

Predicting change in labour market participation of people with spinal cord injury (SCI): Longitudinal evidence from the Swiss SCI community survey

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Abstract

Study Design—Longitudinal, population-based survey.

Objective—To examine change in labour market participation (LMP) of people with spinal cord injury (SCI) living in Switzerland and to identify predictors of increase, decrease and stability in LMP between 2012 and 2017.

Setting—Community.

Methods—Longitudinal information on LMP (i.e., weekly workload) was obtained from 311 gainfully employed, working-age individuals who participated in the Swiss Spinal Cord Injury Cohort Study (SwiSCI) community survey in 2012 and were still of working age at the time of completing the 2017 questionnaire. Statistical preselection of the predictors of change in LMP was carried out by implementing the least absolute shrinkage and selection operator (LASSO) in

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Data Archiving

Owing to our commitment to SwiSCI study participants and their privacy, datasets generated during the current study are not made publicly available but can be provided by the SwiSCI Study Center based on reasonable request (contact@swisci.ch).

Statement of Ethics

Ethical approval for Survey 2012 was approved by the principal ethics committee on research involving humans of the Canton of Lucerne (KEK Luzern, internal application 11042, approved 28.06.2011) and subsequently endorsed by the additional involved cantonal ethics committees of Cantons Basel-Stadt (EK Basel, internal application 306/11, approved 06.09.2011) and Valais (CCVEM Sion, internal application CCVEM042/11, approved 06.12.2011). Ethical approval for Survey 2017 was granted by the leading ethical institution Ethikkommission Nordwest-und Zentralschweiz (EKNZ, Project-ID: 11042 PB_2016-02608, approved Dec 2016). We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research.

Conflicts of Interest

The authors declare that they have no conflict of interest.

Author Contributions

BT, CE, MF and KK were responsible for designing the conceptual framework of the study. CE and KK conducted the statistical analysis. KK, CE and BT prepared the manuscript. MF, US and AS substantially contributed to the data interpretation and the article preparation. AS provided valuable input from vocational integration practice.

a multinomial logistic regression model. The final set of predictors was selected by comparison of several multinomial logistic regression models.

Results—Out of 311 participants, almost half (43%) changed their LMP between 2012 and 2017, 48 increased their weekly workload, 49 reduced and 37 participants left the labour market prematurely. Age at time of the survey, years of education, having children, intention to change weekly workload, high satisfaction with daily routine, extra-time needs for transportation and managing support were associated with change in LMP.

Conclusions—Modifiable factors like education and satisfaction with daily routine should receive particular attention in the context of job retention strategies. More longitudinal research focusing on key employment transitions and trajectories over the life course of persons with SCI is needed to complement, validate and extend our findings.

1 Introduction

Labour market participation (LMP) of people with spinal cord injury (SCI) varies greatly between individuals: some remain employed until retirement age, while others gradually reduce their working hours or leave the labour market early before reaching statutory retirement age [1–3]. Employment rates of people with SCI drop drastically after SCI onset [3], and vary widely across countries ranging from 10.3% in Morocco to 61.4% in Switzerland, as evidenced by a recent study covering 22 countries worldwide [4]. Despite LMP representing a key goal of SCI rehabilitation [5], employment rates of those affected are still between 19.7% (Switzerland) to 59.3% (Brazil) lower compared to the general population [4]. The individual differences in employment trajectories of people with SCI [2, 6, 7] raise the question of why some affected individuals stay permanently employed until retirement age, while others drop out prematurely of the labour market.

Previous research showed that LMP of persons with SCI is influenced by various characteristics at the level of the person and the environment. These characteristics include sociodemographic factors such as age, sex, race, education and pre-SCI work history [8–10], injury-related characteristics such as age at and time since SCI, level and severity of injury [11]. Moreover, health-related aspects such as secondary health conditions (e.g. pain or depression), functional independence, psychological factors such as self-efficacy and environmental factors like workplace accessibility and insurance policies represent additional key determinants of LMP [10]. Previous research conducted in Switzerland is in line with most of these findings [7, 12–14]. However, due to its prevailing cross-sectional nature and because the few existing longitudinal analyses [2, 6, 7] did not focus on a comprehensive description of the determinants of within-person variation in LMP, little is known about the predictive power of the above-described factors in explaining changes in LMP over time.

The Swiss health care system performs very well regarding indicators such as life expectancy, public satisfaction and perceived quality [15]. The basic self-paid health insurance, which is mandatory, covers a wide range of goods and services for curative and rehabilitative care. The Swiss government supports the system by subsidizing the private insurance providers. Additional insurance providers from the social security scheme such

as the Swiss Accident Insurance (Suva) and the Swiss Disability Insurance (IV) fund rehabilitation and vocational integration services that have the goal of returning individuals to the labour market. However, because the Swiss health care system is also highly complex, fragmented and charged with a poor case coordination, the Swiss health care costs and the share of out-of-pocket payments are exceptionally high compared to other European countries [15].

For the majority of the individuals with SCI, the situation is particularly well in the Swiss health care system. Four specialized centres for SCI provide inpatient and outpatient medical, psychological, social and vocational rehabilitation and integration services along individuals' life course. The initial acute and post-acute rehabilitation is conducted by an interprofessional team, typically takes 3 to 9 months (depending on the SCI severity) and aims to increase the individuals' autonomy and ability to participate in major life areas [16]. Additional inpatient and outpatient vocational integration and job coaching services support individuals in returning to and maintaining work or during vocational retraining if returning to the pre-injury job is not possible [17, 18]. These services are most often funded by the IV and partly also by the Suva. After discharge from their initial inpatient rehabilitation, individuals may seek further support from ParaHelp (i.e. a specialized home care institution for persons with SCI) or from the Swiss Paraplegic Association (SPA) that provides life and peer counselling and helps with housing, legal and financial issues [19].

