# Factors affecting return to work after carpal tunnel syndrome surgery in a large French cohort

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ORIGINAL ARTICLE

# Factors Affecting Return to Work After Carpal Tunnel Syndrome Surgery in a Large French Cohort

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ABSTRACT. Parot-Schinkel E, Roquelaure Y, Ha C, Leclerc A, Chastang J-F, Raimbeau G, Chaise F, Descatha A. Factors affecting return to work after carpal tunnel syndrome surgery in a large French cohort. Arch Phys Med Rehabil 2011; 92:1863-9.

**Objective:** To evaluate occupational outcomes after surgical release of the median nerve in carpal tunnel syndrome (CTS).

**Design:** Retrospective study 12 to 24 months after surgery.

**Setting:** Hand centers (N=3) in 2 different areas.

**Participants:** Patients who had undergone surgical release of the median nerve in 2002 to 2003.

**Interventions:** Not applicable.

**Main Outcome Measure.** Duration of sick leave after surgery and associated factors were analyzed by using bivariate (log rank) and multivariate analyses of survival (Cox model).

**Results:** Questionnaires mailed in 2004 regarding medical condition (history and surgery), employment (occupational category codes in 1 digit), and compensation were returned (N=1248; 62%), with 253 men and 682 women stating they were employed at the time of surgery (N=935). Most were working at the time of the study (n=851; 91.0%). Median duration of sick leave before returning to work was 60 days. The main factors associated with adverse occupational outcome (long duration of sick leave) were simultaneous intervention for another upper-extremity musculoskeletal disorder, belief (by the patient) in an occupational cause, and "blue-collar worker" occupational category (the strongest determinant).

**Conclusion:** This study emphasizes the multifactorial nature of the occupational outcome of CTS after surgery, including occupational category. The probability of return to work for each risk factor provides a fair description of prognosis for physicians and patients.

**Key Words:** Carpal tunnel syndrome; Musculoskeletal disorders; Occupational disease; Prognosis; Rehabilitation; Return to work.



CARPAL TUNNEL syndrome (CTS) is the most common peripheral entrapment neuropathy in the upper extremity and a frequent cause of disability.[1,2] Surgical release or decompression rates in the United States are 250,000 to 500,000 per year compared with 130,000 to 155,000 per year in France.[3] Medical outcomes of surgical treatment of CTS have been studied in the last 20 years to evaluate preoperative predictors of prognosis,[4-8] such as the potential effects of the surgical techniques.[9-11] Return to work has been studied by using community-based studies and compensation-based studies, mostly in the United States.[12-18]

The aim of the study was to conduct a population-based investigation of surgical cases using hospital databases to define patterns of return to work in a general population and to analyze factors associated with return to work more than 1 year after surgery.

## METHODS

A retrospective study involving subjects who had undergone surgery was conducted in 2004 in 2 French areas, the Maine and Loire area in 2002 and 2003 and the Loire-Atlantique area in 2003. The Pays de la Loire region was chosen to develop the French National surveillance system on CTS and other musculoskeletal disorders in 2002 because this region was representative of the French workforce.[2,3] Subjects were included by using the National Medical Information Systems Program.

The search criteria were "carpal tunnel syndrome release" and "carpal tunnel syndrome ambulatory release" to include all patients aged 20 to 59 years living in these areas who had undergone carpal tunnel surgery. We included patients from only the main hand surgery centers (75% of CTS surgery of the areas, 2002 data from the National Medical Information Systems Program), Centre de la Main (Maine & Loire), Clinique St Léonard (Maine & Loire), Clinique Jeanne d'Arc (Loire-Atlantique). Surgery teams have performed mini-open surgery for many years (under direct vision and minimally invasive technique with division of the transverse carpal ligament through a small and remote incision).[19]

Patients with incorrect mail addresses or already included in another study were excluded.

**List of Abbreviations**

| | |
|---|---|
| CTS | carpal tunnel syndrome |
| OCC | occupation category code |

