individuals (n, 22) had a significantly decreased mean score (66.96) compared with right-handed individuals (78.43; n, 127) ($P = .007$). Finally, of individuals who reported drinking mixed alcoholic drinks, the mean score of those drinking more than 2 drinks per week (n, 10) was significantly lower than that of those drinking 1 to 2 drinks per week (n, 26): 61.7 versus 83.5, respectively ($P = .014$). Of note, no difference existed between reported drinkers and nondrinkers.

Shoulder Rating Questionnaire

As with the Subjective Shoulder Rating System, those with shoulder injury or surgery showed statistically significant relative decreases in score, thereby supporting the validity of the Shoulder Rating Questionnaire. As in the Subjective Shoulder Rating System, smokers (n, 30) had a significantly lower mean score (62.08) compared with right-handed individuals (78.43; n, 127) ($P = .007$) (Table 3). Furthermore, those undergoing a moderate workout pattern had higher scores than did those who are sedentary and those who undergo strenuous workouts ($P = .001$) (Table 3). Interestingly, those who stated that they drink alcohol in general (n, 90) had a significantly increased mean score (75.61), as compared with those who do not drink (68.08; n, 73) ($P = .012$). As with the Subjective Shoulder Rating System scores, the average Shoulder Rating Questionnaire score of those who drink 1...
Table 2. Association between Subjective Shoulder Rating System and explanatory variables (univariate, n < 166).

| Explanatory Variable                      | n  | Mean ± SD³ | P   |
|-------------------------------------------|----|------------|-----|
| Q3. Hand domain                           |    |            |     |
| Left                                      | 22 | 66.96 ± 20.83 | .007|
| Right                                     | 127| 78.43 ± 17.71 |     |
| Q4. Problematic side of shoulder           |    |            |     |
| Both                                      | 37 | 66.78 ± 19.13 | .01 |
| Left only                                 | 37 | 77.16 ± 17.57 |     |
| Right only                                | 63 | 76.90 ± 15.83 |     |
| Multiple pairwise comparisons⁶             |    |            |     |
| Left only–both                            |    | (0.871, 19.885) |
| Right only–both                           |    | (1.625, 18.614) |
| Q5. Smoking                               |    |            |     |
| Yes                                       | 30 | 68.43 ± 20.68 | .005|
| No                                        | 133| 78.70 ± 17.38 |     |
| Q6. Packs per day                         |    |            |     |
| < 1                                       | 19 | 73.32 ± 21.37 | .089|
| 1-3                                       | 11 | 60.00 ± 17.19 |     |
| Q8. Work pattern                          |    |            |     |
| Strenuous                                 | 7  | 67.71 ± 19.69 | .093|
| Active                                    | 26 | 71.70 ± 17.01 |     |
| Moderate                                  | 33 | 80.00 ± 16.53 |     |
| Normal                                    | 57 | 82.83 ± 18.88 |     |
| Sedentary                                 | 30 | 76.42 ± 18.47 |     |
| Q10. Shoulder injury                      |    |            |     |
| Yes                                       | 56 | 72.93 ± 19.77 | .034|
| No                                        | 107| 78.84 ± 14.87 |     |
| Q11. Shoulder surgery                     |    |            |     |
| Yes                                       | 15 | 67.53 ± 14.72 | .04 |
| No                                        | 148| 77.75 ± 18.52 |     |
| Q12. Drinking                             |    |            |     |
| Yes                                       | 90 | 78.48 ± 15.34 | .22 |
| No                                        | 73 | 74.75 ± 21.53 |     |

