



ELSEVIER

Contents lists available at ScienceDirect

## Journal of Psychosomatic Research

journal homepage: [www.elsevier.com/locate/jpsychores](http://www.elsevier.com/locate/jpsychores)

# Does well-being suffer when control in productive activities is low? A dyadic longitudinal analysis in the disability setting

Christine Fekete<sup>a,b,\*</sup>, Hannah Tough<sup>a,b</sup>, Martin W.G. Brinkhof<sup>a,b</sup>, Johannes Siegrist<sup>c</sup><sup>a</sup> Swiss Paraplegic Research, Nottwil, Switzerland<sup>b</sup> Department of Health Sciences and Health Policy, University of Lucerne, Lucerne, Switzerland<sup>c</sup> Senior Professorship 'Work Stress Research', Faculty of Medicine, University of Düsseldorf, Life-Science-Center, Düsseldorf, Germany

## ARTICLE INFO

## Keywords:

Productive activities  
Well-being  
Socioeconomic position  
Informal caregivers  
Spinal cord injury

## ABSTRACT

**Objectives:** We investigate the relationship between control in productive activities (paid work, housework, caregiving) and well-being in persons with a physical disability and their caregiving partners from a dyadic perspective, exploring not only the effect of own control on well-being, but also the effect of the partners' control on well-being. We further evaluated socioeconomic and caregiving characteristics as potential risk factors for low control in productive activities.

**Methods:** Longitudinal dyadic data from the pro-WELL survey ( $n = 246$ ) including persons with spinal cord injury (SCI) and their caregiving partners were used and mixed-effects regression modelling was applied. Well-being was operationalized with a cognitive (Satisfaction with Life Scale, SWLS) and an affective component (Positive and Negative Affect Scale, PANAS).

**Results:** Control at work was positively related to well-being in persons with SCI, but less so in caregiving partners. Control in housework and caregiving was associated with higher well-being. The partners' control was linked to affective well-being. Poor socioeconomic conditions were negatively related to control at work and in caregiving, but not to control in housework. Caregiving characteristics seem unrelated to control at work or housework, but higher objective caregiver burden was linked to reduced control in caregiving.

**Conclusions:** Our findings suggest that low control in productive activities are common in the disability setting and represent an instrumental factor for reduced well-being that is augmented by poor socioeconomic conditions and high objective burden of care. Interventions aiming to optimize well-being through the integration in productive activities should take into account opportunities of exerting control.

## 1. Introduction

Control in productive activities exerts beneficial effects on health and well-being [1]. Control is understood as a feature of environmental conditions and the personal evaluation of feelings of autonomy and mastery in a given situation that enables individuals to respond with positive appraisal, enhanced motivation, and overt behaviour [2]. High control in paid work was related to better self-reported health [3] and reduced risk of stress-related disorders [4], such as coronary heart disease (CHD) [5,6], mental health [7–11], and metabolic syndrome [12]. Similar beneficial effects were observed in unpaid productive activities, including reduced CHD risk in women with respect to control in housework [13], as well as depression and well-being in relation to control in informal care [14,15].

However, the extent to which low control in productive activities

affects well-being in persons with physical disabilities remains largely unexplored. Given their functional limitations, persons with physical disabilities are at risk of dropping out of the labour market, of being forced to change their jobs, or to reduce their workload [16–18]. These conditions often result in lower responsibility, reduced opportunities for decision making and assignment of tasks with low levels of control. We therefore assume that persons with physical disabilities less often benefit from the positive effects of control at work on well-being. Low control over household tasks might also be more prevalent in persons with physical disabilities as their functional capacity limits their ability to manage tasks optimally. Similarly, their informal caregivers are likely to experience low control in productive activities if the burden of care limits the access to high quality jobs or if caring includes inevitable tasks, such as transfers, support with eating, drinking or self-care which the person with disability cannot do unassisted. As the care-receiver

\* Corresponding author at: Guido A. Zäch Strasse 4, 6207 Nottwil, Switzerland.

E-mail address: [christine.fekete@paraplegie.ch](mailto:christine.fekete@paraplegie.ch) (C. Fekete).

<https://doi.org/10.1016/j.jpsychores.2019.04.015>

Received 12 November 2018; Received in revised form 25 April 2019; Accepted 25 April 2019

0022-3999/ © 2019 Published by Elsevier Inc.

may feel the partner's strain created by the low control in caregiving, feelings of guilt or powerlessness may impact on the care-receiver's well-being. This example underlines the importance to examine control in productive activities in couples coping with disabilities from a dyadic perspective, exploring not only the effect of own control on well-being, but also the effect of the partner's control on well-being.

Besides the importance of detecting well-being effects of control in productive activities in persons with disabilities or informal caregivers, it is of similar importance to identify factors associated with low control. Evidence from general population studies shows for example that persons in lower socioeconomic positions are at risk of experiencing low control in paid work [19,20] or housework [11,13]. Furthermore, a high burden of informal care is likely to create conflicts between different life spheres that might impact upon the opportunity to access jobs with high responsibility or control. Likewise, a high caregiver burden may reduce the control over home and caregiving activities, given the potential overload created by the volume of everyday tasks. Whether socioeconomic conditions and the caregiving situation relate to control in productive activities in persons with disabilities or caregiving obligations remains however largely unexplored.

