# Functional incapacity related to rotator cuff syndrome in workers. Is it influenced by social characteristics and medical management?

Romain Champagne, Julie Bodin, Natacha Fouquet, Yves Roquelaure, Audrey Petit

**Functional incapacity related to rotator cuff syndrome in workers. Is it influenced by social characteristics and medical management?**

Romain Champagne (MD)[a], Julie Bodin (PhD)[a], Natacha Fouquet (PhD)[a,b], Yves Roquelaure (MD, PhD)[a,c], Audrey Petit* (MD, PhD)[a,c]

[a]INSERM, U1085, IRSET, ESTER Team, University of Angers, F-49045 Angers, France

[b]Santé publique France, French national public health agency, Direction of Occupational Health, F-94415 Saint-Maurice, France

[c]University Hospital of Angers, Department of Occupational health, F-49933 Angers, France

*Corresponding author: Dr Audrey Petit

aupetit@chu-angers.fr

CHU Angers - Centre de consultations de pathologie professionnelle

4, rue Larrey 49933 Angers cedex 9, France

Tel: 0033 (0)2 41 35 49 81 - Fax: 0033 (0)2 47 35 34 48

1 **Functional incapacity related to rotator cuff syndrome in workers. Is it influenced by**

2 **sociodemographic characteristics and medical management?**

3

4 **ABSTRACT**

5 **Study design.** Survey.

6 **Introduction.** Rotator cuff syndrome (RCS) is one of the most common musculoskeletal

7 disorders (MSD) reported in workers. The functional incapacity related to RCS may vary

8 according to the sociodemographic context and to the medical management.

9 **Purpose of the study.** To analyze the RCS-related functional incapacity assessed by the

10 Disabilities of the Arm, Shoulder and Hand (DASH) questionnaires in workers according

11 their sociodemographic characteristics and the use of care.

12 **Methods.** A cross-sectional study carried out on a French sample of workers diagnosed with

13 RCS. The DASH and DASH-work scores were studied according to the sociodemographic

14 factors, to the musculoskeletal symptoms and to the RCS medical management during the

15 preceding 12-months.

16 **Results.** 207 workers who suffered from RCS filled out the questionnaire of which 80% were

17 still working. The DASH score was significantly higher in women (24.0 *versus* 17.4; $p<0.01$;

18 effect size (d) = 0.39), in patients over the age of 50 (23.6 *vs* 11.3; $p<0.005$) and in case of

19 another upper limb MSD ($p<0.0001$; $d\geq0.4$). The DASH and DASH-work scores were

20 significantly higher in case of use of care for RCS ($p<0.005$; $d>0.6$).

21 **Discussion.** The demographic factors and the RCS medical management influenced the

22 overall incapacity assessed by the DASH Questionnaire. Work incapacity was more

23 especially related to the use of care for RCS.

24    **Conclusion**. The sociodemographic and medical parameters added to other established

25    predictors could help guide clinicians in managing their patients.

26    **Keywords:** Rotator cuff syndrome, Functional incapacity, Workers, DASH questionnaire.

27    **Level of evidence:** Not applicable (descriptive survey).

28

29 **MANUSCRIT**

30 **1. Introduction**

31 Upper-extremity musculoskeletal disorders (UE-MSDs) are currently by far the most common

32 occupational pathology in developed countries.[1,2] The rotator cuff syndrome (RCS) is the

33 second most frequent location of UE-MSDs after the wrist/hand locations. Whether caused

34 and/or aggravated by working conditions, RCS is responsible for significant disability,

35 sickness absence, and high economic and health care burden. The socio-economic

36 consequences are numerous, both at the level of the individual and more generally at

37 company and society levels.[3] Moreover, the disability prognostic in workers with RCS is a

38 complex phenomenon which can be related with several domains including sociodemographic

39 factors, and medical characteristic and management.[4-7]

40 The assessment of functional incapacity and residual functional capacities of the upper limb

41 allows assessing the impact of RCS on quality of life as well as on daily life and occupational

42 activities; it also allows guiding RCS-related management. Only a few studies have

43 investigate prognostic factors for UE-MSDs.[6-8] Since early intervention produces better

44 results, it would be highly beneficial to promptly identify workers at risk of greater disability

45 and prolonged absence or work cessation, thus enabling targeted rehabilitation strategies.