(continued)
Table 2. (continued)

| Explanatory Variable        | n  | Mean ± SD | P     |
|-----------------------------|----|-----------|-------|
| Q13A. Bottles of beer per week |    |           |       |
| 1-2                         | 31 | 80.80 ± 13.93 | .17   |
| > 2                         | 26 | 75.00 ± 17.25 |       |
| Q13B. Number of mixed drinks |    |           |       |
| 1-2                         | 26 | 83.54 ± 12.64 | .014  |
| > 2                         | 10 | 61.70 ± 22.32 |       |
| Q13C. Glasses of wine per week |    |           |       |
| 1-2                         | 26 | 77.27 ± 16.37 | .12   |
| > 2                         | 16 | 68.13 ± 20.33 |       |
| Q18. Medical conditions     |    |           |       |
| High blood pressure         |    |           |       |
| Yes                         | 39 | 69.077 ± 22.509 | .23   |
| No                          | 127| 79.242 ± 16.266 |       |
| Elevated cholesterol        |    |           |       |
| Yes                         | 32 | 71.063 ± 20.837 | .049  |
| No                          | 131| 78.214 ± 17.560 |       |
| Obesity                     |    |           |       |
| Yes                         | 18 | 66.556 ± 20.004 | .011  |
| No                          | 145| 78.083 ± 17.860 |       |

*Estimated standard deviation.

to 2 drinks per week (n, 26) was significantly higher (79.56) than that of those who drink more than 2 drinks per week (59.30; n, 10) (P = .0016). Those with elevated cholesterol (n, 32) also had a lower mean score (66.37) than that of those without elevated cholesterol (73.65; n, 132) (P = .046). In addition, obese individuals (n, 18) had a lower average score (59.36) than that of non-obese individuals (72.82; n, 146) (P = .0016) (Figure 4). Of note, obesity was a subjective measure; that is, it was listed among possible medical conditions.

Oxford Shoulder Questionnaire

Whereas the previous 2 questionnaires used scores out of a possible 100 (higher scores being associated with increased shoulder function), the Oxford Shoulder Questionnaire has some noticeable differences. A lower score, for example, is associated with better shoulder function; possible scores range from 12 to 60 (best to worst). Shoulder injury and shoulder surgery were again associated with decreased shoulder function (increased score in this case) compared with those without injury or surgery (Table 4). Again, smokers (n, 30) reported significantly lower function (30.03) relative to those who do not smoke (24.40; n, 136) (P = .0042) (Figure 5). Moderately active individuals also had a lower mean score than that of participants with activity patterns on both ends of the activity spectrum (P = .0006). As in the other 2 questionnaires, those reporting elevated cholesterol (n, 32) had a significantly higher mean score (28.56) than that of those without elevated cholesterol (24.66; n, 131) (P = .044). Data from obese individuals (n, 18) showed statistical significance (P = .0044),
When compared with nonsmokers, cigarette smokers reported significantly lower active range of motion in both left and right shoulders (Tables 6 and 7). Survey responders who reported drinking alcoholic beverages in general had a greater active range of motion than did those who reported not drinking alcohol. There was also evidence of moderate exercise being associated with a greater range of motion, versus vigorous activity and lack of exercise; data were significant only for the left arm. Survey responders who reported a strenuous work pattern had less active range of motion than that of those who reported a moderate work pattern. This was significant for the left arm and it approached statistical significance in the right arm. Finally, those who reported shoulder surgery had a significantly lower active range of motion arc for the right arm; this decrease approached statistical significance for the left arm.

The nature of this study is prone to selection bias. Only those who looked at the Web sites and elected to participate were included. There was also no control group. Therefore, it is hard to draw conclusions about the type of person who was looking at the Web sites, but it would probably be unusual for a person with good shoulder function and no pain to spend his or her free time looking at sites that deal with shoulder pathology.

Perhaps the most interesting finding in this study is the significantly lower reported shoulder function in participants who smoked cigarettes relative to those who claimed not to smoke. That this correlation was statistically significant in each questionnaire, as well as in the questions regarding perceived active range of motion, suggests a quantifiable link between smoking and shoulder dysfunction and pain. Although the correlation between smoking and decreased shoulder function is interesting, causation cannot be determined. Kane et al found a strong trend between smoking and rotator cuff disease at the microscopic level. Although a strong association was found between smoking and shoulder dysfunction, no link could be made to reported pack-years of smoking.

The statistically significant association between shoulder dysfunction and elevated cholesterol in all 3 questionnaires (but not range-of-motion queries) is an interesting association. Although no causation can be assumed from these results, research may eventually find that the deleterious vascular effects produced by smoking, hypercholesterolemia, and obesity may adversely affect the shoulder.