In light of the substantial research gaps identified for the setting of disability, we aim to investigate 1) whether own control in productive activities (paid work, housework, caregiving) is associated with well-being ('actor effects'), 2) whether the partners' control is associated with own well-being ('partner effect'), and 3) whether socioeconomic conditions and the caregiving situation relate to control in productive activities. These aims are studied in the context of a longitudinal dyadic study on couples defined by a person with a physical disability, spinal cord injury (SCI), and a caregiving partner. Persons with SCI sustain a complete or partial loss of sensory and motor function below the lesion level which markedly impacts on health and functioning [21]. As a consequence, engagement in productive activities is generally restricted, and many affected persons depend on informal care [22], which is often provided by the partner or spouse [23].

## 2. Methods

### 2.1. Participants and data collection

We used data from the pro-WELL study, a longitudinal survey of persons with SCI and their caregiving partners including three waves (baseline; month 6; month 12). The study's main objective was to explore how social relationships and productive activities impact upon well-being [24]. The pro-Well study sample is characterized by a mean time since injury of about 24 years and thus assesses long-term outcomes of the psychological adaptation process after the onset of SCI. Pro-WELL is nested within the community survey of the Swiss Spinal Cord Injury Cohort Study (SwiSCI) [25,26]. The SwiSCI survey included residents of Switzerland who sustained a traumatic or non-traumatic SCI and were aged above 16 years at time of survey. Persons with congenital conditions causing the SCI, new SCI during palliative care, neurodegenerative disorders, and Guillain-Barré syndrome were excluded from the SwiSCI survey. Given that a central registry on persons with SCI is not available in Switzerland, the SwiSCI population was recruited through three specialized SCI-rehabilitation centers, the national association for persons with SCI (Swiss Paraplegic Association), and a SCI-specific home care institution [27]. Of 3144 eligible persons, 1922 participated in the survey and are used as sampling frame for the pro-WELL study. Inclusion criteria for the pro-WELL study were French or German language skills, 30–65 years of age, and having a partner involved in caregiving who was also willing to participate. Out of the population-based sampling frame of 1922 SwiSCI participants, 676 met eligibility criteria and 133 persons with SCI and their partners participated at baseline (response rate 19.7%). In total, 123 couples ( $n = 246$ ) completed at least two waves and were thus included in longitudinal analysis. The baseline non-response analysis indicated

good representation of the source population, and a drop-out analyses revealed no bias towards sociodemographic and lesion characteristics at wave 2 and 3. Further details on inclusion criteria, recruitment outcomes, participation rates, and non-response were previously reported [24].

The baseline assessment consisted of a telephone interview (75 items for persons with SCI; 99 items for partners) and a written questionnaire (paper-pencil or online; 128 items SCI; 119 items partner). The follow-up assessments at month 6 and 12 included 129 items for both person groups (SCI and partners). We offered the participants to choose their preferred data collection mode at follow-up (standardized telephone interview, paper-pencil, or online questionnaire) to minimize attrition rate. In this study, we used longitudinal data that were collected between May 2015 and January 2017. The study protocol and all measurements were approved by the Ethical Committee of Northwest and Central Switzerland (document EKNZ 2014–285). Regulations concerning informed consent and data protection were strictly observed and all participants signed an informed consent form.

### 2.2. Measures

*Control at work* was measured with four items from the Job Content Questionnaire (JCQ) [28] assessing control in organizing work, developing new skills, choosing the work pace, and the involvement in central decisions of the organization. Control in *housework* was assessed with two items on the control over tasks and the freedom to organize daily housework [13]. Control in *caregiving* was assessed with two items on restrictions in personal plans due to caregiving and the feelings of being forced to overtake caregiving tasks. All control items were rated on a four-point scale ranging from 0 'completely disagree' to 3 'completely agree', with higher scores indicating higher control. For each activity, a sumscore over the control items was built (work: 0–12; housework and caregiving: 0–6). To capture potential additive effects of control on well-being, we calculated a sumscore over all productive activities for the subgroup of persons with SCI involved in housework and paid work and for partners involved in housework, paid work and caregiving. The sumscore was based on the assumption that all control domains are equally important for well-being, therefore, the original work control scale (0–12) was weighted with 0.5 to achieve the same scales weighting (control sumscore SCI: 0–12; caregiving partners: 0–18).

*Well-being* was operationalized with a cognitive and an affective component, including a global cognitive judgment of satisfaction with one's life, and the assessment of experiences of positive and negative emotions. The five-item Satisfaction with Life Scale (SWLS) was used to measure the cognitive component of well-being [29]. The items were rated on a five-point Likert scale ranging from 1 'strongly disagree' to 5 'strongly agree' [30]. A sumscore was calculated (5–25), with higher scores representing better life satisfaction. The Positive and Negative Affect Scale short form (PANAS-S) was used to assess the affective component of well-being [31]. The PANAS-S includes a positive and a negative affect subscale (five items each) assessing the strength of emotions on a five-point scale. For both subscales, a 5–25 sumscore was generated. Higher positive subscale scores indicate more positive affect, higher negative subscale scores indicate more negative affect.

*Socioeconomic conditions* were assessed using information on education, household income, and subjective social position. Education was measured as total years of formal education, combining school and vocational training [32]. In persons with SCI, education was defined as years of formal education before potential retraining due to disability. Income was assessed by net equivalent household income, including data on disposable household income weighted by household members [33]. The MacArthur Scale of Subjective Social Status was used to measure the subjective evaluation of one's position in society, represented by a 10-rung ladder [34]. Given their relative stability over time, socioeconomic conditions were measured only at baseline.

The *caregiving situation* was assessed by objective caregiver burden and the availability of external support in caregiving. The objective caregiver burden was measured by daily hours of caregiving and type and load of help provided [35]. Six items from the Personal Activities of Daily Living (ADL) scale and five items from the instrumental ADL (IADL) scale were used [35]. All items were rated on a three-point scale (0 'no help provided', 1 'some help provided', 2 'much help provided'). A sumscore for ADL (0–12) and IADL (0–10) was calculated, higher scores indicating more help provided. The availability of external professional support was measured with a single dichotomous item (receiving external support vs. not receiving support).

