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

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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 ($p < 0.0001$; $d \geq 0.4$). 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.

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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

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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

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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/m²), overweight (BMI between 25 and 30
105 kg/m²), obesity (BMI ≥ 30 kg/m²) 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.

109 **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.

122 **4. Results**

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 \pm 16.6 and 20.5 \pm 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

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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

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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

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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

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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/m ²	90	19,5	16,5	15,5	
25 – 30 kg/m ²	67	20,9	15,4	17,5	
≥ 30 kg/m ²	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	

DASH for workers suffering from RCS

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	

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DASH for workers suffering from RCS

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	

DASH for workers suffering from RCS

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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	

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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