It seems intuitive that moderate exercise was associated with the best shoulder function, compared with higher intensity exercise programs and none at all. Such a judgment remains somewhat subjective in terms of what defines a moderately active lifestyle, compared with a sedentary or strenuous

with a higher mean score (31.61) than that of nonobese individuals (24.66; n, 148) (Figure 6).

**Shoulder Pain**

Three of the shoulder pain–related questions revealed statistically significant differences between smokers and nonsmokers, with cigarette smokers reporting higher complaints of pain (Table 5). In question 19, a higher score is associated with more shoulder pain, whereas in questions 31 and 34, lower scores are associated with more pain (Figure 2C).
Table 3. Association between Shoulder Rating Questionnaire and explanatory variables (univariate, n < 164).

| Explanatory Variable          | n  | Mean ± SD | P    |
|-------------------------------|----|-----------|------|
| Q4. Problematic side of shoulder |    |           |      |
| Both                          | 37 | 66.69 ± 16.41 | .062 |
| Left only                     | 37 | 75.59 ± 17.10 |      |
| Right only                    | 63 | 68.60 ± 17.77 |      |
| Q5. Smoking                   |    |           |      |
| Yes                           | 30 | 62.08 ± 19.20 | .0008|
| No                            | 134| 74.50 ± 17.70 |      |
| Q6. Packs per day             |    |           |      |
| < 1                           | 19 | 65.02 ± 21.73 | .28  |
| 1-3                           | 11 | 57.00 ± 13.17 |      |
| Q8. Work pattern              |    |           |      |
| Strenuous                     | 7  | 60.90 ± 21.38 | .0001|
| Active                        | 26 | 60.51 ± 19.15 |      |
| Moderate                      | 33 | 78.13 ± 15.21 |      |
| Normal                        | 57 | 76.23 ± 15.86 |      |
| Sedentary                     | 30 | 76.42 ± 17.04 |      |
| Multiple pairwise comparisons  |    |           |      |
| Active–moderate               |    | (−29.80, −5.45)|    |
| Active–normal                 |    | (−26.70, −4.73)|    |
| Active–sedentary              |    | (−28.35, −3.47)|    |
| Q10. Shoulder injury          |    |           |      |
| Yes                           | 56 | 67.07 ± 18.10 | .01  |
| No                            | 108| 74.90 ± 18.30 |      |
| Q11. Shoulder surgery         |    |           |      |
| Yes                           | 15 | 55.34 ± 17.80 | .0002|
| No                            | 149| 74.00 ± 18.20 |      |
| Q12. Drinking                 |    |           |      |
| Yes                           | 90 | 75.61 ± 18.28 | .012 |
| No                            | 73 | 68.08 ± 20.97 |      |

(continued)
one. The link between moderate alcohol consumption and greater shoulder function is another reason for further study of the associations drawn from this survey. Note, however, that moderate daily alcohol intake has been shown to have a beneficial cardiovascular effect.8,12

The preceding findings raise many questions, and follow-up studies with greater participation will be necessary for validation. The data used in this study comprised 166 entries; a larger number will no doubt be necessary to confirm findings. Furthermore, of those entries, 134 came from Caucasian participants; a more heterogeneous population may shed some light on ties between shoulder dysfunction and race-related factors. As with any survey, it is difficult to draw a truly random population, but this is an important factor.

Inadequate population sampling and unintentional selection bias can skew the results. Last, specific causes of decreased shoulder function were never addressed. Further evaluation of dysfunctions may validate the correlations drawn from this survey.