**Confounders.** The selection of confounders was informed by directed acyclic graphs (DAGs) which allow the visualization of interrelationships between variables of interest, in our case control in productive activities, well-being and various factors that potentially affect this association [36]. The purpose of a DAG is to identify the appropriate set of variables that need to be adjusted for as to principally facilitate causal inference [36]. First, candidate confounders and the interrelationships between variables were established based on the literature and theory. Second, we validated the DAG by exploring the presumed relationships (edges) between variables (nodes) in bivariate analysis, and subsequently removing all non-significant relationships. Third, the minimal sufficient adjustment set was derived and used to estimate the total effect of low control on well-being. The minimal sufficient adjustment set included the following confounders: age, sex, education as well as health conditions of persons with SCI. The three control variables were not mutually adjusted in the main analysis as the validated DAG indicates that the control variables do not measure a 'common' underlying control dimension. We however performed a sensitivity analysis in which the control dimensions are mutually adjusted for persons involved in all three activities (Appendix B). An illustration of the DAG development and validation is given in Appendix C. Health conditions of persons with SCI were measured using the SCI Secondary Conditions Scale [37], whereby the frequency and intensity of nine common health conditions were rated on a four-point Likert scale (0 'no problem', 1 'mild/infrequent', 2 'moderate/occasional', 3 'significant/chronic'). In order to adjust analysis for the health status of the person with SCI, information on health conditions were imputed to the corresponding caregiving partner. For the analysis of the association of socioeconomic and caregiving characteristics with low control, we identified age, sex and lesion characteristics of persons with SCI as confounders. Given that time since injury was not associated with control in any productive activity, neither in persons with SCI nor in partners, this variable has not been included in analysis.

### 2.3. Statistical analysis

Analyses were conducted using STATA version 14.2 for Windows (College Station, TX, USA). We first described the baseline distribution of study variables and performed comparative analyses using parametric and non-parametric tests to identify differences in basic distributions of main parameters between persons with SCI and their caregiving partners.

The dyadic analysis to address study aims 1 and 2 were informed by the Actor Partner Interdependence Model (APIM) [18,38]. In order to assess the actor and partner effects of control on well-being, we stratified analyses to persons with SCI and caregiving partners and used a two-level mixed model with random effects for persons (level 2) and repeated measures (level 1). Although this analysis strategy does not allow an exploration of directionality of effects, it provides estimates which account for both cross-sectional and longitudinal associations between variables. As all well-being outcomes were non-normally distributed, Tobit and generalized linear models (GLM) were employed. Tobit models account for the left-skewness in the life satisfaction and positive affect scores [39], and the GLM with a gamma distribution was flexible in modelling the negative binomial distribution of the negative

affect score. We used a GLM with the identify link function to provide comparability between coefficients. Clustered (for Tobit models) and robust (for GLM) standard errors were calculated. After running unadjusted models, models for persons with SCI and for caregiving partners were adjusted for age, sex, education, and health conditions of the persons with SCI. We have additionally fitted distinct models in which the control variables were mutually adjusted as part of sensitivity analysis for the subgroup of persons engaged in all activities. All confounders were entered as continuous variables. Multilevel analysis has been shown to be robust to the issue of missing data, therefore no missing data was imputed [40,41]. Selection bias was negligible and thus not accounted for in analysis [24]. We report regression coefficients, 95% confidence intervals and respective *p*-values.

To address study aim 3 (factors associated with low control), we applied linear and Tobit regressions on baseline data, whereby socioeconomic conditions and caregiving characteristics were used as predictors and control in productive activities as continuous outcomes. Due to the non-normal distribution of control in housework and caregiving, Tobit models were employed. We stratified the analysis to account for potential differences between persons with SCI and caregiving partners. Multiple imputation was used on the baseline data to account for item non-response. We applied multiple imputation by chained equations and all missing values of predictors, but not outcomes were imputed. Imputations were carried out for 15 datasets. Besides unadjusted models, models were adjusted for age, sex and lesion characteristics of the person with SCI. We reported coefficients, its 95% confidence intervals and respective *p*-values derived from equal fraction missing information tests.

## 3. Results

Persons with SCI were predominantly male and caregiving partners female. The pro-WELL population was on average 51.2 years old and 54.5% of persons with SCI and 64.2% of partners had paid work. On average, partners provided 1.8 h of care per day. With 71%, paraplegia was the dominant diagnosis and about half of participants indicated an incomplete lesion. Persons with SCI on average lived 24.7 years with the disability. Mean education was around 14 years and subjective social position ranging from 0 to 10 was on average around 6 in both groups. Persons with SCI indicated the household income 185 Swiss Francs higher than their caregiving partners. We observed no statistical differences in basic socioeconomic conditions between persons with SCI and caregiving partners. Persons with SCI rated their control at work higher than their caregiving partners, whereas caregiving partners rated their control in housework higher. On a 0–6 scale, mean control in caregiving was around 4.5. Caregiving partners reported higher life satisfaction, higher positive affect, and lower negative affect than persons with SCI (Table 1).