46 Functional assessment included objective and subjective parameters. Among the 16

47 questionnaires aimed at assessing the functional capacities of the shoulder, the Disabilities of

48 the Arm, Shoulder and Hand Scale (DASH) is a relevant tool for evaluating subjective

49 shoulder disability of injured workers with UE-MSDs and can also be used as a simple

50 surveillance tool in an active working population.[8-14]

51 **2. Purpose of the study**

52  To provide a comprehensive overview of the current increased number of UE-MSDs in

53  relation to work, the French National Public Health Agency (*Santé publique France*) has

54  developed an experimental network for the epidemiological surveillance of UE-MSDs in a

55  French region.[15] The aim of the study was to describe and analyze the scores obtained with

56  the DASH questionnaire according to the sociodemographic, and medical characteristics and

57  management of workers diagnosed with a RCS.

58  **3. Methods**

59  3.1. The studied population

60  Between 2002 and 2005, 83 occupational physicians (OPs) from a French region were

61  volunteered to participate in a sentinel network for the surveillance of MSDs;[15] each of them

62  randomly included 1 to 112 workers during the inclusion period (3 years). In order to be

63  included, a worker had to be aged between 20 and 59, work in a private or public company

64  located in our region, regardless of the type of employment contract and whether they

65  suffered from MSD or not, and had to give consent. The workers filled out a self-administered

66  questionnaire that assessed various sociodemographic, medical and occupational

67  characteristics. A clinical examination was performed by the OPs, which could diagnose the

68  main UE-MSDs including RCS, according to the clinical examination protocol of the

69  European SALTSA consensus.[16] That led to the diagnosis of RCS in 274 of the 3,710 workers

70  (7.4 %) included in the study.

71  A follow-up self-questionnaire was sent and a follow-up medical of the workers initially

72  included was undertaken between 2007-2010. The questionnaire was divided into two parts:

73  1) a general part that assessed sociodemographic characteristics and musculoskeletal

74  symptoms through the Nordic questionnaire;[17,18] 2)a part specifically aimed at workers

75  suffering from a RCS at inclusion which included an assessment of the medical and surgical

76    treatment (including physician consultations, physiotherapy sessions and sick leave duration)

77    related to the RCS and an assessment of the functional incapacity of the upper limb using the

78    DASH questionnaires.

79    **3.2. Variables of interest**

80    3.2.1. Assessment tools

81    The DASH questionnaire is a self-administered questionnaire composed of 30 items,

82    supplemented by one optional module containing four items relating to the impact of UE-

83    MSDs at work (DASH-work questionnaire). This module is assessed separately from the first

84    30 items. Regarding the main questionnaire, at least 27 of 30 items must be completed in

85    order to calculate the score. The four items of the work-related module must be completed for

86    the calculation of the DASH-work score. Each item is graded according to a Likert scale (1:

87    no difficulty; 2: slight difficulty; 3: average difficulty; 4: great difficulty; 5: impossible). The

88    total calculated score ranges from 0 to 100; the higher the score, the greater the incapacity.[17]

89    For illustration purposes, the average DASH score for a general American population is

90    10.1/100.[18]

91    The Nordic questionnaire is a tool aimed at MSDs screening, created to answer the question:

92    "Do musculoskeletal troubles occur in a given population, and if so, in what parts of the body

93    are they localized?".[17] It is used in the study in the form of a self-administered questionnaire.

94    It includes closed questions aimed specifically at various areas affected by MSDs. A human

95    body is presented as a model divided into ten anatomical areas for which the symptoms

96    (stiffness, pain, discomfort, numbness) are evaluated systematically over a given period

97    (preceding 7-days or 12-months). The Nordic questionnaire is validated for the assessment of

98    shoulder MSDs.[20]

99    3.2.2. Risk factors

100 Regarding individual risk factors, age at follow-up was evaluated in three categories (under

101 40 years old; between 40 and 49; over 49 years old). This choice was made given that the

102 prevalence and disability of RCS increases significantly after the age of 40, and even more so

103 after the age of 50.[22] The follow-up body mass index (BMI) was evaluated in three categories:

104 underweight and normal weight (BMI < 25 kg/m$^2$), overweight (BMI between 25 and 30

105 kg/m$^2$), obesity (BMI ≥ 30 kg/m$^2$) according to the World Health Organization.

106 Regarding the medical management, evaluated aspects at follow-up were sick leaves,

107 physician consultations, physiotherapy sessions and surgery in relation with the RCS during

108 the preceding 12-months.