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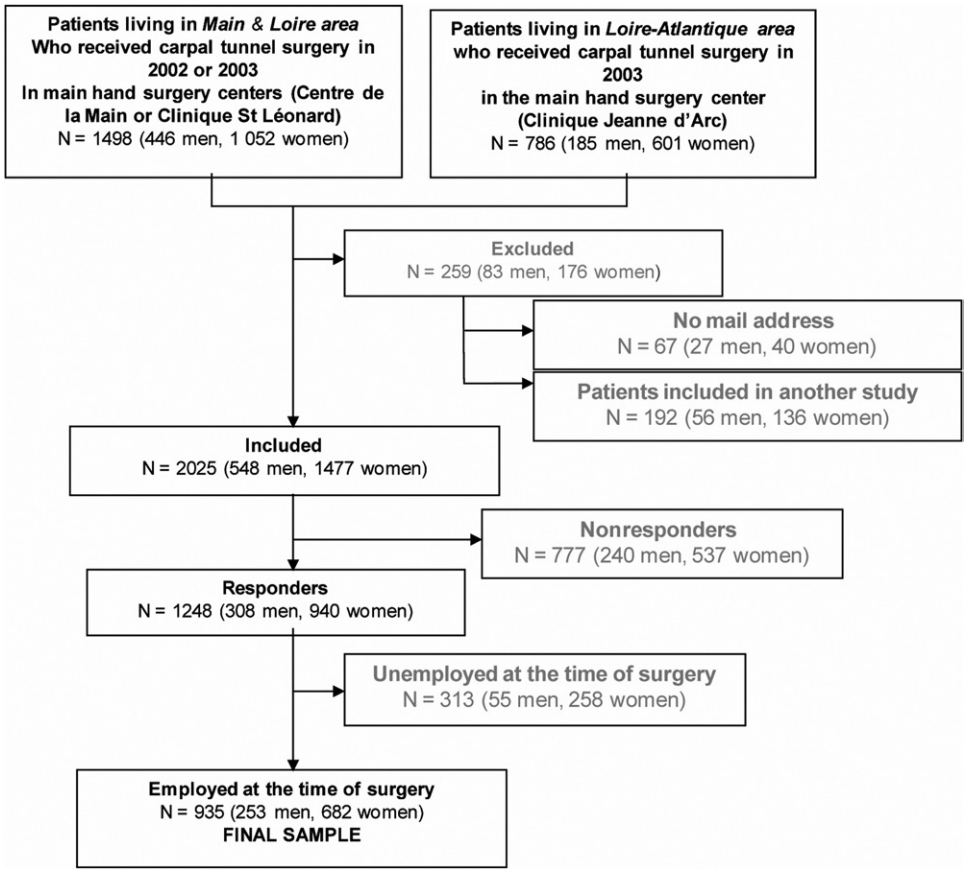


**Fig 1. Flow diagram.**

The final sample was based on responders to the questionnaire who were employed at the time of surgery (fig 1).

A self-administered questionnaire was mailed to each subject in 2004. Information was collected as follows. Medical history: obesity, pregnancy, diabetes mellitus, thyroid disease, upper-limb trauma (eg, fracture), rheumatoid arthritis, and any other upper-limb musculoskeletal disorder; surgery: uni- or bilateral release, associated surgery (at the same time), and satisfaction with results; more than a 2-year interval between symptoms and surgery also was recorded; employment and job: the last job was coded according to the French classification of occupations (occupation category codes [OCC], 1 digit), over 15 years in the same job; and outcome: return to work and duration of sick leave, and modification of work task.

Information regarding sick leave payment under the workers' compensation system and the subjective imputation of causality by the patient also were requested (missing data were coded as no sickness pay under the workers' compensation system and no imputation of causality to work, respectively).

The main outcome was duration of sick leave after surgery, with the patient as the unit (not hand). Duration included the day of surgery to the end of sick leave, when the patient returned to any work (with or without restriction). In view of the retrospective design, the main occupational factor was the OCC. When patients had not recovered at the time of the questionnaire, they were considered censured and duration of sick leave was the time between surgery and answering the questionnaire.

After comparing responders and nonresponders to the questionnaire, the sample was analyzed. Subjects who returned to any work in 2004 were compared with those who did not (secondary outcome) by using bivariate and multivariate analyses (logistic model). Probability of return to work based on duration of sick leave was estimated by using the Kaplan-Meier estimator. Bivariate analyses using the log-rank test and multivariate analyses using the Cox model were performed including all relevant items. Pregnancy was not included in multivariate analyses. Stratification for sex and area was performed to check that results were valid for men and women and for the 2 geographic areas included in the study.

SAS, version 9.1,[a] ,was used for all statistical analyses. Associations were considered significant for $P<.05$.

## RESULTS

Of 2025 subjects included, 1248 responded to the questionnaire (61.6%; see fig 1).

Sex ratio and age were significantly different between responders and nonresponders in the Maine and Loire area (women/men, 3.1 vs 1.7; $P<.001$; age, $47\pm8$ vs $46\pm9$y; $P=.033$, respectively). No difference was observed in the Loire-Atlantique area (sex ratio, 3.0 vs 3.7 women/men; age, $46\pm9$ vs $46\pm8$y, respectively).