### 3.1. Control and well-being (actor effects)

Control at work was positively related to cognitive and affective well-being in persons with SCI, while this relationship was less pronounced in caregiving partners ( $p > .05$ ). Control in housework was consistently linked to better cognitive well-being and higher positive affect in both groups and to lower negative affect in caregiving partners. Caregiving partners who rated their control in caregiving higher reported better cognitive well-being and lower negative affectivity (Fig. 1; for adjusted and unadjusted results see Appendix A). The subgroup analysis including persons involved in all productive activities reveals consistent associations of higher additive control with cognitive well-being and positive affect in both person groups and with negative affect in caregiving partners (Appendix A). When mutually adjusting the control variables in the subgroup of persons performing all activities, we observe stable associations between control and cognitive well-being, whereas associations with affective well-being are less

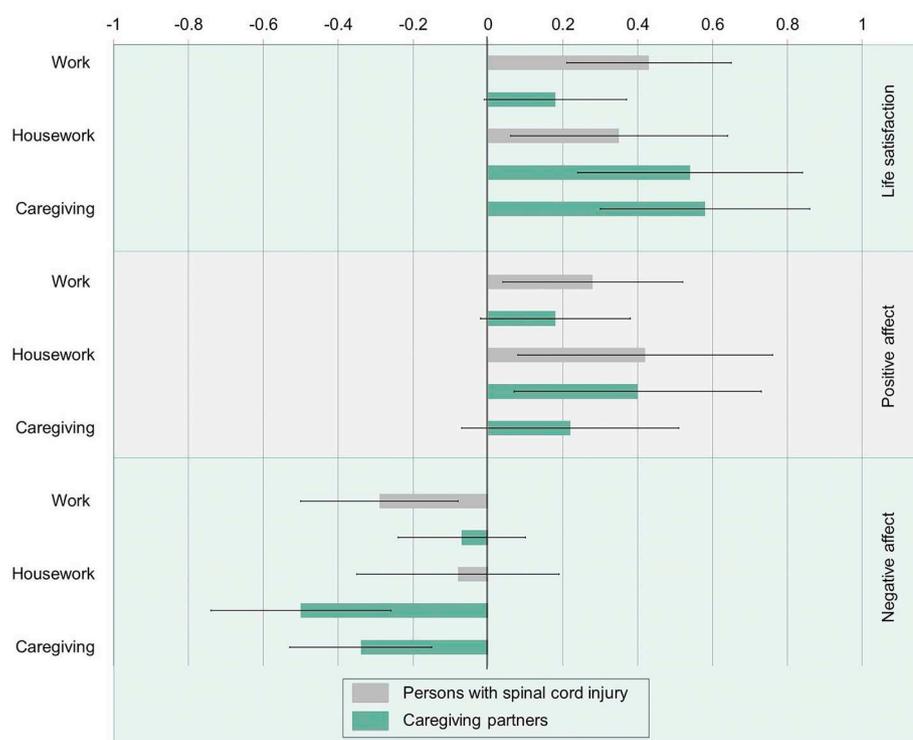
**Table 1**  
Baseline characteristics of the pro-WELL study participants.

	Persons with SCI	Caregiving partners	Difference
Total [Missing values: SCI; partner]	123 (100)	123 (100)	<i>p-value</i> <sup>a</sup>
Categorical variables	N (%; 95% CI)	N (%; 95% CI)	
<b>Sociodemographic characteristics</b>			
Male [0;0]	91 (74.0, 65.4–81.0)	32 (26.0, 19.0–34.6)	< 0.001
Paid employment [0;0]	76 (61.8, 52.8–70.0)	88 (71.5, 62.8–78.9)	0.01
<b>Lesion characteristics</b>			
Lesion severity [2]			N/A
Complete paraplegia	39 (32.2, 24.4–41.2)	--	
Incomplete paraplegia	47 (38.8, 30.5–47.9)	--	
Complete tetraplegia	23 (19.0, 12.9–27.1)	--	
Incomplete tetraplegia	12 (9.9, 5.7–12.8)	--	
External help in caregiving [6]	--	27 (23.1, 15.3–0.31)	
<b>Continuous variables</b>			
	Mean (SD)	Mean (SD)	
Age in years [1;6]	51.7 (9.4)	50.6 (10.1)	0.10
Years of education [2;7]	14.0 (3.3)	14.2 (3.1)	0.55
Household income [18;16]	4629.0 (1470.9)	4443.8 (1525.7)	0.37
Subjective social position (range 0–10) [4;5]	6.0 (1.7)	6.1 (1.6)	0.75
Years since injury [5]	24.5 (11.6)	--	N/A
Hours of caregiving [12]	--	1.8 (3.3)	N/A
Support in ADL (range 0–12) [0]	--	2.1 (2.8)	
Support in IADL (range 0–12) [0]	--	3.5 (2.8)	
Control at work (range 0–12) (n = 76;88) [2;2]	7.6 (2.2)	6.7 (2.5)	< 0.001
Control in housework (range 0–6) (n = 110;114) [20;11]	4.3 (1.4)	4.9 (1.2)	< 0.001
Control in caregiving (range 0–6) [18]	--	4.5 (1.6)	N/A
Control sumscore (range SCI: 0–12; caregivers: 0–18) [12;23] <sup>b</sup>	7.9 (1.8)	12.7 (2.5)	N/A
Life satisfaction (range 5–25) [3;2]	17.3 (3.8)	18.8 (3.9)	0.002
Positive affect (range 5–25) [3;4]	17.2 (3.7)	17.9 (3.6)	0.14
Negative affect (range 5–25) [3;3]	8.8 (3.5)	8.1 (3.2)	0.09

Abbreviations: CI: Confidence interval; SCI: Spinal cord injury; SD: Standard deviation. N/A: not applicable.