**3.3. Statistical analyses**

110 The DASH scores were evaluated on the basis of individual factors (age, gender, BMI), the

111 presence (or the absence) of MSDs of the upper limb and the spine (shoulders, elbows, hands,

112 fingers, neck, upper and lower back, hips) at follow-up, and the RCS medical management

113 during the preceding 12-months. The DASH scores were compared using parametric (Student

114 and ANOVA) and non-parametric (Wilcoxon and Kruskal-Wallis) tests with EpiInfo$^®$

115 software. The significance threshold was set at 0.05. Finally, the effect sizes (d) were

116 calculated when parametric tests were used and percentages of difference were calculated

117 when non-parametric tests were used.

118 Each subject provided informed written consent to participation in the study at baseline, and

119 the study received approval from France's National Committee for data Protection

120 (Commission Nationale de l'Informatique et des Libertés), first in 2001 and then again in

121 2006.

**4. Results**

122

123  Among the 274 workers diagnosed for a RCS during the first phase of the study (2002-2005),

124  207 filled out the questionnaire of the second phase of the study at follow-up between 2007

125  and 2010. The DASH score could be calculated for 190 of them. One hundred and sixty-two

126  workers reported shoulder's symptoms during the preceding 12-months (through the Nordic

127  questionnaire) and 167 were still working during the second questionnaire; the DASH-work

128  score could therefore be calculated for 154 workers (81.1%).

129  The population for which the DASH score could be calculated was formed of 55.3% of men.

130  The subjects were mainly over the age of 50 (57.9%). Slightly over half of the subjects were

131  overweight or obese (51.4 %). The averages of the DASH and DASH-work scores were 20.3

132  ± 16.6 and 20.5 ± 19.9 /100, respectively.

133  The DASH score was significantly higher in women than in men (24.0 *versus* 17.0; p=0.008).

134  The DASH score was significantly higher in subjects over the age of 40, and even higher in

135  those over 50, compared to those under the age of 40 (p=0.003). However, no significant

136  difference was found within the BMI categories. No significant difference was found for the

137  DASH-work score according to individual factors (Table I).

138  The workers who reported an upper limb MSD during the preceding 12-months had a

139  significantly higher DASH score, regardless of the anatomical affected area; this was not the

140  case for low back pain. Moreover, we observed a very significant difference in the DASH

141  score depending on whether the subjects did not show any shoulder symptom, showed

142  isolated shoulder symptoms or showed shoulder symptoms as well as a different other area of

143  the upper limb (p<0.0001) (Table II).

144  Finally, the DASH and DASH-work scores were significantly higher in workers who had

145  consulted a physician (p<0.001) or a physiotherapist (p<0.001), or who benefited from one or

146  several sick leaves (p<0.001) related to the shoulder symptoms during the previous 12-

147  months. By contrast, there was no significant difference for the DASH and DASH-work

148  scores depending on whether or not surgery had been performed on the shoulder (Tables III

149  and IV).

150  **5. Discussion**

151  The present study, carried out within a large population of workers highlights higher DASH

152  scores in women, in workers over the age of 40, those who suffered from upper limb MSDs

153  (regardless of its location) and those who had sought medical treatment in relation with the

154  RCS. However, the DASH score was not affected by overweight or any surgery performed on

155  the shoulder. The DASH-work score was only affected by medical management (excluding

156  surgery) related to the RCS, during the preceding 12-months.

157  The DASH-score averages observed in our population were overall lower than those observed

158  in other populations of workers suffering from MSDs.[8,23-25] This can be explained by the fact

159  that our population was recruited through occupational medicine and mainly consisted of still

160  working people at baseline. Conversely, the DASH and DASH-work scores observed in our

161  population were overall higher than in general populations of workers (not specifically

162  diagnosed with a MSD). This can be explained by the higher sensitivity of our diagnostic

163  methods for MSDs (through the SALTSA standardized clinical examination).[16,22]

164  A significantly higher DASH score in women (24.0 *versus* 17.4; p<0.01; d=0.39) confirms the

165  data found in the literature.[26,27] It could be explained by women's higher sensitivity to pain

166  and the fact that they report functional incapacity more readily than men do.[28] Another

167  hypothesis could be linked to the types of tasks performed depending on gender.[29]

168  Unsurprisingly, the study confirms the impact of age on the DASH score.[7]  Indeed, in our

169  study, the DASH score was twice as high for workers aged over 50 as for workers aged under