However, despite of available services studies within the frame of the Swiss Spinal Cord Injury Cohort (SwiSCI) study, for instance, showed that between 20 and 30% of the affected individuals who initially return to work drop out or withdraw from the labour market before statutory retirement age [1, 12, 14]. Longitudinal evidence on the predictors of change in LMP over time may inform practitioners and policy makers on key targets of interventions that support a sustainable vocational integration of persons with SCI.

The objective of this study was thus to examine change in LMP of people with SCI living in Switzerland. Specifically, we aimed (1) to describe the change in LMP over a time of five years and (2) to investigate the predictors of increase, decrease and stability in LMP over this time.

2 Methods

2.1 Study design and participants

We conducted a longitudinal study using data of individuals with SCI who participated in the 2012 and the 2017 community surveys of the SwiSCI [20]. The SwiSCI community survey aims to collect longitudinal data on all Swiss residents aged over 16 years with a traumatic or non-traumatic SCI and is conducted every five years, starting for the first time in 2012. Details on the SwiSCI study design, sampling strategy and recruitment are provided elsewhere [20]. For the purpose of our study, we included individuals of working age (the statutory working age in Switzerland is 16 to 63 for females and 16 to 64 for males) who participated in the 2012 and the 2017 surveys and who were gainfully employed when they completed the 2012 survey.

2.2 Measures

The SwiSCI questionnaire modules are available online [21]. Our outcome variable was change in LMP between 2012 and 2017 of those participants who indicated to be gainfully employed in the 2012 survey. Change in LMP between 2012 and 2017 was operationalized based on information on LMP status and weekly workload that was collected in both surveys with the same multiple-choice question (“What is your current working situation?”). Participants who selected the response options “working for wages with an employer” or “self-employed” were also asked to report their weekly workload in percentages of a full-time equivalent of a standard 42-hour week in Switzerland. Based on this information, participants were assigned to one of the four following groups of LMP change between 2012 and 2017:

- (1) people who increased their weekly workload,
- (2) people whose weekly workload remained the same,
- (3) people who decreased their weekly workload,
- (4) people who changed their work status from paid work to no paid work.

2.3 Data analysis

2.3.1 Variable selection—First, potential predictor variables at the level of socio-demographic, health-related, functioning-related, psychological and environmental factors were selected based on the most recent international and Swiss evidence on determinants of LMP among persons with SCI [7, 12–14]. We then checked whether information on these variables was collected in the 2012 SwiSCI community survey and agreed upon our variable selection with vocational integration experts involved in the survey development. Table 1 presents the predictors that were finally included in the analysis, along with the collapsing strategy we applied to overcome the skewed distribution of the response options. All information on our predictor variables is from the 2012 survey.

Statistical preselection of the predictors of change in LMP was carried out by implementing the least absolute shrinkage and selection operator (LASSO) in a multinomial logistic regression model. The reference category was the group with the same weekly workload in 2017 as in 2012. Similar to backward selection regression, LASSO regression is shrinking the coefficients of non-important predictors (also called discarded predictors) to 0 [22]. Unlike the backward selection regression, LASSO regression has no restriction on the numbers of considered predictors. The selection of predictors with nonzero coefficients (retained predictors) is based on a penalty to the sum of the absolute values of the regression coefficients in the minimization of the residual sum of squares [23]. The larger the value of the penalty, the more predictors are discarded. We selected the value of the penalty using the ten-cross validation procedure [24].

To enhance the stability of the estimated associations, LASSO regression was applied to 100 bootstrap samples with replacement. Each generated bootstrap sample has the same distribution in the LMP as the original data. For each predictor, the number of samples in which it was retained was calculated.

2.3.2 Descriptive statistics and regression analysis—Descriptive statistics of participant characteristics and predictor variables (i.e. absolute and relative frequencies for categorical variables, median and interquartile ranges for continuous variables) were calculated based on the SwiSCI 2012 survey, stratified by the four groups of LMP change.

Four multinomial regressions with predictors selected in 50%, 60%, 70%, and 80% of the 100 bootstrap samples were carried out. The predictors from the model with the smallest Akaike information criterion (AIC), that measures a model's predictor error [25] were considered as the best predictors of our outcome.

All analyses were performed using the software R version 3.6.0 for Windows [26]. LASSO regression was performed using the R package glmnet [27] and multinomial logistic regression was conducted using the R package nnet [28]. Missing data were imputed using the R package missForest [29], which represents a distribution free missing value imputation technique based on random forests. Variables with more than 20% missing values were excluded.

3 Results

3.1 Sample characteristics

Figure 1 details the constitution of our study sample. A total of 311 participants fulfilled our inclusion criteria, i.e. of working age and gainfully employed in 2012. Almost half of the participants (n=134) changed their weekly workload from 2012 to 2017: 48 increased, 49 decreased it and 37 dropped out of the labour market. The median age of the three groups was 47, 41 and 52, respectively, and 45 for participants who didn't change their weekly workload. The median age of a whole sample was 46 and the median age at SCI event 26 years.

Table 2 shows the socio-demographic, SCI-related sample characteristics and descriptive statistics of the predictor variables, stratified by the different groups of LMP change. The average weekly workload of our sample was 57.1% in 2012 and 56.6 % in 2017.