<sup>a</sup> *p*-values derived from *t*-tests for normally distributed variables, Wilcoxon tests for non-normally distributed variables and chi-square tests for dichotomous variables.

<sup>b</sup> Only applies for the subgroup of persons with SCI involved in housework and paid work (n = 63) and partners involved in housework, paid work and caregiving (n = 85).



**Fig. 1.** Actor effects of control in productive activities on cognitive (life satisfaction) and affective well-being (positive and negative affect) in persons with spinal cord injury (grey bars) and caregiving partners (green bars). Bars on the x-axis display regression coefficients and fine lines indicate 95% confidence intervals. *Reading instruction for results on life satisfaction and positive affect:* Bars indicate the increase in life satisfaction and positive affect with each unit of increase in control at work, housework or caregiving (see y-axis). *Reading instruction for results on negative affect:* Bars indicate a decrease in negative affect with each unit of increase in control at work, housework and caregiving (see y-axis). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

**Table 2**

Partner effects of control at work, in housework and in caregiving on cognitive and affective well-being stratified for persons with spinal cord injury (SCI) and their caregiving partners: Unadjusted and adjusted coefficients (B) and its 95% confidence intervals (CI).

Measure, range	Cognitive well-being		Affective well-being			
	SWLS, 5–25		PANAS-S, positive affect subscale, 5–25		PANAS-S, negative affect subscale, 5–25	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)
Partner's control at work (0–12)						
Persons with SCI	−0.19 (−0.41–0.2)	−0.18 (−0.39–0.04)	0.09 (−0.15–0.33)	0.12 (−0.13–0.36)	0.02 (−0.22–0.25)	−0.02 (−0.23–0.19)
Caregiving partners	0.22 (−0.05–0.49)	0.12 (−0.14–0.38)	0.30 (0.04–0.56) <sup>a</sup>	0.28 (0.02–0.54) <sup>a</sup>	−0.05 (−0.27–0.19)	−0.03 (−0.23–0.18)
Partner's control in housework (0–6)						
Persons with SCI	0.11 (−0.20–0.41)	0.06 (−0.25–0.37)	0.37 (0.03–0.71) <sup>a</sup>	0.41 (0.07–0.76) <sup>a</sup>	−0.16 (−0.46–0.14)	−0.07 (−0.33–0.19)
Caregiving partners	0.16 (−0.12–0.43)	0.21 (−0.08–0.50)	−0.09 (−0.39–0.20)	−0.23 (−0.54–0.08)	−0.05 (−0.31–0.21)	−0.03 (−0.27–0.21)
Partner's control in caregiving (0–6)						
Persons with SCI	0.20 (−0.10–0.50)	0.14 (−0.16–0.43)	0.25 (−0.05–0.55)	0.22 (−0.08–0.53)	0.02 (−0.20–0.23)	0.02 (−0.16–0.21)
Partner's control sumscore (SCI 0–12; partners 0–18) <sup>a</sup>						
Persons with SCI	0.20 (−0.08–0.48)	0.21 (−0.06–0.49)	0.18 (−0.05–0.42)	0.12 (−0.18–0.43)	−0.30 (−0.49–−0.10)**	−0.23 (−0.42–−0.04) <sup>a</sup>
Caregiving partners	0.07 (−0.25–0.38)	0.08 (−0.23–0.40)	0.07 (−0.23–0.37)	0.07 (−0.24–0.39)	−0.13 (−0.37–0.11)	−0.14 (−0.43–0.16)

Abbreviations: PANAS-S: Positive and Negative Affect Scale, short form; SWLS: Satisfaction with Life Scale.

Note: Each row run as separate model. Model 1: unadjusted; Model 2: adjusted for age, sex, education and secondary health conditions of person with SCI.

\*  $p \leq .05$ , \*\*  $p \leq .01$ , \*\*\*  $p \leq .001$ .

<sup>a</sup> Only applies for the subgroup of persons with SCI involved in housework and paid work ( $n = 63$ ) and partners involved in housework, paid work and caregiving ( $n = 85$ ).

robust (Appendix B, non-robust results marked with <sup>a</sup> or <sup>b</sup>).

### 3.2. The partners' control and well-being (partner effects)

The partners' perception of control in productive activities was not related to cognitive well-being and negative affectivity and the experience of control in caregiving was not associated with well-being of the persons with SCI. Nevertheless, we observed that caregiving partners reported higher positive affect if their partner with SCI experiences higher control at work and persons with SCI indicated higher positive affect if the caregiving partner reported higher control in housework. For the subgroup of persons performing all productive activities, we found that an accumulation of low control over work, housework and caregiving in caring partners was related to increased negative affect of persons with SCI (Table 2). The mutual adjustment of all control variables in the subgroup of persons engaged in all activities supports the finding from main analysis that the partners' experience of control is not related to cognitive well-being. Although all results for affective well-being point in the same direction as main results, we observe divergent CIs and therefore  $p$ -values in some cases. More specifically, two partner effects revealed in main analysis fall below the conventional level of statistical significance (Appendix B, results marked with <sup>b</sup>), and two non-significant results from main analysis reach  $p$ -values  $< .05$  in this subgroup (Appendix B, results marked with <sup>a</sup>).

### 3.3. Factors associated with low control

Poor socioeconomic conditions were associated with lower control at work and in caregiving, but not with control in housework. More specifically, persons with SCI with lower household income, education and subjective social position and caregiving partners with lower education reported lower control at work. Caregiving partners with less household income and lower subjective social position indicated lower control in caregiving than caregivers with higher income or subjective social position. The objective caregiver burden was not related to control at work or in housework, but higher objective burden was linked to reduced control in caregiving. The availability of external help in caregiving was not related to control in any productive activity (Table 3).