170    40 (23.6 *versus* 11.3; p<0.005). The physiological aging of tissue combined with cumulative

171    exposure to work constraints during the course of a career may explain this result. Moreover,

172    aging causes tissue to adapt and recover slower following physical efforts.[30] Our results do

173    not show a significant impact of BMI on the DASH scores. Indeed, it is more common to

174    observe overweightness having an impact on the pain and functional incapacity of the lower

175    limb and the lumbar spine.[31] Previous Studies showed above all, the impact of obesity on the

176    occurrence of MSDs as opposed to on the functional incapacity that is cause.[32,33] Finally, this

177    study did not allow measuring the impact of psychological factors on the DASH score.

178    However, literature shows that focusing on depression has a significant impact on the

179    variation of the DASH score, but its clinical relevance has not been established.[34,35]

180    Regarding the DASH-work score, no significant relation has been shown with individual risk

181    factors. This is undoubtedly explained by the purely work-related nature of the questions in

182    this module. Moreover, the subjects who were not still working at the time of the second

183    phase of the study were not taken into consideration for this score and yet, some of them

184    could have been excluded from work due to a serious functional incapacity of the shoulder or

185    retired on account of their age; these are conditions which are likely to influence the DASH-

186    work score, but which have not been measured here. Furthermore, the level of functional

187    incapacity felt by a worker can be decreased by using job retention measures (workstation

188    layout, transfer to a different department, etc.), which lead to a decrease of the DASH-work

189    score.[7] This specific module has been studied to a relatively small extent in the literature and

190    it could be more subjective than the rest of the DASH questionnaire on account of the

191    potential impact of working conditions perceived by the worker on functional incapacity at

192    work and therefore on the DASH-work score.[36]

193    The results of the Nordic questionnaire have demonstrated a significant higher DASH score

194    for workers suffering from MSDs that affects the upper limb and/or the upper back. This was

195    particularly true in case of upper limb disorder (26.0 *versus* 6.6; p<0.0001). The DASH

196    questionnaire is therefore a tool used for the overall assessment of the upper limb, sensitive,

197    but not exclusively specific to the shoulder.[10] One of the elements that could explain this

198    weak specificity could be the usual interdependence between neck pain and shoulder pain, as

199    well as the projection of neck pains onto the upper limb and conversely.[37] Nevertheless, the

200    DASH questionnaire remains a valid tool in the case of neck pain.[10,37] The projection of

201    referred pain of the upper limb probably also explains why we observe higher DASH scores

202    in the case of multiple MSDs of the upper limb.[22]

203    Our results highlight a significant increase in DASH and DASH-work scores for workers who

204    consulted a physician or a physiotherapist, or who were placed on sick leaves in relation with

205    shoulder's symptoms. This supports the hypothesis that workers who feel a greater functional

206    incapacity (measured by DASH and DASH-work scores) are also the ones who most often

207    seek medical treatment.[6] Workers who were on sick leave had the highest DASH and DASH-

208    work scores (40.5 *versus* 18.7; p<0.001 and 49.4 *versus* 19.1; p=0.001, respectively).

209    However, our results must be interpreted with caution on account of the small number of

210    subjects, and more especially for shoulder surgery.

211    Finally, the self-administered questionnaire, despite the sources of bias associated with it, is

212    undoubtedly the best approach in assessing perceived functional incapacity, which is therefore

213    subjective. This approach, used alongside an objective clinical assessment of physical

214    incapacity, is essential to the overall understanding of the impact of the RCS.

215    **6. Conclusions**

216    The study highlights the clinical relevance of DASH scores, including in case of multiple

217    disorders of the upper limb, and the use of these scores on a large sample of workers shows

218    the feasibility of using them as part of routine practice.[13,14,39] Our study confirms the impact

219     of sociodemographic and, medical characteristics and management on RCS-related functional

220     incapacity assessed by the DASH tool in workers. These results have clinical and research

221     implications since these parameters added to other established predictors could help predict

222     the functional incapacity degree and even could help predict stay at work in individuals with

223     UE-MDSs. Moreover, the DASH tool could potentially help guide clinicians in determining

224     early interventions for those patients.

225

229  **References**

230  1. Walker-Bone K, Palmer KT, Reading I, Coggon D, Cooper C. Prevalence and impact of

231  musculoskeletal disorders of the upper limb in the general population. Arthritis Rheum.

