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ORIGINAL ARTICLE



Professional reintegration among professionally active Portuguese stroke survivors: a multicentric study

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ABSTRACT

Purpose: To assess professional reintegration, the perceived impact of stroke on work, and the main determinants of return to work (RTW) among stroke survivors.

Materials and methods: A cross-sectional study was performed, based on a cohort of stroke survivors. A structured questionnaire was administered to previously working stroke survivors, 18–24 months post-stroke. Data on sociodemographic characteristics, stroke features and their impact on work, access to rehabilitation services during hospital admission and after discharge, social support, and professional reintegration were reported by 553 stroke survivors.

Results: On average, 56.6% (95% CI 52.4–60.8) of stroke survivors resumed professional activity, 20 months after stroke. Approximately 90% of survivors who RTW, returned to the same job and same function they performed before stroke. The majority did not receive reintegration support. The main determinants of RTW were lower age, higher socioeconomic status, and better functional status.

Conclusions: Professional reintegration and vocational support after stroke, remained below the international goals for community reintegration of stroke survivors. Future studies should explore the impact of professional and social reintegration on the psychological health and quality of life of stroke survivors and the barriers, challenges, and strategies used to overcome them, to allow for effective professional reintegration policies.

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> IMPLICATIONS FOR REHABILITATION

- The amount of professionally active people affected by stroke events is rising worldwide, with increasing numbers of survivors with restricted occupational participation.
- Higher age and lower socioeconomic status appear to be main determinants for no return to work and so, a special attention should be given to this particular group of stroke survivors.
- Vocational and social support after stroke is highly needed to help in the reintegration of a professionally active life.
- Social and community support after stroke should be offered as soon as possible after stroke to promote a successful professional reintegration.

Introduction

The rising incidence of stroke contributes to increase the global burden of the disease [1]. The majority of professionally active stroke survivors achieve functional independence when performing daily living activities however, losses in other specific areas such as cognition, mood, and environment affect their full social and professional reintegration [2,3]. The loss of productivity after stroke contributes to its negative impact on the well-being and life satisfaction of survivors [4,5], whilst increasing the economic burden for both the individual and the society [6,7]. Thus, professional reintegration is usually recognized as an indicator of recovery [8] and quality of life [5,9,10], being a common goal for most young stroke survivors [9]. European guidelines, such as the “Action Plan for Stroke in Europe 2018–2030” stress the relevance of returning to work, vocational support, and access to work as main necessities after stroke [11].

Professional reintegration is currently defined as the overall process of enabling individuals with either temporary or permanent disability to access, return to, or remain in employment. It includes benefits such as vocational guidance, participation in training costs, professional retraining and workability assessment, involving the employee, health professionals and the employer [12]. Therefore, professional reintegration in post-stroke context is crucial to improve survivors’ recovery, promote life satisfaction by consolidating self-esteem, increase confidence and social identity, stimulate psychosocial adjustment, endorse family well-being and support community reintegration [13]. Although vocational programs for stroke survivors are becoming disseminated, their main benefits and outcomes are still unclear [14], as they are undoubtedly under-researched, and the service provision is inconsistent, poorly organized, and incapable to answer to survivors’ needs [15]. Thus, professional reintegration outcomes are difficult

to evaluate, with most literature frequently restricting their analysis to return to work (RTW) [16].

Professional reintegration after stroke is a complex outcome that is influenced by biological, psychological, social and economic factors, with many of these difficult to quantify and not yet widely explored [8].

Consequently, stroke-related factors (type of stroke, thrombolytic procedures and National Institutes of Health Stroke Scale (NIHSS)) [17,18], motor and cognitive impairments [9,18–20], functionality and independence after stroke [18–22], sociodemographic characteristics (gender, age, education, financial status and health insurance) [3,17,18,20,22] and work-related factors (employment status, job type, enterprise size, job adaptations and stress at work) [18,19,21,22] are the most frequent determinants of RTW assessed in literature. On contrary, the rehabilitation services, social and community support, and availability of vocational programs are less frequently studied [23,24].

In the Portuguese context, access to rehabilitation services is widely available and stroke survivors benefit from them for as long as they need [25]. For social and community support, although they are nationally widespread, most patients are unaware of their existence. This is likely to impact on their care due to limited knowledge on what support is available and how to navigate the system, which may hinder their offer and how to reach their services (being a very bureaucratic pathway). Professional reintegration centers, are institutions, independent from rehabilitation facilities, specialized on occupational reintegration according to the disability status [26]. They comprise a group of professionals (not only rehabilitation, but also psychologists and social services professionals) and services (including vocational programs) which support the survivor to reintegrate professional life whilst considering the disability, community structures and work conditions. In Portugal there are only two institutions available, with a limited capacity to answer survivors needs. Across Europe, inequities in access to rehabilitation services after stroke is an international concern but recommendations regarding which patients should access ongoing rehabilitation are inconsistent [27]. Thus, multidisciplinary cooperation within occupational groups in outpatient rehabilitation is a key item that can influence and improve the follow-up of stroke patients [28].