Of 1248 subjects in the responding groups, 935 were employed at the time of surgery and included in the final sample. Most were working at the time of the study (n=851; 91.0%). Various factors were associated with the lack of return to work, including bilateral release, associated surgery, other musculoskeletal disorders, OCC, and dissatisfaction with surgery, whereas sickness payment under the workers' compensation system seemed protective (table 1). Stratified analyses indi-

**Table 1: Characteristics of Subjects Who Did Not Return to Work and Comparison With Subjects Who Returned to Work**

| | | | Subjects Who Returned to Work | | | Logistic Model* (reference = return to work) | | |
|---|---|---|---|---|---|---|---|---|
| Variable | Category | Total N | n | % | P† | aOR | 95% CI | P |
| Sex | Women | 682 | 624 | 91.5 | NS | 1 | | NS |
| | Men | 253 | 227 | 89.7 | | 0.95 | 0.47–1.89 | |
| Area | Loire Atlantique | 332 | 303 | 91.3 | NS | 1 | | NS |
| | Maine et Loire | 603 | 548 | 90.9 | | 1.07 | 0.95–1.22 | |
| Age >50y | No | 596 | 555 | 93.1 | .005 | 1 | | .02 |
| | Yes | 336 | 294 | 87.5 | | 1.94 | 1.10–3.43 | |
| Bilateral release | No | 852 | 784 | 92 | .005 | 1 | | .003 |
| | Yes | 81 | 65 | 80.3 | | 3.46 | 1.51–7.93 | |
| Associated surgery | No | 733 | 677 | 92.4 | .02 | 1 | | NS |
| | Yes | 177 | 153 | 86.4 | | 1.47 | 0.78–2.80 | |
| | Missing data | 25 | 21 | 84 | | | | |
| Obesity‡ | No | 771 | 711 | 92.2 | .02 | 1 | | NS |
| | Yes | 145 | 123 | 84.8 | | 1.88 | 0.95–3.73 | |
| | Missing data | 19 | 17 | 89.5 | | | | |
| Pregnancy | No | 599 | 548 | 91.5 | NS | NI | | NI |
| | Yes | 51 | 49 | 96.1 | | | | |
| | Missing data + men | 285 | 254 | 89.1 | | | | |
| Diabetes mellitus | No | 887 | 811 | 91.4 | NS | NI | | NI |
| | Yes | 40 | 34 | 85 | | | | |
| | Missing data | 8 | 6 | 75 | | | | |
| Thyroid disease | No | 847 | 772 | 91.2 | NS | NI | | NI |
| | Yes | 79 | 73 | 92.4 | | | | |
| | Missing data | 9 | 6 | 66.7 | | | | |
| Upper-limb trauma (fracture) | No | 899 | 819 | 91.1 | NS | NI | | NI |
| | Yes | 36 | 32 | 88.9 | | | | |
| Rheumatoid arthritis | No | 922 | 840 | 91.1 | NS | NI | | NI |
| | Yes | 13 | 11 | 84.6 | | | | |
| Any personal risk factor for CTS§ | No | 631 | 581 | 92.1 | NS | NI | | NI |
| | At least 1 | 304 | 270 | 88.8 | | | | |
| Other musculoskeletal disorders | No | 462 | 437 | 94.6 | .0001 | 1 | | .01 |
| | Yes | 463 | 407 | 87.9 | | 2.18 | 1.21–3.95 | |
| | Missing data | 10 | 7 | 70 | | | | |
| OCC | Farmers | 31 | 30 | 96.8 | .05 | - | | |
| | Self-employed | 28 | 27 | 96.4 | | ‖1 | | .004 |
| | Managers, executives | 42 | 42 | 100 | | - | | |
| | Intermediates | 125 | 117 | 93.6 | | 3.77 | 0.71–20.01 | |
| | Lower white-collar workers | 353 | 319 | 90.4 | | 4.57 | 0.98–21.39 | |
| | Blue-collar workers | 356 | 316 | 88.8 | | 11.00 | 2.30–52.64 | |
| Time between first symptoms and surgery | <2y | 515 | 474 | 92 | NS | NI | | NI |
| | ≥2y | 420 | 377 | 89.8 | | | | |
| Subjective imputation of cause to work | No | 76 | 75 | 98.7 | .051 | 1 | | NS |
| | Yes | 839 | 758 | 90.4 | | 5.12 | 0.67–39.31 | |
| | Missing data | 20 | 18 | 90 | | | | |
| >15y at the same job | No | 612 | 562 | 91.8 | NS | NI | | NI |
| | Yes | 310 | 277 | 89.4 | | | | |
| | Missing data | 13 | 12 | 92.3 | | | | |
| Dissatisfaction with surgery | No | 772 | 717 | 92.9 | <.0001 | 1 | | .02 |
| | Yes | 131 | 112 | 85.5 | | 2.22 | 1.12–4.40 | |
| | Missing data | 32 | 22 | 68.8 | | | | |
| Sickness payment under the workers' compensation system | No | 583 | 504 | 86.5 | <.0001 | 1 | | .0001 |
| | Yes | 352 | 347 | 98.6 | | 0.07 | 0.03–0.20 | |
| Modification of task | No | 819 | 737 | 90 | .004 | 1 | | NS |
| | Yes | 116 | 114 | 98.3 | | 0.32 | 0.07–1.41 | |