232  2004;51:642e651.

233  2. Huisstede BMA, Bierma-Zeinstra SMA, Koes BW, Verhaar JAN. Incidence and

234  prevalence of upper-extremity musculoskeletal disorders. A systematic appraisal of the

235  literature. BMC Musculoskelet Disord. 2006;7:7.

236  3. Kuijpers T, van der Windt DA, van der Heijden GJ, Bouter LM. Systematic review of

237  prognostic cohort studies on shoulder disorders. Pain. 2004 Jun;109(3):420-31.

238  4. Bhatia S, Piasecki DP, Nho SJ, et al. Early return to work in workers' compensation

239  patients     after     arthroscopic     full-thickness     rotator     cuff     repair.     Arthroscopy.

240  2010;26(8):1027e1034.

241  5. Desmeules F, Braën C, Lamontagne M, Dionne CE, Roy JS. Determinants and predictors

242  of   absenteeism   and   return-to-work   in   workers   with   shoulder   disorders.   Work.

243  2016;55(1):101e113.

244  6. Sandford FM, Sanders TAB, Lewis JS. Exploring experiences, barriers, and enablers to

245  home- and class-based exercise in rotator cuff tendinopathy: A qualitative study. J Hand Ther.

246  2017;30(2):193-199.

247  7. Raman J, Walton D, MacDermid JC, Athwal GS. Predictors of outcomes after rotator cuff

248  repair-A meta-analysis. J Hand Ther. 2017;30(3):276-292.

249  8. Armijo-Olivo S, Woodhouse LJ, Steenstra IA, Gross DP. Predictive value of the DASH

250  tool for predicting return to work of injured workers with musculoskeletal disorders of the

251  upper extremity. Occup Environ Med. 2016;73(12):807e815.

252    9. Bot SDM, Terwee CB, van der Windt D a. WM, Bouter LM, Dekker J, de Vet HCW.

253    Clinimetric evaluation of shoulder disability questionnaires: a systematic review of the

254    literature. Ann Rheum Dis. 2004;63(4):335–41.

255    10. Fan ZJ, Smith CK, Silverstein BA. Assessing validity of the QuickDASH and SF-12 as

256    surveillance tools among workers with neck or upper extremity musculoskeletal disorders. J

257    Hand Ther. 2008;21(4):354-65.

258    11. Desai AS, Dramis A, Hearnden AJ. Critical appraisal of subjective outcome measures

259    used in the assessment of shoulder disability. Ann R Coll Surg Engl. 2010 Jan;92(1):9–13.

260    12. Angst F, Schwyzer H-K, Aeschlimann A, Simmen BR, Goldhahn J. Measures of adult

261    shoulder function: Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH) and its

262    short version (QuickDASH), Shoulder Pain and Disability Index (SPADI), American

263    Shoulder and Elbow Surgeons (ASES) Society standardized shoulder assessment form,

264    Constant (Murley) Score (CS), Simple Shoulder Test (SST), Oxford Shoulder Score (OSS),

265    Shoulder Disability Questionnaire (SDQ), and Western Ontario Shoulder Instability Index

266    (WOSI). Arthritis Care Res (Hoboken). 2011;63 Suppl 11:S174–88.

267    13. Moshe S, Izhaki R, Chodick G, Segal N, Yagev Y, Finestone AS, Juven Y. Predictors of

268    return to work with upper limb disorders. Occup Med (Lond). 2015;65(7):564-9

269    14. Kennedy CA, Beaton DE. A user's survey of the clinical application and content validity

270    of the DASH (Disability of the Arm, Shoulder and Hand) outcome measure. J Hand Ther.

271    2017;30(1):30-40.

272    15. Ha C, Roquelaure Y, Leclerc A, Touranchet A, Goldberg M, Imbernon E. The French

273    Musculoskeletal Disorders Surveillance Program: Pays de la Loire network. Occup Environ

274    Med. 2009 Jul;66(7):471–9.

275     16. Sluiter JK, Rest KM, Frings-Dresen MH. Criteria document for evaluating the work-

276     relatedness of upper-extremity musculoskeletal disorders. Scand J Work Environ Health.

277     2001;27 Suppl 1:1–102.

278     17. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G, et al.

279     Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Appl

280     Ergon. 1987;18(3):233–7.

281     18. Hagberg M, Silverstein B, Wells R, Smith M, Hendrick H, Cararyon P, et al.

