

**How much do problems with your limbs, neck, and spine limit your physical activities?**  
 (such as daily activities, housework, work outside the home and exercising) 0 - Not at all 10 - Extremely

**limbs:** left arm (from shoulder to fingers) ..... 0 0 0 0 0 0 0 0 0 0  
 right arm (from shoulder to fingers) ..... 0 0 0 0 0 0 0 0 0 0  
 left leg (from hip to toes) ..... 0 0 0 0 0 0 0 0 0 0  
 right leg (from hip to toes) ..... 0 0 0 0 0 0 0 0 0 0

**neck:** ..... 0 0 0 0 0 0 0 0 0 0  
**spine:** (from upper to lower back) ..... 0 0 0 0 0 0 0 0 0 0

**How much do other medical problems limit your physical activities?** (such as weight, heart, stomach, lungs ...) ..... 0 0 0 0 0 0 0 0 0 0

**How much do problems with your limbs, neck, and spine bother you?** (such as by making you feel depressed or anxious) ..... 0 0 0 0 0 0 0 0 0 0

Fig. E-1  
 The self-reported Review of Musculoskeletal System (ROMS) questionnaire.

TABLE E-1 SF-12 Physical and Mental Component Summary (PCS and MCS) Scores As a Function of the ROMS Scales in Three Groups of Patients*						
ROMS Scale	Patients with Shoulder Problems, N = 3617		Patients with Hip Problems, N = 2478		Patients with Knee Problems, N = 6857	
	SF-12 PCS, R = 0.62†	SF-12 MCS, R = 0.48†	SF-12 PCS, R = 0.65†	SF-12 MCS, R = 0.43†	SF-12 PCS, R = 0.61†	SF-12 MCS, R = 0.41†
Deficiency, musculoskeletal						
Left arm	<b>-0.33</b> †	0.02	-0.05‡	0.02	0.03‡	-0.02
Right arm	<b>-0.36</b> †	0	0.03	-0.01	0.01	-0.03
Left leg	-0.06†	-0.01	<b>-0.37</b> †	-0.02	<b>-0.36</b> †	0.02
Right leg	-0.07†	-0.02	<b>-0.35</b> †	-0.01	<b>-0.31</b> †	0
Neck	-0.03	-0.09†	0.03	-0.04	0	-0.04‡
Spine	-0.07†	-0.05‡	-0.06†	-0.10†	-0.08†	-0.04§
Deficiency, nonmusculoskeletal						
Weight, heart, stomach, or other	-0.11†	-0.12†	-0.08†	-0.12†	-0.11†	-0.16†
Distress, musculoskeletal						
Anxiety, depression, or other	-0.12†	<b>-0.36</b> †	-0.17†	<b>-0.29</b> †	-0.11†	<b>-0.29</b> †

\*The data are given as standardized regression coefficients. The coefficients in bold were expected to be highly negative (convergent validity), and those not in bold were expected to be close to zero (divergent validity). R = multiple correlation, arm = upper extremity, and leg = lower extremity. †P < 0.001. ‡P < 0.05. §P < 0.01.

TABLE E-2 Functional Scores of Joint-Specific Instruments As a Function of the ROMS Scales in Three Groups of Patients*						
ROMS Scale	Patients with Shoulder Problems, PSS, Function, N = 3670		Patients with Hip Problems, HOOS, Function, N = 2697		Patients with Knee Problems, KOOS, Function, N = 7243	
	Left, R = 0.80†	Right, R = 0.80†	Left, R = 0.77†	Right, R = 0.77†	Left, R = 0.74†	Right, R = 0.73†
Deficiency, musculoskeletal						
Left arm	<b>-0.74</b> †	0.09†	0.03	-0.02	0	0
Right arm	0.09†	<b>-0.74</b> †	0.03	0.04	0	-0.01
Left leg	-0.02	0.01	<b>-0.71</b> †	0.09†	<b>-0.67</b> †	0.04†
Right leg	-0.02	-0.02	0.06†	<b>-0.73</b> †	0.02	<b>-0.67</b> †
Neck	0	-0.01	-0.04‡	-0.04‡	-0.05†	-0.04§
Spine	-0.05†	-0.05†	-0.02	-0.05§	-0.06†	-0.05†
Deficiency, nonmusculoskeletal						
Weight, heart, stomach, or other	-0.01	-0.01	0.03‡	-0.03	-0.09†	-0.10†
Distress, musculoskeletal						
Anxiety, depression, or other	-0.04§	-0.04§	-0.07†	-0.04§	-0.04†	0

\*The data are given as standardized regression coefficients. The coefficients in bold were expected to be highly negative (convergent validity), and those not in bold were expected to be close to zero (divergent validity). R = multiple correlation, arm = upper extremity, and leg = lower extremity. †P < 0.001. ‡P < 0.05. §P < 0.01.