This work aimed to assess the professional reintegration among professionally active Portuguese stroke survivors, 18–24 months after stroke, namely regarding the period of time to RTW, job placement, reintegration support, the perceived impact of stroke on work, and the prevalence and main determinants of RTW. Its main results will contribute to improve the knowledge about characteristics influencing professional reintegration in the first years after stroke. This will contribute to predict the survivors who are more likely to RTW and those who would benefit from an individualized reintegration program.

Materials and methods

This observational and cross-sectional study is based on a cohort of stroke survivors and their informal carers, assembled within the CARESS research project. The study was approved by the Ethics Committees and the respective Data Protection Offices of all the 12 hospitals involved and informed consent was obtained from all participants.

Participants selection

All stroke survivors hospitalized between September 2018 and August 2019 in one of the 12 Stroke Units of the Northern Region

Health Administration of Portugal (ARS-Norte) were invited to participate in the study, 18 to 24 months post-stroke. Only those stroke survivors who consented to being contacted by telephone were considered eligible to participate in the study. Stroke survivors who were institutionalized, with formal carers or living in foster families, who do not understand or speak Portuguese, or have language and/or cognitive deficits (e.g., dysphasia, dementia, memory loss, deafness/hearing loss) and inmates were excluded.

In all Stroke Units, stroke was defined based on the World Health Organization criteria and updated by American Heart Association/American Stroke Association [29], as

brain, spinal cord, or retinal cell death attributable to ischemia, based on pathological, imaging, or other objective evidence of cerebral, spinal cord, or retinal focal ischemic injury in a defined vascular distribution; or clinical evidence of cerebral, spinal cord, or retinal focal ischemic injury based on symptoms persisting ≥ 24 h or until death, and other etiologies excluded.

Stroke survivors were asked for their permission to be contacted and after acceptance, they were invited to participate in the study. A meeting was scheduled according to participants' availability and convenience to conduct the data collection, comprising the administration of structured questionnaires by telephone. If the survivors were unable to answer the questionnaire but had an informal carer, the latter was asked to answer some questions related to the survivor, preferably face-to-face. Of the 2170 eligible stroke survivors invited to participate on CARESS project, 1775 agreed to participate by completing a questionnaire (participation rate of 81.8%). The main reasons for participation refusal were lack of time, lack of interest in the study, and psychological unavailability (when participants reported being emotionally unavailable and not open to discussing or sharing their feelings).

For the current work, from the 1775 participants that agreed to participate on the main project, only stroke survivors working at the time of their stroke were considered eligible ($n=553$). Participants were considered as professionally active before stroke when they reported a paid employment status whether it was part-time, full-time, or self-employed. Retired, voluntary work, household, student, or job-seeking situations were not considered as professionally active, and were excluded from the current sample ($n=1222$) [30].

Data collection

Data was collected by trained interviewers, specifically trained for conducting face-to-face and telephone interviews, using a structured questionnaire on sociodemographic characteristics, stroke characteristics and its impact, access to rehabilitation services during hospital admission and after discharge, social support, and professional reintegration.

Age was considered at the time of the questionnaire and categorized as < 50 years, 50–59 years, and ≥ 60 years. Marital status was grouped into two categories, according to cohabitation with a partner. Educational level was considered as the number of completed years of education and categorized as ≤ 4 years, 5–9 years, and > 10 years. Household monthly income was inquired using previously defined categories and stratified into $\leq 1000\text{€}$, $> 1000\text{€}$, does not know and prefers not to answer. Neighborhood was categorized as urban or rural, according to the stroke survivor perception. Occupations were classified by major professional groups, according to the Portuguese Classification of Occupations 2010 (CPP/2010) [31] and grouped in two categories: blue-collar,

comprising individuals classified in the sixth to ninth major groups of the CPP/2010 (skilled agricultural, forestry and fishery workers, craft and related trades workers, plant and machine operators and assemblers and elementary occupations); and white-collar, comprising individuals classified in the upper five major groups of the CPP/2010 (managers, professionals, technicians, and associate professionals, clerical support workers, and service and sales workers).

Stroke impact was assessed through the Post Stroke Checklist [32] and classified into five categories: motor (items 2, 3, 4 and 10), bowel and bladder (item 15), cognitive (items 7 and 9), emotional (items 8 and 11) and pain (item 5). The ability to drive before and after stroke was grouped in three categories: never drove, stopped driving after stroke, and resume driving after stroke. For functionality after stroke, modified Rankin Scale (mRankin) [33] and Barthel Index (BI) [34] were used. mRankin scale was presented as 0–1 (no/very slight dependence), 2 (slight dependence), 3 (moderate dependence) and 4–5 (severe dependence); and the Barthel Index was categorized into < 60 (severe dependence), 60–90 (moderate dependency), and >90 (slight dependency).

To access the use of rehabilitation services (medical evaluation and treatment), participants were asked if they were observed by the rehabilitation team (Physical and Rehabilitation Medicine doctor, physiotherapist, speech therapist or occupational therapist) and if they did any rehabilitation treatment during hospitalization. Data on rehabilitation after discharge was collected as “never,” “yes, but not anymore” and “yes, until inquiry date.” Access to social or community support after discharge was considered if the stroke survivor reported any permanent or punctual domiciliary support (public or private), nursery services or transportation services to medical/treatment facilities.