3.2 Predictors of change in LMP

3.2.1 Selection of predictor variables—In the first step of the analysis, 14 predictors were retained by the LASSO regression in at least 50% of the bootstrap samples. These were: age at the time of the 2012 survey, age at the time of SCI onset, having children, years of education, intention to change the current weekly workload, satisfaction with quality of life, satisfaction with daily routine, satisfaction with participation in sports, spasticity, sleep, SCI severity, household income, SCI-related extra-time needs for (a) managing support and (b) outdoor transportation. The mean LASSO coefficients and their confidence intervals calculated across the generated 100 bootstrap samples are provided in the Appendix 1.

3.2.2 Predictors of change in LMP—The multinomial logistic regression model with those predictor variables that were retained in more than 70% of the bootstrap samples showed the best fit (AIC=674.03 compared to AIC=690.97 for the 50%, AIC=677.73 for the 60%, and AIC=678.89 for the 80% model). The results of the 70% bootstrap model are

presented in Table 3, while the ones of the 50%, 60% and 80% models are provided in the Appendices 2, 3, and 4. The coefficients of the regression analysis describe the estimated change of the relative logit of being in a specific group compared to the reference group (i.e. no change in weekly workload between 2012 and 2017). The coefficients are to be interpreted for one unit change in a continuous predictor variable and for changing from the reference category to a specific other category in a categorical predictor variable, holding all other predictor variables constant. The main results can be summarized as follows:

- 1) The likelihood of being in the group of participants who *increased their weekly workload* between 2012 and 2017 as compared to being in the reference group is increased for participants who indicated an intention to work more in 2012.
- 2) The likelihood of being in the group of participants who *decreased their weekly workload* as compared to the reference group is lower for participants with children, a higher age at the time of the survey and higher SCI-related extra-time needs for managing support. By contrast, the likelihood is higher for persons who indicate an intention to work less in 2012 and who have more SCI-related extra-time needs for outdoor transportation.
- 3) The likelihood of being in the group of participants who *dropped out of the labour market* as compared to the reference group is increased by a higher age at the time of the survey and by the intention to work more in 2012. By contrast, participants with children, more years of education and higher satisfaction with their daily routine are less likely to drop out of paid work compared to those with the same weekly workload as in 2012.

4 Discussion

Based on longitudinal data of community-dwelling individuals with SCI living in Switzerland, we identified a number of predictors of change in LMP over a time period of 5 years. Age, education, having children, intention to change the current weekly workload, satisfaction with daily routine and SCI-related extra-time needs for transportation and managing support were most strongly associated with change in LMP. These factors should receive particular attention in the context of job retention strategies.

Our study contributes to the existing literature by identifying predictors of within-person change in LMP using longitudinal data. Our finding that more than half of the participants did not change their work status between 2012 and 2017 is in line with previous longitudinal SwiSCI research [7]. Along with our finding that 12% of the participants dropped out of the labour market between 2012 and 2017, this suggests a low likelihood of becoming unemployed once individuals have established a stable work situation and implies that dropouts tend to happen more often in the first phase after returning to the labour market or that people do not return to work at all after SCI onset. This highlights the importance of return-to-work and early job retention or coaching programs.

Beyond previous research showing that age, having children and education influences the current work status [7, 9, 12–14, 30], we also found these factors to be associated with change in LMP over time. For instance, education is one of the factors that was most

consistently reported to positively influence LMP both in Switzerland [7, 12–14] and internationally [9]. Our results are also in line with qualitative research that identified having children as well as the need to support them and to act as a role model as a strong motivator for employment [31].

Chronological age was related to change in LMP in two different ways. First, participants who were older at the time of the 2012 survey were less likely to reduce their weekly workload and, second, they were more likely to drop out than to maintain their workload between 2012 and 2017. These seemingly contradictory results might be explained by the median age of the different LMP change groups (41 years for participants who decreased their weekly workload, 52 years for those who dropped out of the labour market and 45 for those who maintained their weekly workload). While middle-aged participants seem to prefer stability, early retirement becomes a more realistic and attractive option for the older ones. Our findings showed that people with SCI would stay employed with the same workload or leave the labour market prematurely than gradually reduce their workload with increasing age to the point of early retirement. It might also be that gradual reduction of weekly workload might not yet be established in the labour market, might not be possible in particular occupations or might not be feasible for individuals working with already small weekly workload.

While it is not surprising that participants who wanted to work more in 2012 were more likely to increase and those who wanted to work less in 2012 more likely to decrease their working hours, it is rather perplexing that the likelihood of labor market dropout is increased among those who wanted to increase their workload in 2012. While this result should be treated with caution due to the small number of people who wanted to increase their weekly workload in 2012 and dropped out by 2017 (n=4), it nevertheless could be related to the fact that 3 of those 4 participants had only recently sustained their injury (1 to 4 years before the 2012 survey). Therefore, their early dropout could be an indication of an unsuccessful stabilization of their initial work situation. Reflecting on our findings, reducing one's current workload might also be a meaningful individual strategy to stay longer in the labour market instead of dropping out prematurely because of the accumulation of work-related health issues. Yet the reduction in weekly workload or a drop out from the labour market might also have been the result of environmental factors that are beyond the control of the individual such as an organizational restructuring or a company shutdown. We tried to grasp this complexity by including a variable addressing one's intention to change the weekly workload. However, the available data and the five-year time interval are not fine-grained enough to draw firm conclusions regarding the voluntary or involuntary nature of these observed changes in LMP.