## 4. Discussion

This is the first study in the disability setting to investigate the relationship of control in three distinct productive activities with cognitive and affective well-being applying a dyadic perspective and to explore whether socioeconomic and caregiving characteristics were linked to low control. Our study provides evidence that low control in productive activities is negatively related to cognitive and affective well-being, however, the strength of association varied between type of activity and role within the couple. Further, we found limited support for the assumption that the partners' experience of control relates to well-being, as partner effects were only evident for positive affectivity in two out of five tested associations. Poor socioeconomic conditions were linked to low control at work and in caregiving, but not to control in housework. Caregiving partners with high objective caregiver burden were at risk of low control in caregiving, but the caregiver burden was not related to control in paid work or housework.

### 4.1. Control and well-being

In line with findings from general population samples, we observed that persons with low control at work and in housework reported lower well-being compared to those in higher control settings. Several pathways may explain the association of control in productive activities with health and well-being. First, experiencing control reduces the intensity and duration of physiological stress responses as it weakens or eliminates the threatening features of challenging demands [42]. Second, the sense of mastery and self-efficacy associated with the experience of control offers a powerful psychological resource that can mitigate the negative effects of an adverse environment on poor well-being and morbidity [43] and even on mortality [44], by improved coping with stressful conditions [45]. Finally, experiencing control in the performance of challenging tasks may stimulate personal growth, creativity, and the occurrence of psychological flow [46], which positively affect well-being.

Although patterns of associations were consistent for actor effects, we observed slight differences in the strength of associations according to type of activity and role within the couple. While for example low control at work was significantly linked to well-being in persons with

**Table 3**  
 Association of socioeconomic conditions and caregiving characteristics with control in productive activities stratified for persons with spinal cord injury (SCI) and their caregiving partners: Unadjusted and adjusted coefficients (B) and its 95% confidence intervals (CI).

	Control at work (0–12)		Control in housework (0–6)		Control in caregiving (0–6)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)
<b>Persons with SCI</b>						
<i>Socioeconomic conditions</i>						
Education in years	0.22 (0.06–0.37)*	0.21 (0.05–0.37)*	-0.01 (-0.10–0.13)	0.06 (-0.05–0.16)	-	-
Household income, per 1000 CHF	0.80 (0.45–1.15)**	0.80 (0.43–1.18)**	-0.04 (-0.31–0.24)	0.03 (-0.24–0.30)	-	-
Subjective social position (0–10)	0.51 (0.23–0.79)**	0.50 (0.18–0.81)**	-0.15 (-0.37–0.07)	-0.10 (-0.31–0.11)	-	-
<i>Caregiving partners</i>						
<i>Socioeconomic conditions</i>						
Education in years	0.15 (0.05–0.26)**	0.18 (0.00–0.35)*	-0.15 (-0.22–0.09)**	-0.07 (-0.18–0.04)	0.09 (-0.07–0.25)	0.06 (-0.10–0.21)
Household income, per 1000 CHF	-0.03 (-0.25–0.19)	0.05 (-0.00–0.10)	-0.17 (-0.32–0.02)*	-0.01 (-0.25–0.24)	0.46 (0.10–0.82)*	0.43 (0.08–0.78)*
Subjective social position (0–10)	0.40 (0.20–0.59)**	0.26 (-0.07–0.60)	0.00 (-0.13–0.14)	0.02 (-0.20–0.25)	0.36 (0.04–0.67)*	0.38 (0.08–0.69)*
<i>Caregiving characteristics</i>						
Hours of caregiving	0.06 (-0.10–0.21)	0.07 (-0.20–0.34)	0.06 (-0.05–0.1)	0.05 (-0.07–0.18)	-0.17 (-0.31–0.03)*	-0.14 (-0.28–0.00)*
Support in ADL (0–12)	0.14 (-0.06–0.33)	0.08 (-0.14–0.31)	0.06 (-0.07–0.19)	0.02 (-0.12–0.16)	-0.22 (-0.39–0.05)*	-0.18 (-0.35–0.01)*
Support in IADL (0–10)	0.10 (-0.05–0.26)	0.06 (-0.16–0.29)	0.06 (-0.07–0.19)	0.07 (-0.06–0.20)	-0.37 (-0.55–0.20)**	-0.35 (-0.53–0.17)**
No external help in caregiving	Reference	Reference	Reference	Reference	Reference	Reference
External help in caregiving	-0.79 (-1.68–0.10)	-1.17 (-2.67–0.33)	-0.15 (-1.02–0.72)	-0.11 (-0.98–0.76)	-1.12 (-2.25–0.01)	-0.97 (-2.09–0.14)

Abbreviations: ADL: Activities of daily living; CHF: Swiss Francs; IADL: Instrumental activities of daily living.  
 Note: Each row run as separate model. Model 1: Unadjusted; Model 2: Adjusted for age, sex and lesion characteristics of the person with SCI.