NOTE. OR greater than 1 means that subjects were less likely to have returned to work.
Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; NS, not significant ($P \geq .05$), NI=not included.
*Multivariate analysis.
†Univariate analysis.
‡Body mass index ≥30kg/m$^2$.
§Obesity, pregnancy, diabetes mellitus, thyroid disease, upper-limb trauma, or rheumatoid arthritis.
‖Farmers, self-employed, managers, and executives were merged together for the logistic model (reference group), taking into account that managers and executives always returned to work.

**Table 2: Probability of Return to Work in Days for Each Item (using Kaplan Meyer estimator) and Result of Log-Rank Test**

| Variable | | Probability of Return to Work (95% CI) | | | | | | log-Rank *P* |
|---|---|---|---|---|---|---|---|---|
| | | 30d | 60d | 91d | 182d | 273d | 364d | |
| Sex | Women | 19.0 (16.2–22.2) | 58.3 (54.6–62.0) | 76.4 (73.2–79.6) | 87.5 (84.9–89.8) | 90.5 (88.1–92.5) | 91.1 (88.8–93.1) | .04 |
| | Men | 15.4 (11.5–20.5) | 52.6 (46.6–58.8) | 71.1 (65.5–76.6) | 83.0 (78.1–87.3) | 87.1 (82.6–90.9) | 88.3 (84.0–91.9) | |
| Area | Loire Atlantique | 14.6 (11.2–18.9) | 63.8 (58.6–69.0) | 78.4 (73.8–82.7) | 86.0 (82.0–89.5) | 90.3 (86.8–93.2) | 91.2 (87.8–93.9) | .04 |
| | Maine et Loire | 19.9 (16.9–23.3) | 52.9 (49.0–56.9) | 73.1 (69.5–76.6) | 86.4 (83.5–89.0) | 89.1 (86.5–91.5) | 89.9 (87.3–92.2) | |
| Age >50y | No | 14.7 (12.1–17.8) | 55.8 (51.9–59.8) | 75.7 (72.2–79.1) | 87.9 (85.1–90.3) | 91.6 (89.2–93.6) | 92.5 (90.1–94.4) | NS |
| | Yes | 23.5 (19.3–28.4) | 58.3 (53.1–63.6) | 73.8 (69.0–78.4) | 83.6 (79.5–87.4) | 86.1 (82.2–89.6) | 86.8 (82.9–90.2) | |
| Bilateral release | No | 18.2 (15.8–21.0) | 57.8 (54.5–61.1) | 76.7 (73.8–79.5) | 87.4 (85.1–89.5) | 90.6 (88.6–92.5) | 91.3 (89.3–93.1) | .0007 |
| | Yes | 16.2 (9.8–26.3) | 46.2 (36.1–57.7) | 56.2 (45.8–67.3) | 73.7 (63.8–82.8) | 77.5 (67.9–85.9) | 80.0 (70.6–87.9) | |
| Associated surgery | No | 18.9 (16.2–21.9) | 61.0 (57.5–64.6) | 80.0 (77.1–82.8) | 89.2 (86.8–91.3) | 91.9 (89.7–93.7) | 92.6 (90.6–94.4) | .0000 |
| | Yes | 13.6 (9.4–19.7) | 39.2 (32.4–46.8) | 56.3 (49.1–63.7) | 75.0 (68.4–81.1) | 80.7 (74.5–86.1) | 81.9 (75.8–87.2) | |
| Obesity* | No | 18.5 (15.9–21.4) | 58.4 (54.9–61.9) | 76.2 (73.1–79.2) | 87.3 (84.8–89.5) | 90.7 (88.5–92.6) | 91.4 (89.3–93.3) | .0025 |