Contrary to a previous cross-sectional study that found SCI-related extra-time needs for managing support to be a negatively associated with work status [14], we found that the devotion of more time to manage support because of SCI was associated with a lower probability of decreasing the workload. However, this comparison should be treated with caution, as the mentioned cross-sectional study treated this same variable as ordinally scaled (whereas we as continuously) and analyzed a different outcome (i.e. work status and not change in a weekly workload). One possible explanation for our result could be that people

who invest more additional time in organizing support might receive more health-related services that help them to maintain their workload. This factor might be specific for Switzerland with its high availability of health care services in general and the exceptional quality of care in the specialized SCI centres in particular. In addition, the effort these people invest in organizing support might be an indication of their high motivation to stay employed. Contrary to our finding on SCI-related extra-time needs for managing support, we found that more extra-time needs for outdoor transportation increased the probability of reducing the workload. Considering the significant amount of time, the person already has to invest in selfcare and other activities resulting from living with SCI, spending extra-time for transportation and commuting might be a barrier to stable LMP.

Satisfaction with one's daily routine turned out to be a protective factor in our analysis. Participants who were satisfied with their daily routine had a lower risk to drop out from the labor market compared to those in the reference group. Our results thus confirm findings from qualitative studies that have previously identified satisfaction with one's daily routine and good adjustment to life after injury as important factors [32, 33]. Additionally, motivation to work more turned out to be predictive for increasing the workload.

Contrary to previous cross-sectional evidence on factors associated with work status [13, 14], secondary health conditions did not turn out to be a significant predictor of change in LMP in our study. This contradicting longitudinal finding might be explained by several factors. First, the SCI-SCS response options were collapsed differently in previous studies [13, 14] (no/mild problems vs moderate/significant problems) than in our study (no problem vs mild/moderate/ significant problem). Our decision was made because we aim to provide clinicians and vocational integration professionals with a screening tool that helps to identify people at risk of labour market dropout. Even a mild problem may develop into a moderate or severe one over time and identifying it at early stage may foster timely interventions to prevent its progression and negative effect on labour market participation [33, 34]. Second, a five-year time window between surveys might not be fine-grained enough to tackle the influence of secondary health conditions on LMP change, especially because the Spinal Cord Injury Secondary Conditions Scale (SCI-SCS) [35], which was used for assessing the secondary health conditions, asks about their prevalence during the past three months before completing the survey, thus not providing a long-term perspective. Moreover, because we examined change in LMP over time of those who were employed in 2012, our study might have missed individuals with severe health issues who were not employed because of their health state already in 2012.

4.1 Strengths and limitations

A major strength of our study is the comprehensive longitudinal data set allowing us to examine determinants of within-person changes of LMP over the time period of five years. Additionally, by identifying not only predictors of reduced LMP, but also factors contributing to stable or increased LMP, this study points towards targets for preventive interventions.

However, our study has also some limitations. First, the small sample size calls for caution with regard to data interpretation, possible implications and generalizability of our findings.

In particular, the relatively small number of respondents in some of the outcome groups meant that several predictor response categories were sparsely populated, resulting in wide confidence intervals for the regression coefficients. We tried, however, to mitigate this limitation by using bootstrapping modelling. Second, the lack of time up-dated information on LMP (e.g. change in LMP status and weekly workload) and the predictor variables within the longtime interval of five years between the two measurement limits the scope of our study for properly interpreting within-person changes in LMP. Finally, the specialized facilities for individuals with SCI in Switzerland provide a comprehensive spectrum of acute care, rehabilitation and vocational integration services for persons with SCI that are usually covered by the Swiss health, accident or disability insurers. These system-level factors contribute to Switzerland having the highest employment rate of people with SCI worldwide [4]. The predictors for LMP change we identified in our study may thus not be generalizable to other countries with different health and social security systems and policies.

4.2 Practical, policy and research implications

By conducting a longitudinal study on the predictors of within-person change in LMP, our analysis revealed groups at risk of not participating in the labour market as well as protective factors related to the increase of workload. The study thus provides pointers on targets of interventions to support LMP stability in the Swiss SCI population. For example, policy makers should invest in educational programs and vocational integration practitioners should address satisfaction to ensure job retention of people with SCI. Additionally, predictors of reducing the workload or dropping out of the labour market should inform the screening process in job retention programs and outpatient check-ups to identify individuals at risk. When detecting their problematic work situation sufficiently early, individuals could receive individualized support or a re-evaluation of their current job situation to prevent them from getting overburdened and dropping out of the labour market.

Longitudinal life course studies with a sufficiently granular collection of time updated data on work life transitions and trajectories would be beneficial to extend our current knowledge on LMP of individuals with SCI. Additionally, when complemented by qualitative research on the dynamics in individuals' work life, future research could sharpen our understanding on how to support sustainable work over the life course of those affected.