282     Identification, measurement and evaluation of risk. In: Work-Related Musculoskeletal

283     Disorders - A Manual for Prevention. Taylor & Francis; 1995. p. 139–212.

284     19. Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome

285     measure: the DASH (disabilities of the arm, shoulder and hand) [corrected]. The Upper

286     Extremity Collaborative Group (UECG). Am J Ind Med. 1996;29(6):602–8.

287     20. Hunsaker FG, Cioffi DA, Amadio PC, Wright JG, Caughlin B. The American academy of

288     orthopaedic surgeons outcomes instruments: normative values from the general population. J

289     Bone Joint Surg Am. 2002;84-A(2):208–15.

290     21. Palmer K, Smith G, Kellingray S, Cooper C. Repeatability and validity of an upper limb

291     and neck discomfort questionnaire: the utility of the standardized Nordic questionnaire.

292     Occup Med (Lond). 1999;49(3):171–5.

293     21. Roquelaure Y, Ha C, Leclerc A, Touranchet A, Sauteron M, Melchior M, et al.

294     Epidemiologic surveillance of upper-extremity musculoskeletal disorders in the working

295     population. Arthritis Rheum. 2006;55(5):765–78.

296     23. Dupeyron A, Gelis A, Sablayrolles P, Bousquet P-J, Julia M, Herisson C, et al.

297     Heterogeneous assessment of shoulder disorders: validation of the Standardized Index of

298     Shoulder Function. J Rehabil Med. 2010;42(10):967–72.

299    24. Pichora D, Grant H. Upper extremity injured workers stratified by current work status: an

300    examination of health characteristics, work limitations and work instability. Int J Occup

301    Environ Med. 2010;1(3):124–31.

302    25. House R, Wills M, Liss G, Switzer-McIntyre S, Lander L, Jiang D. DASH work module

303    in workers with hand-arm vibration syndrome. Occup Med (Lond). 2012;62(6):448–50.

304    26. Camargo PR, Haik MN, Ludewig PM, Filho RB, Mattiello-Rosa SMG, Salvini TF.

305    Effects of strengthening and stretching exercises applied during working hours on pain and

306    physical impairment in workers with subacromial impingement syndrome. Physiother Theory

307    Pract. 2009;25(7):463–75.

308    27. Kim KS, Kim MG. Gender-related Factors Associated with Upper Extremity Function in

309    Workers. Saf Health Work. 2010;1(2):158–66.

310    28. Fillingim RB, King CD, Ribeiro-Dasilva MC, Rahim-Williams B, Riley JL. Sex, gender,

311    and pain: a review of recent clinical and experimental findings. J Pain. 2009;10(5):447–85.

312    29. Messing K, Stock SR, Tissot F. Should studies of risk factors for musculoskeletal

313    disorders be stratified by gender? Lessons from the 1998 Québec Health and Social Survey.

314    Scand J Work Environ Health. 2009;35(2):96‑112.

315    30. Kennedy CA, Manno M, Hogg-Johnson S, Haines T, Hurley L, McKenzie D, et al.

316    Prognosis in soft tissue disorders of the shoulder: predicting both change in disability and

317    level of disability after treatment. Phys Ther. 2006;86(7):1013–32; discussion 1033–7.

318    31. Viester L, Verhagen EALM, Oude Hengel KM, Koppes LLJ, van der Beek AJ, Bongers

319    PM. The relation between body mass index and musculoskeletal symptoms in the working

320    population. BMC Musculoskelet Disord. 2013;14:238.

321  32. Kortt M, Baldry J. The association between musculoskeletal disorders and obesity. Aust

322  Health Rev. 2002;25(6):207–14.

323  33. Murray CJL, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, et al. Disability-

324  adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a

325  systematic analysis for the Global Burden of Disease Study 2010. Lancet

326  2012;380(9859):2197–223.

327  34. Calderón SAL, Zurakowski D, Davis JS, Ring D. Quantitative Adjustment of the

328  Influence of Depression on the Disabilities of the Arm, Shoulder, and Hand (DASH)

329  Questionnaire. Hand (N Y). 2010;5(1):49–55.

330  35. Roh YH, Lee BK, Noh JH, Oh JH, Gong HS, Baek GH. Effect of depressive symptoms on

331  perceived disability in patients with chronic shoulder pain. Arch Orthop Trauma Surg.

332  2012;132(9):1251–7.