| | Yes | 13.2 (8.6–19.9) | 47.9 (40.1–56.4) | 68.7 (61.1–76.1) | 81.2 (74.5–87.1) | 84.0 (77.6–89.5) | 84.8 (78.4–90.1) | |
| Pregnancy | No | 19.0 (16.0–22.3) | 57.7 (53.8–61.7) | 76.2 (72.7–79.5) | 87.2 (84.4–89.8) | 90.3 (87.8–92.5) | 91.1 (88.6–93.2) | .0065 |
| | Yes | 23.5 (14.1–37.7) | 78.4 (66.4–88.4) | 92.2 (82.8–97.5) | 96.1 (88.1–99.3) | 96.1 (88.1–99.3) | 96.1 (88.1–99.3) | |
| Diabetes mellitus | No | 18.6 (16.1–21.3) | 57.4 (54.1–60.6) | 75.1 (72.2–77.9) | 86.9 (84.6–89.0) | 90.0 (87.9–91.9) | 90.9 (88.8–92.7) | NS |
| | Yes | 10.0 (3.9–24.5) | 47.5 (33.5–63.9) | 80.0 (66.5–90.6) | 80.0 (66.5–90.6) | 82.5 (69.4–92.3) | 82.5 (69.4–92.3) | |
| Thyroid disease | No | 18.0 (15.6–20.7) | 56.7 (53.4—60.0) | 75.4 (72.4–78.2) | 86.3 (83.9–88.5) | 89.5 (87.3–91.5) | 90.3 (88.2–92.2) | NS |
| | Yes | 20.5 (13.1–31.3) | 60.3 (49.7–71.1) | 75.6 (65.7–84.5) | 91.0 (83.4–96.1) | 92.3 (85.1–96.9) | 93.8 (86.9–97.8) | |
| Upper-limb trauma (fracture) | No | 18.1 (15.7–20.8) | 56.7 (53.5–60.0) | 74.8 (71.9–77.6) | 86.4 (84.0–88.5) | 89.7 (87.6–91.6) | 90.6 (88.5–92.4) | NS |
| | Yes | 16.7 (7.9–33.4) | 58.3 (43.0–74.4) | 80.6 (66.4–91.4) | 83.3 (69.6–93.2) | 86.1 (72.9–94.9) | 86.1 (72.9–94.9) | |
| Rheumatoid arthritis | No | 15.9 (12.9–19.4) | 57.3 (53.0–61.7) | 75.6 (71.7–79.3) | 86.6 (83.4–89.4) | 90.7 (87.9–93.0) | 91.5 (88.8–93.7) | NS |
| | Yes | 46.2 (24.0–75.2) | 69.2 (44.6–90.5) | 84.6 (61.2–97.5) | 84.6 (61.2–97.5) | 84.6 (61.2–97.5) | 84.6 (61.2–97.5) | |
| Any personal risk factor for CTS† | No | 18.4 (15.6–21.7) | 56.9 (53.1–60.8) | 75.2 (71.8–78.5) | 86.8 (84.0–89.3) | 90.5 (88.1–92.7) | 91.5 (89.1–93.5) | NS |
| | At least 1 | 17.2 (13.4–21.9) | 56.4 (50.9–62.1) | 74.6 (69.6–79.3) | 85.1 (80.9–88.9) | 87.5 (83.5–90.9) | 88.1 (84.2–91.5) | |
| Other musculoskeletal disorders | No | 19.6 (16.2–23.5) | 62.8 (58.4–67.2) | 80.4 (76.7–83.9) | 90.9 (88.0–93.3) | 94.2 (91.8–96.1) | 94.8 (92.5–96.6) | .0000 |
| | Yes | 16.9 (13.8–20.6) | 51.1 (46.6–55.7) | 70.3 (66.1–74.4) | 82.3 (78.6–85.6) | 85.3 (81.9–88.4) | 86.3 (83.0–89.3) | |
| OCC | Farmers | 51.6 (35.6–69.8) | 80.6 (65.4–92.1) | 87.1 (73.0–95.9) | 96.8 (85.9–99.8) | 96.8 (85.9–99.8) | 96.8 (85.9–99.8) | .0000 |
| | Self-employed | 64.3 (47.0–81.1) | 89.3 (74.9–97.3) | 92.9 (79.6–98.7) | 96.4 (84.6–99.7) | 96.4 (84.6–99.7) | 96.4 (84.6–99.7) | |