5 Conclusion

Based on a longitudinal analysis of a community-dwelling sample of individuals with SCI living in Switzerland, we identified predictors of within-person change in LMP over a time period of five years. Age, education, having children, intention to change the current weekly workload, satisfaction with daily routine and SCI-related extra-time needs for transportation and managing support were most strongly associated with change in LMP. The identified predictors should be taken into consideration in a continuous monitoring at the workplace and during regular check-ups at medical centres to detect risk constellations timely and to subsequently provide support people who are at risk of dropping out of the labour market. In addition, key determinants of LMP stability such as education and satisfaction with daily

routine should be taken up by interventions at the level of policy and practice to promote sustainable LMP of persons living with SCI.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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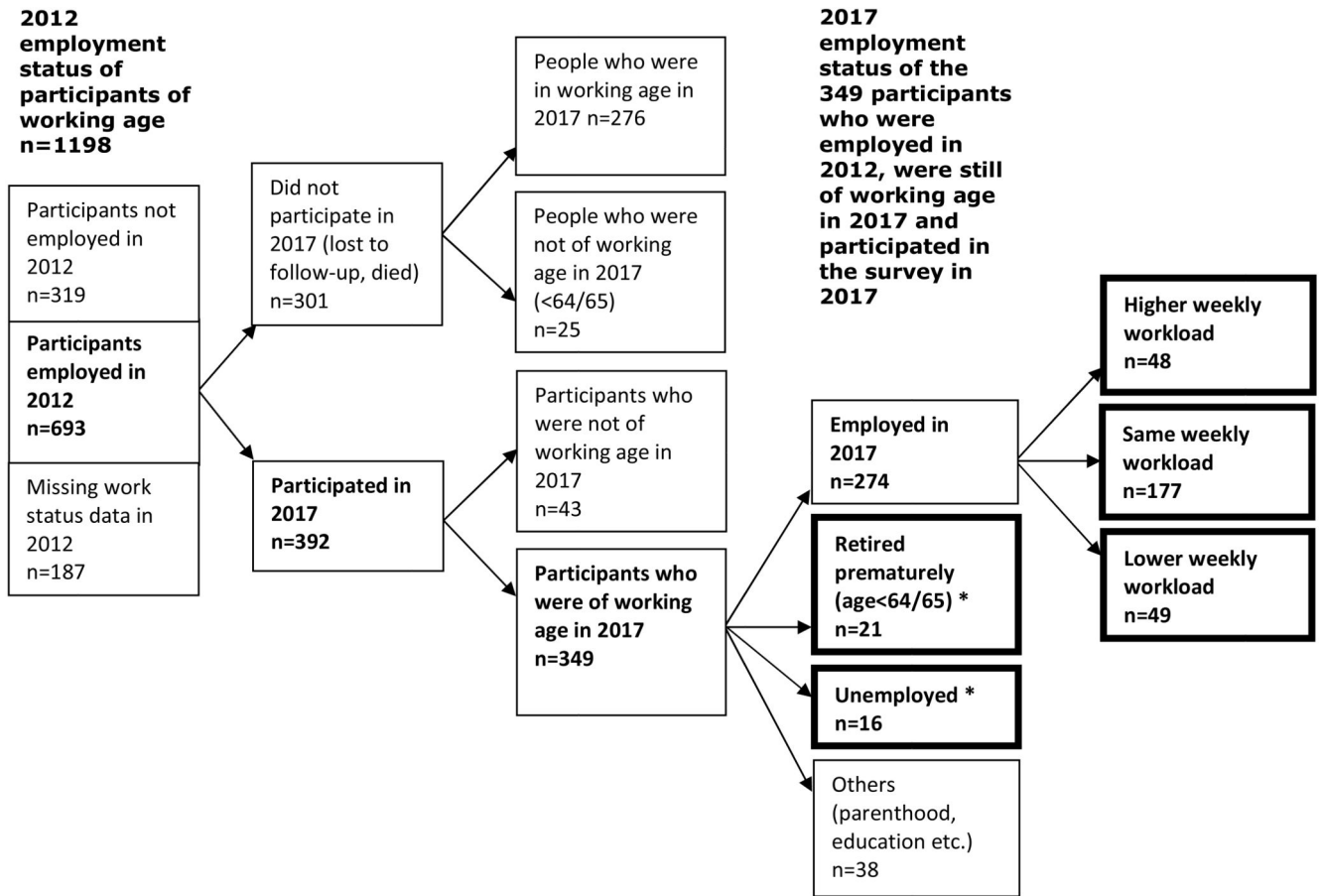


Figure 1. Overview on the selection and size of our study sample, including the four different groups of LMP change

Participants selected for the study participated in the 2012 as well as the 2017 SwiSCI community survey, were employed at the time of the 2012 survey and still of working age in 2017 (boxes with bold lines on Fig 1). Participants were assigned to the following four groups during analysis:

- people who increased their weekly workload between 2012 and 2017,
- people who were employed the same weekly workload in 2017 as in 2012,
- people who decreased their weekly workload between 2012 and 2017,
- people who changed their work status from paid work to no paid work between 2012 and 2017 (retired prematurely or are unemployed).

* These groups were combined for the analysis

Table 1
Predictor and outcome variables used in the study and collapsing strategy for variables with categorical response options