RTW was defined as resuming to any sort of paid employment and included returning to a previous job, returning to similar or modified job or starting a new job, comprising both part-time and full-time work. The period of return to work after stroke was inquired using previously defined categories: <6 months, 6–12 months and >12 months. For the job placement return to the same job and same function was considered. The number of weekly hours before and after stroke was collected as a continuous variable. Survivors who RTW were also asked to report any kind of reintegration support, including access to vocational programs or services. The stroke survivors’ perception of the impact of stroke on their work was assessed using a 10-point Likert scale ranging from 1 (no impact) to 10 (huge impact).

Clinical records were assessed to retrieve data on date, number, and type of stroke. Stroke type was categorized as transient ischemic attack, ischemic, hemorrhagic or other type (venous thrombosis, subarachnoid hemorrhage).

Statistical analysis

Statistical analysis was performed using STATA 15.1 (College Station, TX, 2009). Data were described as counts and proportions for categorical variables and means and standard deviations (SD) for normally distributed continuous variables. Unconditional logistic regression models were fitted to compute gender and age-adjusted odds ratios (ORs) and the respective 95% confidence intervals for the association between sociodemographic, stroke-related and rehabilitation and support characteristics with RTW. The final model was adjusted for gender, age, education, stroke type, stroke impact and rehabilitation during admission.

Results

Characteristics of the participants

Among the 553 stroke survivors who were professionally active at the time of the stroke, more than half were men (Table 1). Around 20 months after stroke, the mean (SD) age was 54.8 (10.8) years. More than two-thirds of the stroke survivors were married or lived with a partner (70.4%), and almost 40% had four or less years of education, while approximately 30% had more than 10 years of formal education. Nearly 70% of the participants had blue-collar occupations and 38% described a household income lower than 1000€, while almost 30% did not know or preferred not to answer the question. More than 50% considered to live in an urban area.

For 86.1% of the participants, the stroke during the study period was the first one they had, and the ischemic etiology was the most frequent (68.5%) (Table 1). Based on the Post Stroke Checklist, during the first 20 months after stroke 64.4% of the stroke survivors reported motor impairments due to stroke, 59.1% emotional changes, 54.4% cognitive complaints, 33.5% had pain and 17.7% presented bowel and bladder complaints. While almost one-quarter of the sample never drove in their life, 15% stopped driving after stroke. More than half of the survivors had a mRankin of 0 or 1 (no or very slight dependence), with only 8% having a mRankin 4 or 5 (severe dependence). Similarly, the majority of participants (83%) had a score of more than 90 on Barthel Index (slight dependency), and only 4% scored less than 60 (severe dependency).

According to the survivors report, 46.4% were not evaluated or treated by the rehabilitation services during hospital admission (Table 1). Among those who were observed, more than three-quarters performed rehabilitation treatment during admission. After discharge, more than half did not do any rehabilitation treatments, and only 16.6% were still doing rehabilitation treatment at the time of the survey. Access to social or community support after discharge was only used by approximately 12% of stroke survivors and during a limited period of time; only 1.8% kept formal or community support nearly 20 months’ post-stroke.

Professional reintegration

On average, 56.6% (95% CI 52.4–60.8) of stroke survivors resumed professional activity, 20 months after stroke. Among those, 79.5% returned to work during the first 6 months after stroke, 12.8% between 6 and 12 months, and 7.7% more than 12 months after stroke (Figure 1).

Overall, approximately 90% of the survivors who RTW, resumed to the same job and same function they performed before stroke (Figure 1). The majority, 91.5%, did not receive reintegration support. Of those who did, 1.6% reported receiving support from a Professional Reintegration Center, 5.5% from Occupational Medicine and 1.3% from other types of support networks (Public Institute for Employment and Vocational Training, psychological support, colleagues’ support or employment entity support). The medium (SD) number of weekly working hours significantly decreased from 43.53 (13.33) to 42.14 (12.36) after stroke ($p=0.028$) (Figure 2). Most survivors (63.3%) stated a minor impact of stroke (1,2 or 3 out of 10) on their job (Figure 1).

The prevalence of RTW after stroke, decreased significantly with age (≥ 60 years vs. <50 years: OR = 0.26; 95% CI 0.17–0.41) (Table 2). Contrariwise, a progressive positive association was observed for education and income (>10 years vs. ≤ 4 years: OR =

Table 1. Sociodemographic, stroke-related, and rehabilitation and support characteristics of the participants (*n* = 553).