| | Managers, executives | 65.9 (51.5–79.7) | 92.7 (82.2–98.1) | 97.6 (89.0–99.8) | 97.6 (89.0–99.8) | 100 | 100 | |
| | Intermediates | 22.4 (16.0–30.8) | 72.0 (64.0–79.6) | 84.8 (78.0–90.4) | 91.2 (85.4–95.3) | 93.6 (88.4–97.0) | 93.6 (88.4–97.0) | |
| | Lower white-collar workers | 15.7 (12.3–19.9) | 59.8 (54.7–65.0) | 79.5 (75.1–83.5) | 88.6 (85.0–91.7) | 89.8 (86.3–92.7) | 90.4 (87.0–93.2) | |
| | Blue-collar workers | 6.5 (4.4–9.6) | 39.4 (34.6–44.7) | 62.0 (56.9–67.0) | 79.2 (74.8–83.2) | 85.5 (81.6–88.9) | 87.0 (83.2–90.2) | |
| Time between first symptoms and surgery | <2y | 15.6 (12.7–19.0) | 56.7 (52.5–61.0) | 77.4 (73.7–80.9) | 87.9 (84.9–90.6) | 91.1 (88.4–93.3) | 91.7 (89.1–93.9) | NS |
| | ≥2y | 21.0 (17.4–25.2) | 56.8 (52.1–61.6) | 72.1 (67.7–76.3) | 84.2 (80.6–87.6) | 87.7 (84.3–90.6) | 88.7 (85.4–91.5) | |
| Subjective imputation of cause to work | No | 57.9 (47.2–69.1) | 85.5 (76.7–92.3) | 94.7 (88.1–98.3) | 97.4 (91.8–99.5) | 97.4 (91.8–99.5) | 100 | .0000 |
| | Yes | 14.0 (11.8–16.5) | 53.6 (50.2–57.0) | 73.0 (69.9–75.9) | 85.2 (82.7–87.5) | 88.8 (86.6–90.8) | 89.6 (87.4–91.6) | |
| >15y at the same job | No | 18.1 (15.2–21.4) | 58.5 (54.6–62.4) | 77.3 (73.9–80.6) | 87.7 (84.9–90.1) | 90.6 (88.2–92.8) | 91.5 (89.1–93.6) | .0455 |
| | Yes | 17.7 (13.9–22.5) | 52.9 (47.5–58.6) | 70.0 (64.8–75.0) | 83.2 (78.9–87.1) | 87.3 (83.3–90.7) | 88.0 (84.1–91.4) | |
| Dissatisfaction with surgery | No | 18.7 (16.1–21.6) | 60.2 (56.7–63.6) | 78.1 (75.1–80.9) | 89.4 (87.1–91.4) | 91.7 (89.6–93.5) | 92.3 (90.3–94.0) | .0001 |
| | Yes | 15.4 (10.2–22.8) | 42.3 (34.4–51.3) | 62.3 (54.1–70.6) | 73.1 (65.3–80.4) | 81.8 (74.7–87.9) | 83.5 (76.5–89.3) | |
| Sickness payment under the workers' compensation system | No | 24.5 (21.2–28.2) | 67.9 (64.1–71.7) | 80.3 (77.0–83.5) | 84.8 (81.8–87.6) | 86.1 (83.1–88.7) | 86.4 (83.5–89.1) | .0089 |
| | Yes | 7.4 (5.1–10.7) | 38.4 (33.5–43.6) | 66.2 (61.2–71.1) | 88.6 (85.1–91.7) | 95.2 (92.6–97.1) | 96.7 (94.4–98.2) | |
| Modification of task | No | 18.8 (16.2–21.6) | 59.1 (55.7–62.5) | 76.6 (73.6–79.4) | 86.3 (83.8–88.5) | 89.1 (86.9–91.2) | 89.8 (87.6–91.8) | NS |
| | Yes | 12.9 (8.0–20.5) | 40.5 (32.2–50.0) | 63.8 (55.1–72.4) | 86.2 (79.3–91.7) | 92.2 (86.5–96.2) | 94.0 (88.6–97.3) | |
| Total | | 18.0 (15.7–20.6) | 56.8 (53.6–60.0) | 75.0 (72.2–77.7) | 86.3 (84.0–88.4) | 89.5 (87.5–91.4) | 90.4 (88.4–92.2) | |