333  36. Dale AM, Gardner BT, Buckner-Petty S, Kaskutas V, Strickland J, Evanoff B.

334  Responsiveness of a 1-Year Recall Modified DASH Work Module in Active Workers with

335  Upper Extremity Musculoskeletal Symptoms. JOR. 2015;25(3):638–47.

336  37. Gorski JM, Schwartz LH. Shoulder impingement presenting as neck pain. J Bone Joint

337  Surg Am. 2003;85-A(4):635–8.

338  38. Huisstede BMA, Feleus A, Bierma-Zeinstra SM, Verhaar JA, Koes BW. Is the disability

339  of arm, shoulder, and hand questionnaire (DASH) also valid and responsive in patients with

340  neck complaints. Spine. 2009;34(4):E130–8.

341  39. Kitis A, Celik E, Aslan UB, Zencir M. DASH questionnaire for the analysis of

342  musculoskeletal symptoms in industry workers: a validity and reliability study. Appl Ergon.

343  2009;40(2):251–5.

344

345 **Table I. DASH et DASH-work scores according to individual characteristics at follow-up.**

|  | N | Score | SD | Median | P value |
|---|---|---|---|---|---|
| **DASH score** | | | | | |
| Gender | | | | | 0,008* |
| Female | 85 | 24,0 | 16,8 | 19,2 | |
| Male | 105 | 17,4 | 16,4 | 13,0 | |
| Age | | | | | 0,003** |
| < 40 years | 22 | 11,3 | 9,2 | 8,8 | |
| 40 - 49 years | 58 | 17,6 | 16,2 | 14,0 | |
| ≥ 50 years | 110 | 23,6 | 17,6 | 18,3 | |
| BMI | | | | | 0, 752** |
| < 25 kg/m² | 90 | 19,5 | 16,5 | 15,5 | |
| 25 – 30 kg/m² | 67 | 20,9 | 15,4 | 17,5 | |
| ≥ 30 kg/m² | 28 | 22,6 | 21,3 | 14,2 | |
| **DASH-work score** | | | | | |
| Gender | | | | | 0,150* |
| Female | 69 | 23,6 | 25,7 | 12,5 | |
| Male | 85 | 17,9 | 23,7 | 6,3 | |
| Age | | | | | 0,231** |
| < 40 years | 21 | 15,5 | 25,4 | 0,0 | |
| 40 - 49 years | 55 | 17,8 | 22,0 | 6,3 | |
| ≥ 50 years | 78 | 23,6 | 26,2 | 18,8 | |

| BMI | | | | | 0,235** |
|---|---|---|---|---|---|
| < 25 kg/m$^2$ | 75 | 18,3 | 25,6 | 6,3 | |
| 25 – 30 kg/m$^2$ | 54 | 23,3 | 23,2 | 18,8 | |
| ≥ 30 kg/m$^2$ | 21 | 20,5 | 24,9 | 6,3 | |

346   * Test de Student          ** Test de Kruskall-Wallis

347

348  **Table II. DASH scores according to the presence of musculoskeletal disorders (MSDs) reported**

349  **on the Nordic questionnaire at follow-up.**

| MSDs location | N | Score | SD | Median | P value* |
|---|---|---|---|---|---|
| Neck/nape | | | | | 0,001 |
| No | 77 | 15,6 | 14,8 | 12,5 | |
| Yes | 113 | 23,6 | 17,5 | 18,3 | |
| Shoulder/arm with elbow/forearm and/or hand/wrist | | | | | <0,0001** |
| No | 41 | 6,6 | 7,8 | 2,5 | |
| Shoulder alone | 47 | 20,0 | 15,3 | 16,7 | |
| Shoulder with another location of MSD | 102 | 26,0 | 17,1 | 22,9 | |
| Shoulder/arm | | | | | <0,001 |
| No | 41 | 6,6 | 7,8 | 2,5 | |
| Yes | 149 | 24,1 | 16,7 | 19,2 | |
| Elbow/forearm | | | | | 0,009 |
| No | 119 | 17,9 | 15,4 | 15,0 | |
| Yes | 71 | 24,5 | 18,4 | 18,3 | |
| Hand/wrist | | | | | <0,001 |
| No | 97 | 14,8 | 14,1 | 11,7 | |
| Yes | 93 | 26,2 | 17,6 | 20,8 | |
| Fingers | | | | | <0,001 |
| No | 123 | 15,9 | 14,1 | 13,4 | |
| Yes | 67 | 28,5 | 18,5 | 24,2 | |
| Upper back | | | | | 0,004 |
| No | 125 | 17,8 | 17,0 | 13,3 | |
| Yes | 65 | 25,2 | 15,7 | 20,8 | |
| Lower back | | | | | 0,163 |
| No | 69 | 18,1 | 17,8 | 13,8 | |
| Yes | 121 | 21,6 | 16,3 | 17,5 | |
| Hip/thigh | | | | | 0,004 |
| No | 134 | 18,1 | 16,3 | 14,4 | |
| Yes | 56 | 25,8 | 17,1 | 20,8 | |