	n(%)
Sociodemographic characteristics	
Gender	
Female	204 (36.9)
Male	349 (63.1)
Age (years)	
<50	164 (29.7)
50–59	183 (33.2)
≥60	205 (37.1)
Marital status	
Married/cohabiting	385 (70.4)
Single/divorced/widowed	162 (29.6)
Educational level (years)	
≤4	209 (38.1)
5–9	180 (32.8)
≥10	160 (29.1)
Occupation	
Blue collar	389 (70.6)
White collar	162 (29.4)
Household income (€/month)	
≤1000	208 (38.0)
>1000	186 (34.0)
Does not know	64 (11.7)
Prefer not to answer	89 (16.3)
Neighborhood	
Urban	284 (54.6)
Rural	236 (45.4)
Stroke-related characteristics	
Previous stroke	
No	476 (86.1)
Yes	77 (13.9)
Stroke type	
Ischemic	359 (68.5)
Hemorrhagic	70 (13.4)
Transient ischemic attack	59 (11.3)
Other type ^a	36 (6.9)
Stroke impact ^b	
Motor	356 (64.4)
Bowel and bladder	98 (17.7)
Cognitive	301 (54.4)
Emotional	327 (59.1)
Pain	185 (33.5)
Driving	
Never drove	134 (24.5)
Stop driving after stroke	82 (15.0)
Resume driving after stroke	330 (60.4)
mRankin ^c	
0–1	307 (55.5)
2	139 (25.1)
3	63 (11.4)
4–5	44 (8.0)
Barthel Index ^d	
<60	22 (4.0)
60–90	72 (13.0)
>90	459 (83.0)
Rehabilitation and support characteristics	
Rehabilitation during admission	
Not observed	249 (46.4)
Observed, with rehabilitation treatment	217 (40.4)
Observed, without rehabilitation treatment	71 (13.2)
Rehabilitation after discharge	
Never	289 (52.3)
Yes, but not anymore	172 (31.1)
Yes, till inquiry date	92 (16.6)
Formal or community support after discharge	
Never	488 (88.3)
Yes, but not anymore	55 (9.9)
Yes, till inquiry date	10 (1.8)

Note: Total does not add 553 in all variables due to missing data.

^aVenous thrombosis and subarachnoid hemorrhage.

^bBased on Post Stroke Checklist (PSC) [32].

^cmRankin [33] 0–1: no/very slight dependence; 2: slight dependence; 3: moderate dependence; 4–5: severe dependence.

^dBarthel Index [34] <60: severe dependence; 60–90: moderate dependency; >90: slight dependency.

4.54; 95% CI 2.75–7.50; and 1000€/month vs. ≤1000€/month: OR = 2.34; 95% CI 1.51–3.61, respectively), after adjustment for gender and age. Survivors who did not know their monthly household income were less likely to RTW (OR = 0.40; 95% CI 0.21–0.76), while those who prefer not to answer to this question or with an income above 1000€, RTW more frequently (OR = 2.11; 95% CI 1.25–3.58), in comparison with participants stating a monthly household income equal or below 1000€. Participants with white-collar occupations were more likely to RTW after stroke (OR = 2.12; 95% CI 1.41–3.18).

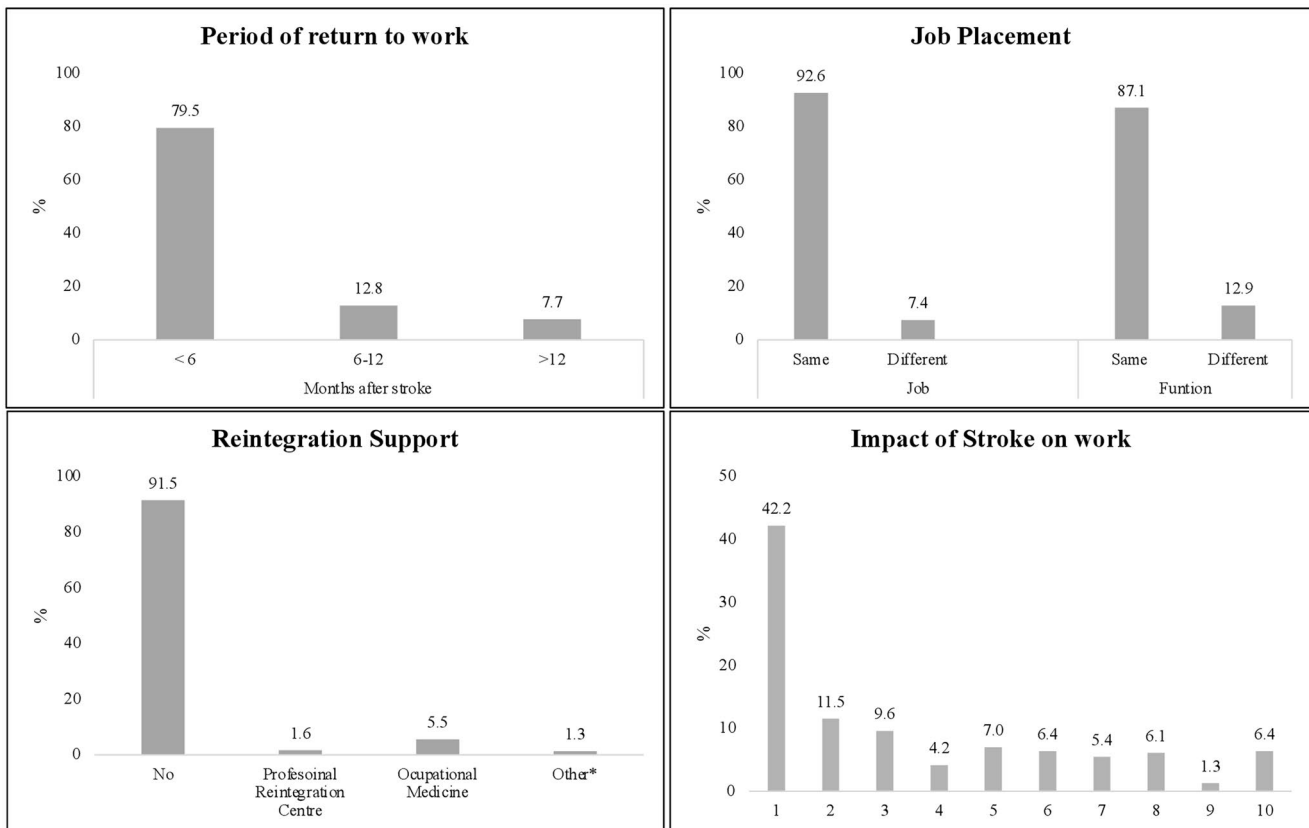
Stroke-related characteristics revealed a significant impact on RTW, even after adjustment for gender and age (Table 2). Stroke survivors without previous stroke events returned to work more frequently than those who had more than one stroke (OR = 0.53; 95% CI 0.32–0.87). Having a transient ischemic attack predicted an almost six-fold better chance of RTW, in comparison with an ischemic damage (OR = 5.90; 95% CI 2.58–13.51). Reporting any kind of stroke impairment, namely motor (OR = 0.10; 95% CI 0.06–0.16), bowel and bladder (OR = 0.52; 95% CI 0.33–0.82), cognitive (OR = 0.38; 95% CI 0.26–0.54), emotional (OR = 0.28; 95% CI 0.19–0.41) or pain-related (OR = 0.38; 95% CI 0.26–0.56) significantly reduced the odds of RTW among survivors. Regarding driving, those who resume driving after stroke were significantly more likely to RTW than those who stopped driving (OR = 24.26; 95% CI 11.43–51.52). As the mRankin functional scale gets worse, the less likely the stroke survivor was to RTW (4–5 vs. 0–1: OR = 0.01; 95% CI 0.00–0.05). Supporting these results, a Barthel Index of more than 90, predicted a better chance of RTW (>90 vs. <90: OR = 7.94; 95% CI 4.44–14.23) (Table 2). No RTW stroke survivor punctuated less than 55 on Barthel Index.