Abbreviations: CI, confidence interval; NS, not significant ($P \geq .05$).

*Body mass index ≥30kg/m$^2$.

†Obesity, pregnancy, diabetes mellitus, thyroid disease, upper-limb trauma, or rheumatoid arthritis.

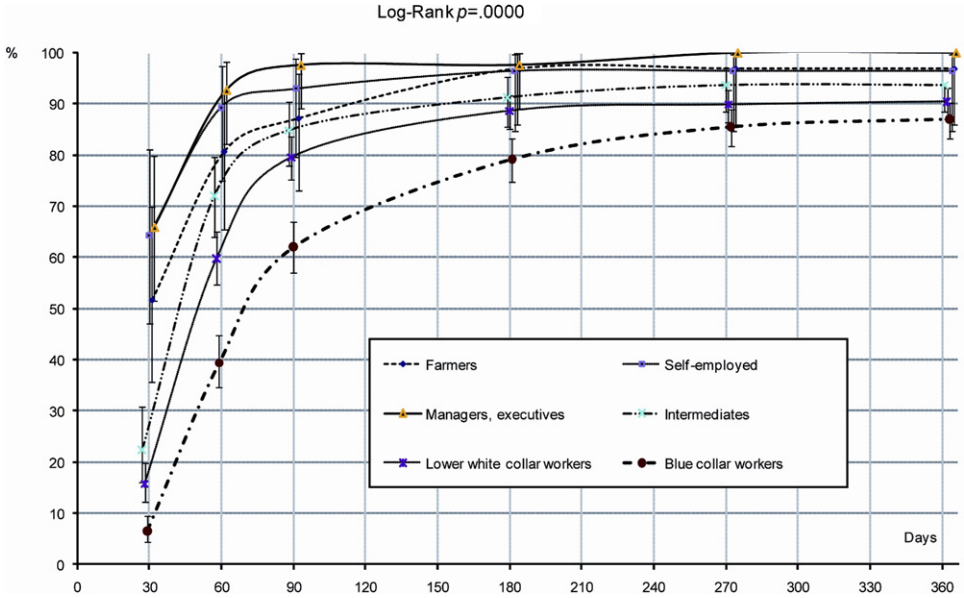


**Fig 2. Survival-like curves using Kaplan-Meier estimator in each occupational category. x-axis, time between surgery and return to work; y-axis, percentage of return to work.**

cated that results were similar for men and women and for the 2 areas.

Median duration of sick leave before return to work was 60 days. Different factors were associated with duration of sick leave before return to work in bivariate analyses (table 2): sex, area, bilateral release, other associated surgery, obesity, pregnancy, other upper-limb musculoskeletal disorder, OCC, subjective imputation of cause to work, time in the current job, dissatisfaction with surgery, and sickness payment under the workers' compensation system. OCC was the variable associated most strongly with duration of sick leave (fig 2). Other upper-limb musculoskeletal disorders and work compensation were associated with OCC ($P<.05$). However, after multivariate analyses by using a Cox model (table 3), only bilateral release, other associated surgery, obesity, other upper-limb musculoskeletal disorder, OCC, subjective imputation of cause to work, and dissatisfaction with surgery were still associated significantly with duration of sick leave. No difference between the 2 areas was observed after adjustment for factors associated with return to work (or between hand centers), such as sickness leave payment under the workers' compensation system.

**Table 3: Results of Multivariate Analysis on Duration of Sick Leave (Cox model)**

| Variable | Category | Hazard Ratio | $Pr>\chi^2$ |
|---|---|---|---|
| Sex | Men vs women | 0.98 (0.82–1.18) | NS |
| Area | Maine et Loire vs Loire Atlantique | 0.90 (0.77–1.06) | NS |
| Age >50y | Yes vs no | 1.03 (0.87–1.20) | NS |
| Bilateral release | Yes vs no | 1.41 (1.05–1.87)† | .02 |
| Associated surgery | Yes vs no | 1.37 (1.13–1.67)† | .0015 |
| Obesity* | Yes vs no | 1.25 (1.02–1.54)† | NS |
| Diabetes mellitus | Yes vs no | 1.22 (0.82–1.83) | NS |
| Upper-limb trauma (fracture) | Yes vs no | 1.17 (0.79–1.72) | NS |
| Rheumatoid arthritis | Yes vs no | 0.79 (0.42–1.49) | NS |
| Other musculoskeletal disorders | Yes vs no | 1.19 (1.02–1.38)† | NS |
| OCC (reference: managers and executives) | Farmers | 1.47 (0.88–2.46) | <.0001 |
| | Self employed | 1.08 (0.63–1.86) | |
| | Intermediates | 2.21 (1.49–3.27)† | |
| | Lower white-collar workers | 2.49 (1.71–3.61)† | |
| | Blue-collar workers | 3.34 (2.28–4.90)† | |
| Time between first symptoms and surgery | ≥2 vs <2y | 1.01 (0.87–1.16) | NS |
| Subjective imputation of cause to work | Yes vs no | 1.88 (1.43–2.48)† | <.0001 |
| >15y at the same job | Yes vs no | 1.14 (0.98–1.34) | NS |
| Dissatisfaction with surgery | Yes vs no | 1.37 (1.10–1.70)† | .0046 |
| Sickness payment under the workers' compensation system | Yes vs no | 1.06 (0.90–1.24) | NS |
| Modification of the task | Yes vs no | 0.99 (0.79–1.24) | NS |

Abbreviations: CI, confidence interval; NS, not significant ($P\geq.05$).
*Body mass index ≥30kg/m$^2$.
†$P<.05$.