\*  $p \leq .05$ , \*\*  $p \leq .01$ , \*\*\*  $p \leq .001$ ;  $p$ -values from equal fraction missing information test.

the disability, effects were less pronounced in caregiving partners. Our study offers limited options of explaining this difference, however, it is of interest to observe that most caregiving partners were females and most persons with SCI were males. In accordance with research on gender roles and their differential effects on health and well-being [47], males in general value paid work higher than females, and a higher priority in terms of what matters for life and what affects self-identity may result in stronger associations with health and well-being. As earlier research documented, psychosocial work conditions have stronger effects on men's than on women's health [11,20]. A related argumentation may apply in case of a stronger consistency of associations between housework and well-being observed among caregiving partners (mostly females) compared to persons with SCI (mostly males), which is supported by previous evidence, showing that low control at home more strongly predicted anxiety and depression in women than did low control at work [11]. Although our study generally provides limited evidence for the assumption that the partners' experience of control in productive activities impacts on well-being, we found two interesting partner effects of control at work and in housework on positive affectivity, which support previous arguments on the gender-specific self-identity and priority of productive engagement. Generally, these results may indicate that the partners' control in the productive activity that he/she values most or spends substantial amount of time leads to enhanced positive affect not only in the person him/herself but also in the partner as the positive psychosocial environment experienced throughout the day impacts on mood and affectivity shared with the partner.

Consistent with earlier research [14,15], our study provides evidence that feelings of control in caregiving relate to caregivers' well-being. Again, the beneficial effects on caregivers' well-being might be explained by the pathways of behavioural, coping and positively stimulating effects of experiencing control mentioned above. Experiencing low control in caregiving may also affect the subjective caregiver burden and therefore the emotional burden of care, which is highly predictive of caregivers health and well-being [48]. Caregivers with low well-being due to their uncomfortable situation with caring may develop feelings of anger and resentment towards the care-recipient, as evidenced by the higher negative affectivity observed in our study. However, we found no support for the hypothesis that low control in caregiving is related to reduced well-being of the care-receiver.

Our study furthermore supports the notion that an accumulation of low control over different productive activities may lead to an additive burden for cognitive and affective well-being. However, given that this analysis is based on a restricted sample involved in all activities, the comparison of strength of independent versus additive effects of different control variables on well-being should be subject to further investigations.

#### 4.2. Factors associated with low control

Our findings on social inequalities in control at work are in line with findings from the general Swiss working population [49] and a recent study on 27-EU member states showing that low control was particularly prevalent in lower occupational classes [19]. The explanation of the higher occurrence of low control in persons with poor socioeconomic conditions reflects the social disadvantage in accessing high quality jobs, such as jobs characterized by high control and decision latitude. Alternatively, as Davey Smith and Harding stated [50], control at work and socioeconomic position are considered as two highly collinear dimensions. Similarly, we found social inequalities in control over caregiving, which may originate from restricted material or psychological resources to cope with the care responsibilities in caregivers in lower social positions. In contrast to earlier findings [11], we were not able to detect social inequalities in control in housework.

Our study identified high objective caregiver burden as risk factor for low control in caregiving, which is not surprising as a high burden

may reflect the need of support in activities of daily routine and basic care. It is however surprising that the availability of external help in caregiving was not related to increased but rather to reduced control. Receiving external support may be related to the lower functional status of the care-receiver and the need of basic care which limits flexibility and controllability over caregiving tasks. More fine-grained information on amount and source of external support in caregiving may help to disentangle the associations between the care situation and control in informal caregiving.

#### 4.3. Strengths and limitations

This is the first study in couples coping with disability that takes into account measures of control in three distinct productive activities and to use a longitudinal design to assess well-being effects of low control. The study is based on an innovative design, including longitudinal dyadic data. Validated measures for most of the constructs under study were used and data were collected with high quality standards. We applied state-of-the-art statistical methods, identified potential confounders by elaborating DAGs, and accounted analysis for potential item-nonresponse bias. Further, the pro-WELL study was nested within a large cohort study and socio-demographic and lesion characteristics of persons with SCI were well represented compared to the source population [24].

Although longitudinal data was used for analyses, reverse causation in the relationship between control in productive activities and well-being cannot be excluded. Also, the term risk factor to describe factors associated with low control in productive activities might be incorrect, as the assumption of causality could not be tested. The small sample size of this study prevented a more complex data analysis. For example, moderating effects of sex or interactions between the different control variables could not be investigated with our data. Moreover, the lack of conventional statistical significance observed in some results might be caused by low sample size [51], which calls for cautious interpretation of results. It should, for example, not be concluded that control at work is not an important environmental feature for mostly female caregiving partners as the lack of statistical significance might result from the small sample size and it is noteworthy that the well-being effects of low control at work showed a consistent directionality. Besides, the analysis on additive effects of control in different productive activities might be prone to methodological shortcomings as the construction of the sum-score is based on the assumption of equal weight of dimensions and comparability to independent effect is limited as this analysis is based on a specific subgroup of persons involved in all investigated activities. The sensitivity analysis in this subgroup testing an additional model which was mutually adjusted for all control variables indicated limited robustness of results for affective well-being, again, given the reduced statistical power of this analysis, findings should be replicated in larger samples. A further limitation of our study is the self-report nature of data and unmeasured confounding due to reporting bias. For example, objective measures of control in productive activities are unavailable and the self-report data might be biased by intrinsic personal characteristics. Finally, the different response modes (paper-pencil; online, telephone interview) may introduce bias in responses with an unknown effect on study results.

#### 5. Implications and conclusions

Despite their restricted generalization, our findings offer some suggestions for policy developments in the setting of disability. The finding of a positive impact of control at work on well-being in persons with SCI underlines the need of structural improvements of the quality of work among employees with disabilities. Given the positive effects of respective interventions in general populations [52,53], such measures are also likely to increase sustainable workability and productivity among vulnerable populations. Moreover, those interventions should

take into account the specific needs of persons in poor socioeconomic conditions, as they were identified as risk groups to experience low control at work.