### CONCLUSION

A statistically significant correlation between decreased shoulder function and cigarette smoking was found (relative to those who do not smoke), along with a similar correlation between decreased shoulder function and elevated cholesterol and obesity. Further in-depth study of these factors appears warranted.
Table 4. Association between Oxford score and explanatory variables (univariate, n < 166).

| Explanatory Variable          | n  | Mean ± SD | P      |
|-------------------------------|----|-----------|--------|
| Q4. Problematic shoulder      |    |           |        |
| Both                          | 37 | 28.51 ± 9.00 | .068   |
| Left only                     | 37 | 23.73 ± 6.96 | .12    |
| Right only                    | 63 | 27.05 ± 10.13|        |
| Q5. Smoking                   |    |           |        |
| Yes                           | 30 | 30.03 ± 9.55 | .0042  |
| No                            | 136| 24.40 ± 9.95|        |
| Q6. Packs per day             |    |           |        |
| < 1                           | 19 | 28.32 ± 10.1 |        |
| 1-3                           | 11 | 33.00 ± 7.38 | .22    |
| Q8. Work pattern              |    |           |        |
| Strenuous                     | 7  | 30.86 ± 6.74 | .0006  |
| Active                        | 26 | 30.00 ± 10.48|        |
| Moderate                      | 33 | 20.42 ± 5.85 |        |
| Normal                        | 57 | 24.16 ± 8.94 |        |
| Sedentary                     | 30 | 24.60 ± 9.95 |        |
| Multiple pairwise comparisonsb|    |           |        |
| Strenuous–moderate            |   | (0.320, 20.546)|    |
| Active–normal                 |   | (0.091, 11.594)|    |
| Active–moderate               |   | (3.203, 15.949)|    |
| Q10. Shoulder injury          |    |           |        |
| Yes                           | 56 | 28.25 ± 8.89 | .0077  |
| No                            | 110| 23.98 ± 10.00|        |
| Q11. Shoulder surgery         |    |           |        |
| Yes                           | 15 | 37.87 ± 6.36 | <.0001 |
| No                            | 151| 24.18 ± 9.26 |        |
| Q12. Drinking                 |    |           |        |
| Yes                           | 90 | 23.66 ± 8.52 | .014   |
| No                            | 76 | 27.50 ± 10.90|        |

(continued)
### Table 4. (continued)

| Explanatory Variable                      | n  | Mean ± SD* | P     |
|-------------------------------------------|----|------------|-------|
| Q13A. Bottles of beer per week            |    |            |       |
| 1-2                                       | 31 | 21.77 ± 6.83 | .04   |
| > 2                                       | 26 | 26.35 ± 9.35 |       |
| Q13B. Number of mixed drinks              |    |            |       |
| 1-2                                       | 26 | 22.73 ± 9.30 | .005  |
| > 2                                       | 10 | 33.20 ± 9.78 |       |
| Q13C. Glasses of wine per week            |    |            |       |
| 1-2                                       | 26 | 22.73 ± 7.45 | .0077 |
| > 2                                       | 16 | 30.56 ± 10.63 |      |
| Q18. Medical conditions                   |    |            |       |
| High blood pressure                       |    |            |       |
| Yes                                       | 39 | 27.05 ± 9.67 | .24   |
| No                                        | 127| 24.91 ± 9.88 |       |
| Elevated cholesterol                      |    |            |       |
| Yes                                       | 32 | 28.56 ± 10.85 | .044  |
| No                                        | 131| 24.66 ± 9.43 |       |
| Obesity                                   |    |            |       |
| Yes                                       | 18 | 31.61 ± 9.64 | .0044 |
| No                                        | 148| 24.66 ± 9.63 |       |

*Estimated standard deviation.

*Simultaneous 95% confidence intervals based on the Tukey-Kramer test procedure (significance level, .05).

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**Figure 5.** Oxford rating of shoulder dysfunction in smokers versus nonsmokers.