TABLE E-3 SF-12 Physical Component Scores as a Function of the ROMS Scales and Functional Scores of Joint-Specific Instruments Prior to Total Joint Arthroplasty for the Treatment of Osteoarthritis in Three Groups of Patients*			
Scale	Shoulder Arthroplasty Patients, N = 76, R = 0.66†	Hip Arthroplasty Patients, N = 334, R = 0.64†	Knee Arthroplasty Patients, N = 256, R = 0.62†
ROMS, deficiency, musculoskeletal			
Index arm	-0.34‡	-0.02	0.08
Opposite arm	-0.18	-0.08	-0.03
Index leg	-0.08	-0.28†	-0.15‡
Opposite leg	0.12	-0.03	-0.18‡
Neck	0.25	0.11	-0.04
Spine	-0.19	-0.06	-0.09
ROMS, deficiency, nonmusculoskeletal			
Weight, heart, stomach, or other	-0.37†	-0.05	0.04
ROMS, distress, musculoskeletal			
Anxiety, depression, or other	NA	NA	NA
Joint-specific questionnaires			
PSS, function, index shoulder	0.19	NA	NA
HOOS, function, index hip	NA	0.43†	NA
KOOS, function, index knee	NA	NA	0.43†

\*The data are given as standardized regression coefficients. R = multiple correlation, index = side on which surgery was performed, opposite = contralateral side, arm = upper extremity, leg = lower extremity, and NA = not applicable. Positive coefficients for joint-specific questionnaires correspond with negative coefficients for ROMS. †P < 0.001. ‡P < 0.01.

**TABLE E-4 Dynamics of Outcomes of Total Joint Arthroplasty for the Treatment of Osteoarthritis in Three Groups of Patients\***