350       * Test de Student       ** Test de Kruskall-Wallis

351

352 **Table III. DASH scores according to RCS medical management during the preceding 12-**

353 **months.**

| | N | Score | SD | Median | P value |
|---|---|---|---|---|---|
| **Physician consultation** | | | | | <0,001* |
| No | 92 | 14,7 | 12,8 | 12,5 | |
| Yes | 76 | 30,5 | 18,0 | 28,9 | |
| **Number of consultations** | | | | | |
| 1 | 16 | 21,0 | 17,2 | 15,7 | |
| 2 or 3 | 30 | 29,2 | 17,3 | 25,8 | |
| > 3 | 16 | 42,5 | 15,6 | 45,4 | |
| **Physiotherapy session** | | | | | <0,001* |
| No | 118 | 16,9 | 14,6 | 14,4 | |
| Yes | 48 | 32,7 | 17,4 | 31,4 | |
| **Number of sessions** | | | | | |
| < 5 | 15 | 27,5 | 17,4 | 20,5 | |
| 5-15 | 12 | 31,8 | 17,8 | 26,7 | |
| > 15 | 10 | 42,9 | 13,6 | 44,6 | |
| **Sick leave** | | | | | <0,001** |
| No | 149 | 18,7 | 15,1 | 16,7 | |
| Yes | 15 | 40,5 | 17,8 | 43,3 | |
| **Sick leave duration** | | | | | |
| < 30 days | 4 | 41,6 | 19,9 | 48,8 | |
| 30 – 55 days | 4 | 30,0 | 17,1 | 25,9 | |
| > 55 days | 3 | 42,2 | 20,5 | 44,2 | |
| **Shoulder surgery** | | | | | 0,225** |
| No | 155 | 20,9 | 16,2 | 18,1 | |
| Yes | 14 | 29,8 | 23,0 | 20,0 | |

354 * Test de Student        ** Test de Wilcoxon

355

356 **Table IV. DASH-work scores according to RCS medical management during the preceding 12-**

357 **months.**

| | N | score | SD | Median | P value |
|---|---|---|---|---|---|
| **Physician consultation** | | | | | **<0,001*** |
| No | 80 | 15,0 | 21,8 | 6,3 | |
| Yes | 58 | 30,5 | 27,2 | 25,0 | |
| **Number of consultations** | | | | | |
| 1 | 12 | 16,1 | 22,2 | 9,4 | |
| 2 - 3 | 26 | 33,4 | 29,6 | 28,1 | |
| > 3 | 10 | 39,4 | 23,8 | 50,0 | |
| **Physiotherapy session** | | | | | **0,002*** |
| No | 105 | 17,6 | 23,0 | 6,3 | |
| Yes | 34 | 32,9 | 28,6 | 28,1 | |
| **Number of sessions** | | | | | |
| < 5 | 13 | 34,6 | 27,4 | 31,3 | |
| 5 - 15 | 8 | 25,0 | 20,6 | 21,9 | |
| > 15 | 6 | 51,0 | 34,8 | 53,1 | |
| **Sick leave** | | | | | **0,001*** |
| No | 127 | 19,1 | 23,4 | 12,5 | |
| Yes | 11 | 49,4 | 30,4 | 50,0 | |
| **Sick leave duration** | | | | | |
| < 30 days | 3 | 66,7 | 14,4 | 75,0 | |
| 30 - 55 days | 4 | 37,5 | 32,3 | 37,5 | |
| > 55 days | 2 | 40,6 | 13,3 | 40,6 | |
| **Shoulder surgery** | | | | | 0,210** |
| No | 130 | 22,3 | 25,6 | 12,5 | |
| Yes | 8 | 10,2 | 17,0 | 3,1 | |

358 * Test de Student    ** Test de Wilcoxon