**Figure 6.** Oxford shoulder scores associated with different medical conditions.
### Table 5. Association between shoulder pain and smoking (yes/no, packs per day).

| Pain From Shoulder / Smoking | n  | Mean Rank | \( P^a \) |
|-----------------------------|----|-----------|-----------|
| Q19. Worst pain             |    |           |           |
| Yes, smoking                | 30 | 99.47     | .037      |
| No                          | 136| 79.98     |           |
| < 1 pack per day            | 19 | 15.18     | .89       |
| 1-3                         | 11 | 15.68     |           |
| Q31. Usual pain (recent)    |    |           |           |
| Yes, smoking                | 30 | 67.62     | .04       |
| No                          | 135| 86.42     |           |
| < 1 pack per day            | 19 | 16.48     | .43       |
| 1-3                         | 11 | 13.86     |           |
| Q34. Severe pain (recent)   |    |           |           |
| Yes, smoking                | 30 | 67.07     | .04       |
| No                          | 135| 86.54     |           |
| < 1 pack per day            | 19 | 15.95     | .72       |
| 1-3                         | 11 | 14.73     |           |

\( P \) values are based on the Wilcoxon 2-sample rank sum test (2-sided).

### Table 6. Association between maximum possible motions–left and explanatory variables (univariate, n < 136).

| Explanatory Variable       | n  | Mean ± SD\(^b\) | \( P \) |
|----------------------------|----|-----------------|--------|
| Q4. Problematic shoulder   |    |                 |        |
| Both                      | 31 | 10.48 ± 3.53    |        |
| Left only                  | 28 | 11.11 ± 2.86    | .017   |
| Right only                 | 54 | 12.31 ± 2.56    |        |
| Multiple pairwise comparisons\(^b\) |   |  (0.2642, 3.3977) |        |
| Q5. Smoking                |    |                 |        |
| Yes                       | 23 | 9.65 ± 4.41     | .024   |
| No                        | 113| 11.94 ± 2.80    |        |
| Q6. Packs per day          |    |                 |        |
| < 1                        | 14 | 10.57 ± 4.55    | .22    |
| 1-3                        | 9  | 8.22 ± 4.00     |        |

(continued)
Table 6. (continued)

| Explanatory Variable          | n  | Mean ± SD | P   |
|-------------------------------|----|-----------|-----|
| **Q8. Work pattern**          |    |           |     |
| Strenuous                     | 7  | 8.71 ± 4.03|     |
| Active                        | 21 | 10.24 ± 3.91|     |
| Moderate                      | 24 | 12.96 ± 1.68| .0004|
| Normal                        | 50 | 12.32 ± 2.03|     |
| Sedentary                     | 30 | 11.96 ± 3.17|     |
| **Multiple pairwise comparisons** | |           |     |
| Strenuous–moderate            |   | (−7.50, −0.99)|     |
| Strenuous–normal              |   | (−6.66, −0.55)|     |
| Strenuous–moderate            |   | (−6.48, −0.02)|     |
| Active–moderate               |   | (−4.99, −0.46)|     |
| Active–normal                 |   | (−4.05, −0.11)|     |
| **Q10. Shoulder injury**      |    |           |     |
| Yes                           | 50 | 11.32 ± 3.02| .53 |
| No                            | 86 | 11.69 ± 3.34|     |
| **Q11. Shoulder surgery**     |    |           |     |
| Yes                           | 12 | 9.33 ± 4.46| .089 |
| No                            | 124| 11.77 ± 3.01|     |
| **Q12. Drinking**             |    |           |     |
| Yes                           | 79 | 12.28 ± 2.22| .0043|
| No                            | 57 | 10.54 ± 4.04|     |
| **Q13A. Bottles of beer per week** | |           |     |
| 1-2                           | 26 | 12.77 ± 1.40| .10 |
| > 2                           | 21 | 11.48 ± 3.25|     |
| **Q13B. Number of mixed drinks** | |           |     |
| 1-2                           | 19 | 12.47 ± 2.32| .078 |
| > 2                           | 7  | 8.71 ± 4.64|     |
| **Q13C. Glasses of wine per week** | |           |     |
| 1-2                           | 22 | 12.18 ± 2.61| .13 |
| > 2                           | 13 | 10.54 ± 3.60|     |

(continued)
Table 6. (continued)

| Explanatory Variable | n   | Mean ± SD  | P    |
|----------------------|-----|------------|------|
| Q18. Medical conditions |    |            |      |
| High blood pressure | Yes | 30 | 10.40 ± 3.61 | .026 |
|                      | No  | 106 | 11.88 ± 3.04 |      |
| Elevated cholesterol | Yes | 28 | 10.07 ± 3.88 | .023 |
|                      | No  | 108 | 11.94 ± 2.93 |      |
| Obesity              | Yes | 15 | 10.53 ± 3.56 | .20  |
|                      | No  | 121 | 11.68 ± 3.17 |      |

*Estimated standard deviation.

bSimultaneous 95% confidence intervals based on the Tukey-Kramer test procedure (significance level, .05).