## DISCUSSION

Most patients with CTS returned to work after surgery. However, certain factors were associated with duration of sick leave, and the average probability of return to work related to each of these factors provides a fair description of prognosis for physicians and patients. This is the first time that this description has been obtained and it will help clinicians inform their patients. The prognostic factors are multiple, including medical (obesity, other musculoskeletal disorders), surgical (bilateral release at the same time, associated surgery, satisfaction with surgery), and occupational parameters (OCC, subjective imputation of cause to work).

Because patients were drawn from 3 hand centers, it is possible that there might have been selection of patients. However, although located in the Pays-de-la-Loire region, these 3 major hand centers are not based in similar areas and they have small differences in surgical practice (associated surgery). No significant differences in outcome were observed with or without adjustment for a possible area effect (although external validation is required). Multilevel analyses were not performed in view of the lack of area effect. Mini-open surgery has been performed by the surgical teams for many years. Although the decision to apply endoscopic carpal tunnel release instead of open carpal tunnel release remains a matter of debate, it seems that it should be guided by the surgeon's preference.[11,19-21]

Occupational category appeared to be the strongest predictor of return to work and duration of sick leave, as reported in previous studies. In a study based on subjects who underwent surgery, Daniell et al[22] found that sick leave was less likely to end before 6 months in industries with a high incidence of CTS. Exposure to intensive hand work also has been described as a poor predictor of return to work,[12] at least in bivariate analysis at 6 months.[16] Repetitive movement at work and heavy manual work were associated with a longer return to work interval in a cohort of surgical cases[18] (without influence of occupational category, but with inclusion of either employees or self-employed) and also in a French study by a different team.[14]

The relationship between sickness payment under a workers' compensation system and return to work is complex. Different results have been reported regarding the influence of workers' compensation.[7,17,23-25] Workers' compensation in some systems may help workers obtain better care and work improvement, as in France, but may lead to longer duration of sick leave before return to work.[14] Workers' compensation also is potentially representative of work exposure and social factors (personal communication: G. Pransky, Prognosis for return to work in carpal tunnel syndrome: a North American perspective, Premus, 2010).[25] It also may be a proxy for severity, bearing in mind that there is no major difference in France between the workers' compensation system and the usual heath care system, and patients with mild CTS usually do not ask for compensation. We found a strong association in this study between sickness payment under the workers' compensation system and OCC, but the self-reported workers' compensation and missing information led us to consider this item in our study with caution.

### Study Limitations

However, this retrospective study was based on hospital data and such a design can lead to potential selection and recall effects. For occupational exposure, we chose to use OCC instead of self-reported exposure to avoid recall effects regarding exposure, but we were not able to distinguish which types of social or specific work exposure were the most relevant. It is true that OCC mixed different levels of physical demands (especially when they are pooled together for statistical reasons). Other baseline conditions, such as severity or intensity of pain at baseline and psychological variables, were not included in view of the possible memory effect associated with the retrospective design.

A potential attrition effect might have led to underestimation of the duration of sick leave (39.4% lost to follow-up). However, the average duration of sick leave reported in other studies has been 17 to 108 days, mostly depending on work characteristics and social categories (personal communication: G. Pransky, Prognosis for return to work in carpal tunnel syndrome: a North American perspective, Premus, 2010),[7,14,26] surgical treatment,[22] and receipt of sick pay.[14] The median of 60 days and proportion of return to work at 90 and 180 days are consistent with previous studies of similar design in unselected populations of workers.[22,26-28] It is interesting that average duration is similar between these North American studies undertaken in a mainly independent labor system and our results in a protective labor system in which, for example, workers cannot be fired when they are on sick leave for this reason. The financial loss for workers during sickness leave also is minimal, at least for the first 3 months. In this protective system, it also is of note that patients who did not return to the previous job remained unemployed. The variable return to work usually means return to any work.

## CONCLUSION

The association with other musculoskeletal disorders that may need surgery (associated surgery, bilateral release) or not (other musculoskeletal disorders) also is consistent with previous studies.[16,29] This could be considered another obstacle to return to work and also as an indicator of a physically demanding job in cases of upper-limb tendonitis. An unfavorable work environment, including physical and psychosocial factors,[26,30] often is considered to indicate poor prognosis, probably also in combination with disorders other than CTS. Dissatisfaction with surgery potentially is an interesting factor, but was difficult to interpret considering that it included expectations and results. However, for the role of workers' compensation and OCC, further prospective studies are needed to clarify which factors best predict return to work, including work exposure, severity at baseline, and use of a functional index.

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