Considering rehabilitation services and support after stroke, participants who were not observed as well as those who were observed by the rehabilitation team but did not initiated treatment during admission, returned more frequently to work (OR = 3.34; 95% CI 2.24–4.98 and OR = 2.63; 95% CI 1.48–4.68, respectively), than those who were observed and were submitted to rehabilitation treatment, after adjustment for gender and age. Stroke survivors who continue to receive rehabilitation treatment after discharge were less likely to RTW. Data suggests that the higher the period of post-discharge rehabilitation, the lower the probability of RTW during the first 20 months after stroke (OR = 0.03; 95% CI 0.01–0.06). Comparing formal or community support, participants who received support were less likely to return to work compared to those who did not receive any level of support (OR = 0.42; 95% CI 0.23–0.76).

Considering sociodemographic, stroke-related and rehabilitation and support characteristics, having 60 or more years old remained inversely associated with RTW (adjusted OR = 0.30; 95% CI 0.16–0.55), while having 10 or more years of education was directly associated with RTW (adjusted OR = 3.35; 95% CI 1.84–6.11) (Table 2). The positive and significant association previously described between transient ischemic attack and RTW also persisted after adjustment (adjusted OR = 4.58; 95% CI 1.83–11.44), but when assessing the stroke impact, only the association with motor impairment remained statistically significant (adjusted OR = 0.17; 95% CI 0.10–0.31) (Table 2). Finally, participants who were observed by the rehabilitation team during admission and initiated treatment were still less likely to RTW (adjusted OR = 0.48; 95% CI 0.29–0.78).

Discussion

The present study provides a characterization of the main aspects of professional reintegration after stroke. Despite good functional



* Public Institute for Employment and Vocational Training, psychological support, colleagues' support or employment entity support.

Figure 1. Professional reintegration characteristics, among stroke survivors who RTW.