Variables	Original response options	Collapsing strategy
Predictor variables:		
Socio-demographic factors:		
Gender	1=Male 2=Female	0=Male 1=Female
Age at the time of the survey	Continuous variable	
Marital status	1=single (never married) 2=married 3=widowed 4=divorced 5=registered partnership	Combined into "Relationship status": 0=Single (categories: single, widowed, divorced, not having partner) 1=In a relationship (i.e. married, in a partnership, having partner)
Partner	0=No 1=Yes	
Having children	0=No 1=Yes	0=No 1=Yes
Education years	Continuous variable	
Household income [30, 36–38]	1=Less than 1500 CHF 2=Between 1500...3000 CHF 3=Between 3000...4500 CHF 4=Between 4500...6000 CHF 5=Between 6000...7500 CHF 6=Between 7500...9000 CHF 7=More than 9000 CHF	0=Less than 4500 CHF 1=Between 4500...7500 CHF 2=More than 7500CHF
SCI-related factors:		
SCI type	3=Paraplegia 6=Tetraplegia	Combined into "SCI severity": 3=Complete tetraplegia 2=Incomplete tetraplegia 1=Complete paraplegia 0=Incomplete paraplegia
SCI degree	1=Complete 2=Incomplete	
Age at SCI event in years	Continuous variable	
Health-related factors:		
Health problems: chronic pain, decubitus, urinary tract infection, spasticity, sleep, bladder dysfunction, bowel dysfunction	0=No problem 1=Mild/infrequent problem 2=Moderate/occasional problem 3=Significant/chronic problem	0=No problem 1=Mild/infrequent problem; Moderate/occasional problem; Significant/chronic problem
Tiredness	0=None 1=Mild 2=Moderate 3=Severe 4=Extreme	0=No problem 1=Mild/ Moderate/Severe/Extreme
Additional disease: Depression	0=No 1=Yes	0=No 1=Yes
Psychological factors:		
Intention to change the current number of working hours	1=More hours 2=Less hours 3=The same amount	1=More hours 2=Less hours 0=The same amount
Satisfaction with quality of life	1=Very bad 2=Bad 3=Fair 4=Good 5=Very good	1=Very bad/Bad 0=Fair 2=Good/Very good

Variables	Original response options	Collapsing strategy
Predictor variables:		
Satisfaction with: health, daily routine, relationships, living conditions, work or education, outdoor mobility, sports, leisure activities at home	1=Very dissatisfied 2=Dissatisfied 3=Neither satisfied nor dissatisfied 4=Satisfied 5=Very satisfied	1=Very dissatisfied/Dissatisfied 0=Neither satisfied nor dissatisfied 2=Satisfied/Very satisfied
Environmental factors:		
Accessibility of workplace or restrooms	1=Very good 2=Rather good 3=Neither good nor bad 4=Rather bad 5=Very bad	2=Rather good/Very good 0=Neither good nor bad 1=Rather bad/Very bad
Problems at work: Parking/Building/Elevator/Devices needed/Accessibility of bathrooms/toilets/Other problems	0=No 1=Yes	0=No 1=Yes
Hindrance due to social attitude	1=Not applicable 2=No influence 3=Made my life a little harder 4=Made my life a lot harder	0= Not applicable/No influence 1=Made my life a little harder/Made my life a lot harder
Extra time for managing support in hours	Continuous variable	
Extra time for outdoor transportation in hours	Continuous variable	
Outcome variables:		
Work status (2012)	1=Paid work 2=Education 3=Unpaid work 4=Unemployed (seeking job) 5=Homemaker 6=Invalidity pension 7=Retired 8=Other	1=Paid work 2=No paid work (categories 2-8)
Weekly workload (2012) in percentage (0% to 100%)	Continuous variable	
Work status (2017)	1=working for wages with an employer, 2=self-employed, 3=unpaid work in family business, 4=working in a sheltered workshop, 5=vocational training or retraining, paid or unpaid, 6=student, 7=housewife, househusband, 8=unemployed, 9=receiving a disability or another pension, 10=retired due to health condition, 11=retired due to age, 12=other	1=Paid work/Self-employed 0=No paid work (categories 3-12)
Weekly workload (2017) in percentage (0% to 100%)	Continuous variable	
Labour market participation change	-	0=The same weekly workload in 2012 and 2017 1=Higher weekly workload in 2017 than in 2012 2=Lower weekly workload in 2017 than in 2012 3=Unemployed/retired in 2017 although still of working age and having been working in 2012

Table 2
Participant characteristics based on the SwiSCI 2012 community survey, stratified by the different groups of LMP change between 2012 and 2017.

Predictor variables	Categories	Total sample n=311 (%)	Higher weekly workload % (n=48)	Same weekly workload % (n=177)	Lower weekly workload % (n=49)	Drop out % (n=37)
Socio-demographic factors:						
Gender	Male	243 (78.1)	15.6	58	14.9	11.5
	Female	68 (21.9)	14.7	53	19.1	13.2
Age at time of the survey *	16 – 24	8 (2.6)	25	37.5	37.5	0
	25 – 39	80 (25.7)	13.8	55	25	6.2
	40 – 54	171 (55)	15.2	63.2	10.5	11.1
	55 – 63/64	52 (16.7)	17.3	42.3	15.4	25
Relationship status	Single	95 (30.5)	19	55.8	12.6	12.6
	In a relationship	216 (69.5)	13.9	57.4	17.1	11.6
Having children	No	221 (71.1)	13.6	53.8	18.6	14
	Yes	90 (28.9)	20	64.4	8.9	6.7
Education in years *	<9	10 (3.2)	20	20	30	30
	9 – 12	47 (15.1)	25.5	51.1	14.9	8.5
	13 – 16	170 (54.7)	13.5	60.6	11.2	14.7
	>17	84 (27)	13.1	57.1	23.8	6
Household income	Less than 4500 CHF	64 (20.6)	12.5	48.4	18.8	20.3
	Between 4500 and 7500 CHF	146 (46.9)	20.5	55.5	13	11
	More than 7500CHF	101 (32.5)	9.9	64.4	17.8	7.9
SCI-related factors:						
SCI severity	Incomplete paraplegia	110 (35.4)	17.3	58.1	15.5	9.1
	Complete paraplegia	124 (39.9)	16.1	59.7	16.1	8.1
	Incomplete tetraplegia	52 (16.7)	9.6	46.2	17.3	26.9
	Complete tetraplegia	25 (8)	16	60	12	12
Age at SCI event *	<16	28 (9)	7.1	57.2	28.6	7.1
	16 – 24	110 (35.5)	14.5	58.2	15.5	11.8