	At Baseline (95% CI)	Change (95% CI)	
		At Approx. Six Months	At Approx. Twelve Months
<b>Total shoulder arthroplasty, n = 202</b>			
SF-12, physical component score	34.1 (32.7 to 35.5)	7.2 (4.8 to 9.5)†	8.4 (6.4 to 10.5)†
SF-12, mental component score	52.7 (51.0 to 54.4)	-0.4 (-2.7 to 1.9)	0.8 (-1.0 to 2.6)
<b>ROMS, deficiency, musculoskeletal</b>			
Index arm	7.9 (7.6 to 8.2)	-4.9 (-5.5 to -4.3)†	-5.3 (-5.8 to -4.7)†
Opposite arm	2.6 (2.1 to 3.1)	-1.0 (-1.7 to -0.3)‡	-0.1 (-0.6 to 0.5)
Index leg	2.0 (1.6 to 2.4)	-0.4 (-1.2 to 0.3)	0.3 (-0.2 to 0.9)
Opposite leg	1.9 (1.5 to 2.3)	0.1 (-0.7 to 0.8)	-0.2 (-0.7 to 0.3)
Neck	2.0 (1.6 to 2.4)	-0.5 (-1.2 to 0.1)	-0.6 (-1.1 to -0.1)§
Spine	2.2 (1.8 to 2.6)	-0.2 (-0.8 to 0.3)	-0.2 (-0.6 to 0.3)
<b>ROMS, deficiency, nonmusculoskeletal</b>			
Weight, heart, stomach, or other	1.4 (1.0 to 1.8)	0.4 (-0.2 to 1.0)	0.3 (-0.1 to 0.8)
<b>ROMS, distress, musculoskeletal</b>			
Anxiety, depression, or other	3.9 (3.4 to 4.4)	-2.0 (-2.6 to -1.3)†	-1.9 (-2.4 to -1.3)†
PSS, function, index shoulder	14.2 (12.2 to 16.2)	25.5 (21.0 to 29.9)†	32.1 (28.6 to 35.5)†
PSS, emotion, index shoulder	1.7 (1.3 to 2.1)	5.4 (4.6 to 6.1)†	5.9 (5.3 to 6.6)†
<b>Total hip arthroplasty, n = 558</b>			
SF-12, physical component score	32.8 (31.8 to 33.8)	14.4 (12.8 to 15.9)†	15.8 (14.5 to 17.1)†
SF-12, mental component score	53.3 (52.3 to 54.3)	0.3 (-1.0 to 1.7)	0.1 (-1.0 to 1.3)
<b>ROMS, deficiency, musculoskeletal</b>			
Index arm	0.7 (0.5 to 0.9)	0.1 (-0.1 to 0.3)	0.1 (-0.1 to 0.3)
Opposite arm	0.8 (0.6 to 1.0)	0 (-0.3 to 0.2)	0.2 (-0.1 to 0.4)
Index leg	7.3 (7.1 to 7.5)	-5.1 (-5.5 to -4.7)†	-5.6 (-6.0 to -5.3)†
Opposite leg	1.6 (1.4 to 1.8)	-0.5 (-0.8 to -0.1)†	-0.3 (-0.5 to 0)
Neck	0.8 (0.6 to 1.0)	-0.1 (-0.3 to 0.1)	0 (-0.2 to 0.1)
Spine	2.0 (1.8 to 2.2)	-0.4 (-0.7 to -0.1)‡	-0.5 (-0.7 to -0.2)†
<b>ROMS, deficiency, nonmusculoskeletal</b>			
Weight, heart, stomach, other	1.2 (1.0 to 1.4)	-0.2 (-0.5 to 0.1)	0.1 (-0.1 to 0.4)
<b>ROMS, distress, musculoskeletal</b>			
Anxiety, depression, other	3.6 (3.3 to 3.9)	-1.9 (-2.3 to -1.5)†	-2.3 (-2.6 to -1.9)†
HOOS, function, index hip	40.6 (38.7 to 42.5)	45.8 (42.8 to 48.8)†	47.3 (45.0 to 49.6)†
HOOS, emotion, index hip	26.1 (24.1 to 28.1)	45.9 (42.1 to 49.7)†	47.3 (43.8 to 50.9)†
<b>Total knee arthroplasty, n = 469</b>			
SF-12, physical component score	32.6 (31.6 to 33.6)	10.6 (8.9 to 12.3)†	10.9 (9.5 to 12.2)†
SF-12, mental component score	54.0 (52.9 to 55.1)	0.7 (-0.7 to 2.1)	-0.5 (-1.8 to 0.8)
<b>ROMS, deficiency, musculoskeletal</b>			
Index arm	1.1 (0.9 to 1.3)	0.1 (-0.2 to 0.3)	0.1 (-0.2 to 0.3)
Opposite arm	1.2 (1.0 to 1.4)	-0.2 (-0.5 to 0.1)	0.1 (-0.2 to 0.3)
Index leg	7.0 (6.7 to 7.3)	-3.8 (-4.3 to -3.4)†	-4.5 (-4.8 to -4.1)†
Opposite leg	3.0 (2.7 to 3.3)	-1.1 (-1.5 to -0.7)†	-0.8 (-1.1 to -0.4)†
Neck	1.0 (0.8 to 1.2)	-0.1 (-0.4 to 0.1)	0.1 (-0.1 to 0.3)
Spine	1.9 (1.6 to 2.2)	-0.1 (-0.5 to 0.2)	-0.1 (-0.3 to 0.2)
<b>ROMS, deficiency, nonmusculoskeletal</b>			
Weight, heart, stomach, or other	1.9 (1.6 to 2.2)	-0.4 (-0.8 to 0)§	-0.3 (-0.6 to 0.1)
<b>ROMS, distress, musculoskeletal</b>			
Anxiety, depression, or other	3.1 (2.8 to 3.4)	-1.4 (-1.9 to -1.0)†	-1.0 (-1.4 to -0.7)†
KOOS, function, index knee	44.2 (43.1 to 45.3)	35.4 (32.2 to 38.6)†	39.0 (36.2 to 41.8)†
KOOS, emotion, index knee	25.8 (23.6 to 28.0)	30.9 (26.6 to 35.2)†	37.7 (33.6 to 41.7)†

\*Change = the postoperative score (at approximately six months [range, three to nine months] or twelve months [range, nine to fifteen months] minus the preoperative score; CI = confidence interval; index = side on which surgery was performed; opposite = contralateral side; arm = upper extremity; and leg = lower extremity. Higher SF-12 and KOOS scores correspond with lower ROMS scores. †P < 0.001. ‡P < 0.01. §P < 0.05.