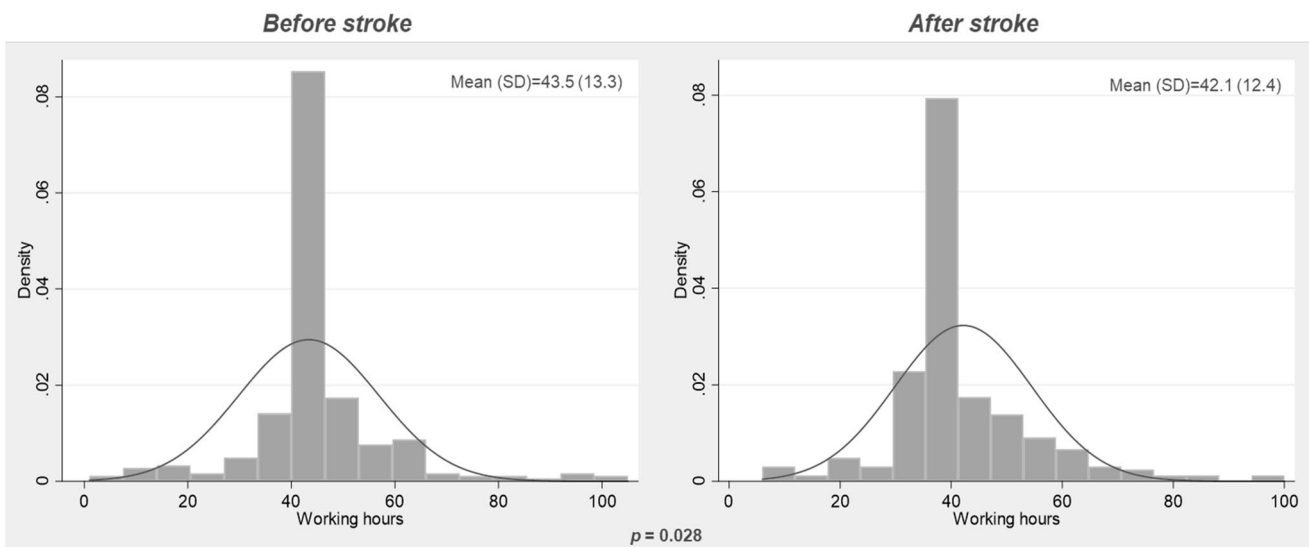


Figure 2. Number of weekly working hours before and after stroke, among stroke survivors who return to work.

recovery, the results revealed a significant lack of professional reintegration, with low RTW rate and access to reintegration services.

A major advantage of this study was the inclusion of data regarding professional reintegration and not only the RTW rate. We observed that most stroke survivors returned to work in the first six months after stroke, with the majority resuming to the same job and same function, without any reintegration support.

Previous data supports these results, describing that the highest rate of RTW occurs between zero and six months and increases at a slower rate after this period [2,35]. It is recognized that stroke survivor-centered vocational programs, mostly those delivered at the workplace, are effective in facilitating RTW and job retention after a stroke [19,36]. This should be delivered by an integrated, cross-sector multi-disciplinary team in a combination of work-directed interventions, coaching/education and/or skills

Table 2. Prevalence of return to work after stroke and adjusted odds ratios for the association with sociodemographic, stroke-related and rehabilitation and support characteristics.

	n(%)	Adjusted OR (95%CI) ^a	Adjusted OR (95%CI) ^b
Sociodemographic characteristics			
Gender			
Female	122 (59.8)	1	1
Male	191 (54.7)	1.02 (0.70–1.48)	0.91 (0.57–1.46)
Age (years)			
<50	121 (73.8)	1	1
50–59	105 (57.4)	0.48 (0.30–0.75)	0.66 (0.38–1.15)
≥60	87 (42.4)	0.26 (0.17–0.41)	0.30 (0.16–0.55)
Marital status			
Married/cohabiting	215 (55.8)	1	
Single/divorced/widowed	93 (57.4)	0.88 (0.60–1.30)	
Educational level (years)			
≤4	82 (39.2)	1	1
5–9	104 (57.8)	1.74 (1.14–2.67)	1.54 (0.91–2.59)
≥10	127 (79.4)	4.54 (2.75–7.50)	3.35 (1.84–6.11)
Occupation			
Blue collar	191 (50.5)	1	
White collar	117 (70.1)	2.12 (1.41–3.18)	
Household income (€/month)			
≤1000	99 (47.6)	1	
>1000	134 (72.0)	2.34 (1.51–3.61)	
Does not know	17 (26.6)	0.40 (0.21–0.76)	
Prefer not to answer	57 (64.0)	2.11 (1.25–3.58)	
Neighborhood			
Urban	174 (61.3)	1	
Rural	137 (58.1)	0.89 (0.62–1.28)	
Stroke-related characteristics			
Previous stroke			
No	282 (59.2)	1	
Yes	31 (40.3)	0.53 (0.32–0.87)	
Stroke type			
Ischemic	191 (53.2)	1	1
Hemorrhagic	31 (44.3)	0.67 (0.40–1.14)	0.78 (0.41–1.46)
Transient ischemic attack	52 (88.1)	5.90 (2.58–13.51)	4.58 (1.83–11.44)
Other type ^c	23 (63.9)	0.98 (0.46–2.09)	0.42 (0.16–1.07)
Stroke impact^d			
Motor	144 (40.5)	0.10 (0.06–0.16)	0.17 (0.10–0.31)
Bowel and bladder	41 (41.8)	0.52 (0.33–0.82)	1.09 (0.63–1.89)
Cognitive	139 (46.2)	0.38 (0.26–0.54)	0.79 (0.48–1.29)
Emotional	149 (45.6)	0.28 (0.19–0.41)	0.73 (0.44–1.20)
Pain	77 (41.6)	0.38 (0.26–0.56)	0.80 (0.50–1.30)
Driving			
Never drove	52 (38.8)	4.21 (1.87–9.48)	
Stop driving after stroke	9 (11.0)	1	
Resumed driving after stroke	249 (75.5)	24.26 (11.43–51.52)	
mRankin^e			
0–1	243 (79.2)	1	
2	58 (41.7)	0.17 (0.11–0.27)	
3	11 (17.5)	0.06 (0.03–0.11)	
4–5	1 (2.3)	0.01 (0.00–0.05)	
Barthel Index^f			
<90	16 (17.0)	1	
>90	297 (64.7)	7.94 (4.44–14.23)	
Rehabilitation and support characteristics			
Rehabilitation during admission			
Not observed	170 (68.3)	3.34 (2.24–4.98)	1
Observed, with rehabilitation treatment	88 (40.6)	1	0.48 (0.29–0.78)
Observed, without rehabilitation treatment	43 (60.6)	2.63 (1.48–4.68)	0.98 (0.50–1.92)
Rehabilitation after discharge			
Never	225 (77.9)	1	
Yes, but not anymore	79 (45.9)	0.25 (0.16–0.38)	
Yes, until inquiry date	9 (9.8)	0.03 (0.01–0.06)	
Formal or community support after discharge			
Never	291 (59.6)	1	
Yes, but not anymore	22 (40.0)	0.42 (0.23–0.76)	
Yes, until inquiry date	0 (0.0)	–	