Predictor variables	Categories	Total sample n=311 (%)	Higher weekly workload % (n=48)	Same weekly workload % (n=177)	Lower weekly workload % (n=49)	Drop out % (n=37)
	25 – 39	124 (40)	16.9	59.7	12.1	11.3
	40 – 54	47 (15.2)	19.1	44.8	19.1	17
Health-related factors:						
	No problem	219 (70.42)	14.3	42.8	22.9	20
Health problem: Decubitus	Mild infrequent problem /Moderate occasional problem /Significant chronic problem	92 (29.58)	28.6	57.1	0	14.3
	No problem	128 (41.16)	15.2	58.8	15.2	10.8
Health problem: Urinary tract infection	Mild infrequent problem /Moderate occasional problem /Significant chronic problem	183 (58.84)	14.7	58.2	15.5	11.6
	No problem	88 (28.3)	18.3	51.7	16.7	13.3
	Mild infrequent problem /Moderate occasional problem /Significant chronic problem	223 (71.7)	13.7	57.5	17.4	11.4
Health problem: Spasticity	No problem	84 (27.01)	19.6	55.4	12	13
	Mild infrequent problem /Moderate occasional problem /Significant chronic problem	227 (72.99)	17.2	56.2	12.5	14.1
Health problem: Chronic Pain	No problem	135 (43.41)	14.2	57.4	18	10.4
	Mild infrequent problem /Moderate occasional problem /Significant chronic problem	176 (56.59)	23.9	52.2	15.9	8
Health problem: Sleep	No problem	109 (35.05)	12.1	58.7	15.7	13.5
	Mild infrequent problem /Moderate occasional problem /Significant chronic problem	202 (64.95)	20.2	51.2	15.5	13.1
Health problem: Bladder dysfunctions	No problem	110 (35.37)	13.7	59	15.8	11.5
	Mild infrequent problem /Moderate occasional problem /Significant chronic problem	201 (64.63)	20.7	56.4	14.8	8.1
Health problem: Bowel dysfunctions	No	282 (90.68)	11.4	57.3	16.5	14.8
	Yes	29 (9.32)	14.7	56.9	15.6	12.8
Health problem: Depression	No problem	64 (20.58)	15.8	57	15.8	11.4
Tiredness	Mild /Moderate/Severe/Extreme	247 (79.42)	14.5	60.1	13.6	11.8

Predictor variables	Categories	Total sample n=311 (%)	Higher weekly workload % (n=48)	Same weekly workload % (n=177)	Lower weekly workload % (n=49)	Drop out % (n=37)
Psychological factors:						
Intention to change the current number of working hours	Intention to keep the current number	242 (77.8)	14	62.4	12	11.6
	Intention to work more	21 (6.8)	52.4	23.8	4.8	19
	Intention to work less	48 (15.4)	6.2	43.8	39.6	10.4
Satisfaction with quality of life	Fair	71 (22.8)	12.7	54.9	11.3	21.1
	Very bad/Bad	15 (4.8)	13.3	33.4	33.3	20
	Good/Very good	225 (72.3)	16.4	59.2	16	8.4
Satisfaction with health	Neither satisfied nor dissatisfied	65 (20.9)	20	47.7	21.5	10.8
	Very dissatisfied/Dissatisfied	59 (19)	13.6	57.5	15.3	13.6
	Satisfied/Very satisfied	187 (60.1)	14.4	59.9	13.9	11.8
Satisfaction with daily routine	Neither satisfied nor dissatisfied	36 (11.6)	13.9	47.2	13.9	25
	Very dissatisfied/Dissatisfied	42 (13.5)	11.9	42.9	21.4	23.8
	Satisfied/Very satisfied	233 (74.9)	16.3	61	15	7.7
Satisfaction with relationships	Neither satisfied nor dissatisfied	43 (13.8)	14	44.1	27.9	14
	Very dissatisfied/Dissatisfied	30 (9.6)	16.7	56.7	13.3	13.3
	Satisfied/Very satisfied	238 (76.5)	15.5	59.3	13.9	11.3
Satisfaction with living conditions	Neither satisfied nor dissatisfied	20 (6.4)	5	65	15	15
	Very dissatisfied/Dissatisfied	20 (6.4)	15	40	20	25
	Satisfied/Very satisfied	271 (87.1)	16.2	57.6	15.5	10.7
Satisfaction with work/education	Neither satisfied nor dissatisfied	37 (11.9)	10.8	43.3	24.3	21.6
	Very dissatisfied/Dissatisfied	27 (8.7)	14.8	48.2	22.2	14.8
	Satisfied/Very satisfied	247 (79.4)	16.2	59.9	13.8	10.1
Satisfaction with outdoor mobility	Neither satisfied nor dissatisfied	43 (13.8)	16.3	60.4	14	9.3
	Very dissatisfied/Dissatisfied	45 (14.5)	6.7	51	15.6	26.7
	Satisfied/Very satisfied	223 (71.7)	17	57.5	16.1	9.4
Satisfaction with sport	Neither satisfied nor dissatisfied	60 (19.3)	13.3	50.1	23.3	13.3
	Very dissatisfied/Dissatisfied	49 (15.8)	10.2	53.1	22.4	14.3
	Satisfied/Very satisfied	202 (65)	17.3	59.9	11.9	10.9