**TABLE E-5 Responsiveness of Outcome Questionnaires Approximately Six and Twelve Months After Total Joint Arthroplasty for the Treatment of Osteoarthritis in Three Groups of Patients\***

Scale	Shoulder Arthroplasty Patients			
	Approx. Six Months, N = 99		Approx. Twelve Months, N = 102	
	SRM	ES	SRM	ES
SF-12, physical component score	0.78	0.78	0.82†	0.99†
SF-12, mental component score	-0.05	-0.04	0.09	0.10
ROMS, deficiency, musculoskeletal				
Index arm	-1.56†	-2.63†	-1.67†	-2.44†
Opposite arm	-0.32†	-0.31†	-0.03	-0.03
Index leg	-0.13	-0.13	0.11	0.13
Opposite leg	0.02	0.02	-0.10	-0.10
Neck	-0.20†	-0.20†	-0.22†	-0.23†
Spine	-0.10	-0.09	-0.07	-0.05
ROMS, deficiency, nonmusculoskeletal				
Weight, heart, stomach, or other	0.17	0.15	0.17	0.17
ROMS, distress, musculoskeletal				
Anxiety, depression, or other	-0.68§	-0.66§	-0.58§	-0.59§
Joint-specific questionnaire				
PSS, function, index shoulder	1.43†	2.14†	1.95†	2.45†
PSS, emotion, index shoulder	1.44†	2.12†	1.66†	2.36†
HOOS, function, index hip	NA	NA	NA	NA
HOOS, emotion, index hip	NA	NA	NA	NA
KOOS, function, index knee	NA	NA	NA	NA
KOOS, emotion, index knee	NA	NA	NA	NA

\*Six-month (range, three to nine-month) and twelve-month (range, nine to fifteen-month) values are given. Positive coefficients for the SF-12 and joint-specific questionnaire responsiveness correspond with negative coefficients for ROMS responsiveness. SRM (standardized response mean) = the average change divided by the standard deviation of the change, ES (effect size) = the average change divided by the standard deviation of the baseline, arm = upper extremity, leg = lower extremity, and NA = not applicable. †Large [0.8, 1.0]. ‡Small [0.2, 0.5]. §Moderate [0.5, 0.8].

**TABLE E-5 (continued)**

Hip Arthroplasty Patients				Knee Arthroplasty Patients			
Approx. Six Months, N = 273		Approx. Twelve Months, N = 381		Approx. Six Months, N = 233		Approx. Twelve Months, N = 333	
SRM	ES	SRM	ES	SRM	ES	SRM	ES
1.30†	1.40†	1.41†	1.59†	1.02†	1.08†	0.99†	1.12†
0.03	0.32	0.01	0.01	0.08	0.07	-0.05	-0.05
0.06	0.06	0.05	0.05	0.03	0.03	0.03	0.02
-0.02	-0.02	-0.09	0.09	-0.11	-0.10	0.02	0.02
-1.46†	-1.77†	-1.77†	-2.09†	-1.10†	-0.99†	-1.28†	-1.56†
-0.18	-0.17	-0.10	-0.11	-0.36‡	-0.34‡	-0.25‡	-0.24‡
-0.08	-0.06	-0.03	-0.02	-0.07	-0.07	0.05	0.04
-0.15	-0.14	-0.22‡	-0.20‡	-0.05	-0.05	-0.02	-0.02
-0.08	-0.08	0.06	0.06	-0.18	-0.16	-0.10	-0.09
-0.59§	-0.63§	-0.69§	-0.70§	-0.43§	-0.45§	-0.33§	-0.34§
NA	NA	NA	NA	NA	NA	NA	NA
NA	NA	NA	NA	NA	NA	NA	NA
1.84†	2.06†	2.12†	2.20†	NA	NA	NA	NA
1.48†	1.93†	1.40†	2.14†	NA	NA	NA	NA
NA	NA	NA	NA	1.48†	1.58†	1.59†	1.73†
NA	NA	NA	NA	0.96†	1.24†	1.06†	1.67†