^aAdjusted for gender and age.^bAdjusted for gender, age, education, stroke type, stroke impact and rehabilitation during admission.^cVenous thrombosis and subarachnoid hemorrhage.^dBased on Post Stroke Checklist (PSC) [32].^emRankin [33] 0–1—no/very slight dependence, 2—slight dependence, 3—moderate dependence and 4–5—severe dependence.^fBarthel Index [34] <60—severe dependence, 60–90—moderate dependency, and >90—slight dependency.

training [37]. An approach that includes not only physical rehabilitation but also psychosocial, employment and caregiver support services, also present meaningful results in the RTW process [23] and is effective for both slower and long term results after a stroke [15]. The involvement of the employers in this process is of most significance [38], being recognized the benefits of having vocational rehabilitation specialists support during the hiring process. This multi-professional approach, taking into consideration the specific needs of stroke survivors, increases RTW rate and professional reintegration with benefits for both the survivors and the society [18,19,21].

Literature describes a highly variable rate of RTW after a stroke, ranging from 7.3% to 75% across studies [2,3]. An average of 20 months' post-stroke, our data described a RTW rate of approximately 57%, in accordance with other studies with similar approaches, criteria and follow up time [35,39]. The variability of RTW rate and predictors of RTW are justified by the different populations assessed, the different periods of assessment, the type of stroke considered and the heterogeneous concept of RTW across studies [6]. To increase professional reintegration, and more specifically, the RTW rate of stroke survivors, it is important to assess it across the post-stroke trajectory, to explore and understand its determinants, and to define strategies to promote professional reintegration among the most disadvantaged survivors.

The most significant sociodemographic determinants of RTW were age and socioeconomic status. Younger stroke survivors, under the age of 50 years old, were more likely to RTW than older stroke survivors, as previously described in literature [3,22]. In Portugal the official retirement age of the general population is 66 years of age. However, the government pays a sick leave for up to three years and the possibility of retiring earlier with the full pension amount, for people who have a disability. This appears to justify the RTW rate decline after the age of 60 years old [40]. Regarding gender outcomes, our results found no difference between gender on RTW rate as opposed to the findings from other studies where it was demonstrated that being a male increases the odds of RTW after a stroke [3,20].

In accordance with previous published data [17,18,21,22], socioeconomic status, including better educational level, higher income and white-collar job type, was a main determinant for RTW. Our data cannot find a relationship between RTW and income necessity. To deeply approach this question, a comprehensive qualitative study that investigates the reasons for RTW or non RTW would be required. Existing qualitative studies found that some people in fact RTW because they had a financial need to do it, but others refer that the main reasons are a sense of feeling useful, busy and socially important [24,41].

The impact on motor function and a worst functional performance were also associated with a lower RTW rate but after adjustment, only motor impairments remained significantly associated with RTW. In fact, the inverse association between blue-collar stroke survivors and RTW is usually understood as a result of the motor impairments [9,18–20], since these workers typically perform more physical tasks and our results support these findings. Besides, *Glader* et al. verified that impaired functional status after stroke is more common in patients with lower socioeconomic status, emphasizing the existence of socioeconomic differences in RTW [42]. Lack of access to health education and poorer/late access to health institutions, reduce the success of acute phase treatments and rehabilitation treatments after stroke among poorer survivors [43,44]. Rehabilitation programs and professional reintegration centers should consider socioeconomic disparities and focus on giving stroke survivors the opportunity

to readapt their function according to their impairments or change their tasks, keeping the same job place [15,23,45].

Our data revealed that most stroke survivors had great functionality results in the instruments used. This goes against the idea that functional performance is detrimental for RTW and professional reintegration. In fact, stroke patients are often unable to RTW besides good physical recovery [2,35]. Cognitive and emotional impact, are both very important factors that influence RTW for those who otherwise display excellent functional recovery [2] and a lack of formal evaluation may have underestimated its impact on RTW, in our sample. The ability to drive after a stroke also represents a major determinant for RTW that can be related to both motor and cognitive impairment and represent a barrier for those who need to use their own vehicle to work [46]. In previously driving stroke survivors it is important to determine the need to continue driving after a stroke. In Portugal, patients remain legally allowed to drive after stroke events unless they are notified to the authorities' as incapable. For these cases and if necessary, a driving ability appointment is mandatory to determine both the motor and cognitive ability and safety for driving and to evaluate the vehicle adaptations and financial support required, which may help their community and professional reintegration [13,46].