Predictor variables	Categories	Total sample n=311 (%)	Higher weekly workload % (n=48)	Same weekly workload % (n=177)	Lower weekly workload % (n=49)	Drop out % (n=37)
Satisfaction with leisure activities at home	Neither satisfied nor dissatisfied	27 (8.7)	7.4	55.6	25.9	11.1
	Very dissatisfied/Dissatisfied	12 (3.9)	16.7	58.3	8.3	16.7
	Satisfied/Very satisfied	272 (87.5)	16.2	57	15.1	11.7
Environmental factors:						
Problems at work	No	201 (64.6)	15.9	55.3	16.9	11.9
	Yes	282 (90.7)	15.2	59.3	14.5	11
Accessibility of workplace or restrooms	Neither good nor bad	29 (9.3)	17.2	34.5	27.6	20.7
	Rather bad/Very bad	64 (20.6)	18.8	62.4	9.4	9.4
	Rather good/Very good	247 (79.4)	14.6	55.4	17.4	12.6
Hindrances due to social attitude	Not applicable/No influence	203 (65.3)	15.8	57.1	14.3	12.8
	Made my life a little harder/Made my life a lot harder	108 (34.7)	14.8	56.5	18.5	10.2
Extra time for managing support*	<1 h	84 (34.3)	11.9	57.1	14.3	16.7
	1 - 2 h	66 (26.9)	12.1	57.6	19.7	10.6
	2 - 5 h	69 (28.2)	15.9	52.3	18.8	13
	>5 h	26 (10.6)	11.5	57.8	11.5	19.2
Extra time for outdoor transportation*	<1 h	45 (17)	13.3	68.9	11.1	6.7
	1 - 2 h	52 (19.6)	15.4	63.5	11.5	9.6
	2 - 5 h	110 (41.5)	14.5	50.9	16.4	18.2
>5 h	58 (21.9)	15.5	51.8	24.1	8.6	
Continuous variables:						
Age at time of the survey in years	Median [Q1-Q3]	46 (38 - 52)	47 (39 - 52)	45 (39 - 51)	41 (33 - 51)	52 (43.5 - 56)
Age at SCI event in years	Median [Q1-Q3]	26 (20 - 34)	27.6(21 - 34)	26(19.5 - 33.5)	24(17.5 - 34.5)	27(21 - 38.5)
Education in years	Median [Q1-Q3]	14 (13 - 17)	13 (12 - 15.5)	14 (13 - 17)	15(13 - 18)	13(13 - 15.78)
Extra time for managing support in hours	Median [Q1-Q3]	1.37 (0.5 - 3)	1(0 - 2.94)	1.33(0.38 - 3)	1.73(1 - 3)	2(1 - 3.6)
Extra time for outdoor transportation in hours	Median [Q1-Q3]	3 (1 - 5)	2.75(1 - 5)	2(1 - 5)	3.04(1.5 - 7)	3(2 - 4.21)

* These variables were used as continuous in the analyses and presented as categorical for descriptive reasons only.

Table 3
Model with those predictors that were selected in 70% of the bootstrap samples in the LASSO regression.

Variable	Response option	Estimates (95% Confidence interval)		
		Higher number of working hours (Ref.=same number)	Lower number of working hours (Ref.=same number)	Drop out (Ref.=same number)
Intercept		-1.41 (-2.537, -0.283)	-1.631 (-2.8, -0.462)	-0.528 (-1.508, 0.452)
Age at the survey in years	Age at the survey in years	0.122 (-0.286, 0.53)	-0.533 (-0.936, -0.13)	0.602 (0.097, 1.106)
Having children	Having children (Ref: = Not having children)	0.045 (-0.69, 0.78)	-1.288 (-2.215, -0.361)	-1.255 (-2.306, -0.203)
Years of education	Years of education	-0.328 (-0.714, 0.058)	0.079 (-0.284, 0.441)	-0.493 (-0.903, -0.084)
Age at SCI event in years	Age at SCI onset in years	0.014 (-0.374, 0.401)	0.318 (-0.12, 0.756)	0.117 (-0.282, 0.515)
Intention to change the weekly workload	Intention to work more (Ref: = Intention to keep the current number of working hours)	2.580 (1.328, 3.832)	-0.112 (-2.383, 2.159)	1.748 (0.195, 3.302)
	Intention to work less (Ref: = Intention to keep the current number of working hours)	-0.414 (-1.7, 0.871)	1.675 (0.856, 2.494)	0.392 (-0.748, 1.531)
Satisfaction with daily routine	Dissatisfaction with daily routine (Ref. = Neither satisfied nor dissatisfied)	-0.538 (-2.13, 1.054)	0.781 (-0.679, 2.240)	-0.189 (-1.469, 1.090)
	Satisfaction with daily routine (Ref.=Neither satisfied nor dissatisfied)	-0.155 (-1.293, 0.983)	-0.013 (-1.184, 1.158)	-1.71 (-2.777, -0.644)
SCI-related extra time for managing support	SCI-related extra time for managing support	-0.293 (-0.969, 0.383)	-0.756 (-1.361, -0.151)	-0.114 (-0.639, 0.412)
SCI-related extra time for outdoor transportation	SCI-related extra time for outdoor transportation	-0.047 (-0.614, 0.519)	0.748 (0.252, 1.243)	-0.224 (-0.883, 0.436)

AIC: 674.0326

Ref. – reference category

AIC - Akaike information criterion