Table 7. Association between maximum possible motions–right and explanatory variables (univariate, n < 136).

| Explanatory Variable | n   | Mean ± SD  | P    |
|----------------------|-----|------------|------|
| Q4. Problematic shoulder |    |            |      |
| Both                 | 31  | 10.42 ± 3.50 |      |
| Left only            | 25  | 13.28 ± 1.43 | .0003|
| Right only           | 53  | 11.21 ± 2.38 |      |
| Multiple pairwise comparisons | | (0.5763, 3.5686) | |
| Left only–right only | (1.2031, 4.5182) | |
| Q5. Smoking          | Yes | 19 | 10.47 ± 4.10 | .024 |
|                      | No  | 114 | 11.63 ± 2.88 |      |
| Q6. Packs per day    | < 1 | 14 | 10.93 ± 4.18 | .42  |
|                      | 1-3 | 5  | 9.20 ± 3.56 |      |

(continued)
### Table 7. (continued)

| Explanatory Variable                  | n    | Mean ± SD² | P     |
|--------------------------------------|------|------------|-------|
| Q8. Work pattern                     |      |            |       |
| Strenuous                            | 4    | 11.25 ± 4.03 |      |
| Active                               | 20   | 10.25 ± 3.91 |      |
| Moderate                             | 28   | 12.29 ± 1.68 | .06   |
| Normal                               | 48   | 12.20 ± 2.03 |      |
| Sedentary                            | 24   | 11.50 ± 3.17 |      |
| Q10. Shoulder injury                 |      |            |       |
| Yes                                  | 48   | 11.56 ± 2.64 | .79   |
| No                                   | 85   | 11.41 ± 3.31 |      |
| Q11. Shoulder surgery                |      |            |       |
| Yes                                  | 12   | 8.92 ± 3.92  | .0023 |
| No                                   | 121  | 11.72 ± 2.88 |      |
| Q12. Drinking                        |      |            |       |
| Yes                                  | 74   | 12.20 ± 2.20 | .0032 |
| No                                   | 59   | 10.54 ± 3.72 |      |
| Q13A. Bottles of beer per week       |      |            |       |
| 1-2                                  | 26   | 12.04 ± 1.78 | .93   |
| > 2                                  | 20   | 12.10 ± 2.77 |      |
| Q13B. Number of mixed drinks         |      |            |       |
| 1-2                                  | 22   | 13.09 ± 1.44 | .24   |
| > 2                                  | 4    | 10.00 ± 4.24 |      |
| Q13C. Glasses of wine per week       |      |            |       |
| 1-2                                  | 19   | 12.00 ± 2.36 | .75   |
| > 2                                  | 13   | 11.70 ± 3.15 |      |
| Q18. Medical conditions              |      |            |       |
| High blood pressure                  |      |            |       |
| Yes                                  | 28   | 11.21 ± 3.25 | .63   |
| No                                   | 105  | 11.53 ± 3.04 |      |
| Elevated cholesterol                 |      |            |       |
| Yes                                  | 26   | 11.12 ± 3.13 | .52   |
| No                                   | 107  | 11.55 ± 3.07 |      |

(continued)
Table 7. (continued)

| Explanatory Variable | n  | Mean ± SD\(^a\) | P    |
|----------------------|----|----------------|------|
| Obesity              |    |                |      |
| Yes                  | 15 | 10.87 ± 3.18   | .43  |
| No                   | 118| 11.54 ± 3.07   |      |

\(^a\)Estimated standard deviation.

\(^b\)Simultaneous 95% confidence intervals based on the Tukey-Kramer test procedure (significance level, .05).

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