It was not possible to determine the main reasons why more than half of the stroke survivors were not observed by a rehabilitation team and/or did not take part in any rehabilitation treatment during admission and after discharge. Although it is possible that some stroke survivors that were seen by a rehabilitation doctor were unable to remember it, our results seem to support that lower stroke impact and good functional status were the main reason for not being observed or treated. Such would explain why participants who were observed by the rehabilitation team during admission and did rehabilitation treatment during admission and after discharge, and presented the worst functional outcomes, were less likely to RTW. Besides, probably because our sample had such great functional status, only 16% of stroke survivors continue rehabilitation treatment at 20 months after stroke. However, rehabilitation support is considered an important tool not only to improve and maintain functional status but also to promote community and professional integration, both in short and long term after stroke [13,47,48].

Indeed, social support (that may include professional support to RTW, access to social benefits, participation in daily living activities, maintaining contact with family and friends and organizing financial affairs) and community support (such as day hospital programs, community and/or home-based rehabilitation programs, and community recreational programs) are as important as rehabilitation support for successful reintegration [49,50]. However, in our sample almost 90% of the participants had no formal social or community support after discharge. This appears to be in line with the findings across Europe, where the lack of social support for stroke survivors is still a concern [51]. In Portugal, it occurs mainly due to poor literacy skills, of how to require it and given the bureaucratic procedures that it evolves, affecting mostly those who live in rural and isolated areas [52], and the lower socioeconomic and unskilled stroke survivors' workers, preventing them from RTW [49,50,53]. Lack of community and social support contributes to a sense of abandonment of stroke survivors, lower their quality of life and limit awareness on social rights (e.g., financial aids, rehabilitation support, psychological counseling, professional reintegration support) and social management of daily life activities (e.g., information on driving after stroke, arrange housekeeping, participation in activities of daily life, dealing with disabilities) [49,50,54].

Study limitations

This is a regional based study with a high participation rate and a representative sample size. However, some limitations should be discussed. Data collection via telephone is likely to have excluded a number of participants who are not competent and/or feel comfortable using telephones, but also those who present impaired cognitive skills that impact on their ability to express their physical and psychosocial limitations. However, telephone interviews are a widespread method of data collection among this population turning into a useful method of contact. Previous literature concluded that in an after stroke setting, they are a valid and reliable method for assessing both functional and cognitive outcomes [55,56], even when assessing sensible data [55,56], in this after-stroke setting. Additionally, the subjective information of the stroke impact reported by survivors is a meaningful information that can be related to their RTW and professional reintegration success [57].

Because this was not a prospective study and medical records are not registered in a standardized and uniform way across all stroke units, some stroke-related data (as is the case of NIHSS, acute therapy (thrombolysis or thrombectomy) and location of stroke), had missing information that did not allow its use to analyze an association with RTW, as previously suggested by other studies. However, we believe that data collected regarding the type of stroke and functional status could attenuate this limitation and be interpreted as a proxy of the severity of the disease. Regarding workplace-related factors for RTW, because the current work aimed to assess the professional reintegration among professionally active stroke survivors, patients who were unemployed or job seeking at stroke onset were excluded. Although previous literature supports higher difficulties in being professionally active among previously unemployed stroke survivors [18], we believe that their work integration would be dependent on other variables, beyond stroke, and we decided to implement a more conservative approach, trying to minimize the possibility of bias.

Many collected data were self-reported, which may lead to social-desirability bias. However, this is a frequent method of data collection reported on recent literature [58,59], Patient Reported Outcome Measures (PROMS) are a patient-centered approach that represents a value-based health care [60], and the instruments used are a valid and reliable method for assessing both functional and cognitive outcomes even though telephone interview [55,56]. Furthermore, to minimize this possible bias, all clinical data was revised by a physician specialized on stroke and rehabilitation.

Informal carers were used as proxys of the stroke survivors when they were unable to answer the questionnaire. This may impose some information bias that needs to be addressed, especially on more subjective domains [61] However, although a systematic review reported that proxy respondents mostly overestimated impairments compared with patient self-reports [62], the authors also showed that beyond the acute stroke period, the reliability of proxy respondents for validated scales of ADL (as the ones used in this study) was substantial to excellent [62]. Another study, aiming to assess the validity and responsiveness of proxy-responses compared to patient-responses across multiple domains (including cognitive function, physical function, satisfaction and QoL), concluded that in stroke patients with >3 months from stroke, proxy-reported PROMs demonstrated strong and even better validity than patient-reported PROMs [63]. Additionally, in the current study, the proportion of answers by proxy represented 5% of the total sample which is not enough to influence the final results. Also, by including participants who receive carer support to answer the questionnaire from them, the sample was not restricted to the better functional status stroke survivors. In fact,

if these participants were excluded, we would be inducing another selection bias, as the participants would be significantly different from the excluded population.

Conclusions

This study highlights that age and socioeconomic status appear to be the main determinants for RTW and that professional reintegration and vocational support after stroke remain below the expected goals for community reintegration of stroke survivors. A key finding was that the majority of stroke survivors returned to work in the first six months after stroke, and that globally they resumed to the same job and same function, without any reintegration support. Future studies should explore the perception of the impact of professional and social reintegration of stroke survivors on their psychological health and quality of life. It is essential to study the barriers and challenges of stroke survivors, and the strategies used in the rehabilitation process, in order to improve our knowledge and propose new strategies for their professional reintegration. Understanding the current status of professional reintegration among stroke survivors can be useful to respond to international recommendations and implement integrated people-centered approaches, that place the needs and rights of stroke survivors and their communities at the center of health and social systems.

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