A second implication relates to the level of control in housework and caregiving. Positive experience of control in informal caregivers can be enhanced by widening opportunities of engaging home care services to reduce the potentially excessive workload. Moreover, relief from continuous caregiving demands may be achieved by redistribution of care responsibilities among family members and close friends, enabling the caregiving partner to at least temporarily opt out of this role. In addition, specific skill training and enhanced professional support may be instrumental in improving the experience of control in caregiving and housework. Again, informal caregivers in low socioeconomic positions should receive special emphasis when planning respective interventions.

**Appendix A. Actor effects of control at work, in housework and in caregiving on cognitive and affective well-being stratified for persons with spinal cord injury (SCI) and their caregiving partners: Unadjusted and adjusted coefficients (B) and its 95% confidence intervals (CI)**

Measure, range	Cognitive well-being		Affective well-being			
	SWLS, 5–25		PANAS-S, positive affect subscale, 5–25		PANAS-S, negative affect subscale, 5–25	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)	B (95% CI)
Control at work (0–12)						
Persons with SCI	0.43 (0.21–0.66)***	0.43 (0.21–0.65)***	0.30 (0.07–0.53)*	0.28 (0.04–0.51)*	–0.32 (–0.52–0.12)**	–0.29 (–0.50–0.08)**
Caregiving partners	0.18 (–0.01–0.36)	0.18 (–0.01–0.38)	0.20 (0.00–0.40)*	0.18 (–0.02–0.39)	–0.10 (–0.27–0.06)	–0.07 (–0.24–0.09)
Control in housework (0–6)						
Persons with SCI	0.40 (0.11–0.69)**	0.35 (0.06–0.64)*	0.43 (0.11–0.76)**	0.42 (–0.08–0.05)*	–0.16 (–0.45–0.12)	–0.08 (–0.35–0.19)
Caregiving partners	0.50 (0.22–0.78)***	0.54 (0.24–0.84)***	0.26 (–0.05–0.57)	0.40 (0.07–0.72)*	–0.37 (–0.64–0.10)**	–0.50 (–0.74–0.26)***
Control in caregiving (0–6)						
Caregiving partners	0.49 (0.22–0.77)***	0.58 (0.30–0.87)***	0.16 (–0.12–0.43)	0.22 (–0.07–0.50)	–0.39 (–0.59–0.18)***	–0.34 (–0.53 to –0.16)***
Control sumscore (SCI 0–12; partners 0–18) <sup>a</sup>						
Persons with SCI	0.56 (0.25–0.85)***	0.55 (0.24–0.85)***	0.41 (0.08–0.50)**	0.41 (0.10–0.72)*	–0.16 (–0.47–0.15)	–0.11 (–0.43–0.21)
Caregiving partners	0.45 (0.02–0.66)***	0.49 (0.28–0.69)***	0.26 (0.03–0.48)**	0.35 (0.13–0.57)**	–0.23 (–0.38–0.09)**	–0.20 (–0.34–0.06)**

Abbreviations: PANAS-S: Positive and Negative Affect Scale, short form; SWLS: Satisfaction with Life Scale.

Note: Each row run as separate model. Model 1: unadjusted; Model 2: adjusted for age, sex, education and secondary health conditions of person with SCI.

<sup>a</sup>Only applies for the subgroup of persons with SCI involved in housework and paid work (n = 63) and partners involved in housework, paid work and caregiving (n = 85).

\* p ≤ .05, \*\* p ≤ .01, \*\*\* p ≤ .001.

**Appendix B. Actor and partner effects of control at work, in housework and in caregiving on cognitive and affective well-being stratified for persons with spinal cord injury (SCI) and their caregiving partners: Coefficients (B) and its 95% confidence intervals (CI) additionally adjusted for all control dimensions for the subgroup of persons with SCI involved in housework and paid work and partners involved in housework, paid work and caregiving**

Measure, range	Cognitive well-being		Affective well-being	
	SWLS, 5–25		PANAS-S, positive affect subscale, 5–25	
	B (95% CI)		B (95% CI)	
<b>ACTOR EFFECTS</b>				
Control at work (0–12)				
Persons with SCI	0.37 (0.13–0.62)**		0.23 (–0.03–0.48) <sup>b</sup>	–0.31 (–0.56–0.06)*
Caregiving partners	0.16 (–0.05–0.36)		0.24 (0.01–0.48)* <sup>a</sup>	–0.002 (–0.15–0.14)
Control in housework (0–6)				
Persons with SCI	0.43 (0.06–0.80)*		0.39 (0.00–0.78)*	0.19 (–0.11–0.49)
Caregiving partners	0.50 (0.15–0.85)**		0.38 (–0.03–0.78) <sup>b</sup>	–0.25 (–0.48–0.01)*
Control in caregiving (0–6)				
Caregiving partners	0.56 (0.21–0.92)**		0.22 (–0.16–0.59)	–0.30 (–0.61–0.01) <sup>b</sup>
<b>PARTNER EFFECTS</b>				
Partners control at work (0–12)				
Persons with SCI	–0.11 (–0.37–0.15)		0.23 (–0.06–0.52)	–0.30 (–0.55–0.05) <sup>a</sup>
Caregiving partners	0.10 (–0.17–0.37)		0.24 (–0.02–0.51) <sup>b</sup>	–0.15 (–0.44–0.15)

Partners' control in housework (0–6)			
Persons with SCI	0.01 (–0.40–0.43)	0.23 (–0.26–0.73) <sup>b</sup>	0.09 (–0.19–0.36)
Caregiving partners	0.06 (–0.34–0.46)	–0.55 (–0.94– –0.16) <sup>***a</sup>	0.02 (–0.31–0.35)
Partners' control in caregiving (0–6)			
Person with SCI	–0.11 (–0.59–0.38)	0.39 (–0.15–0.94)	0.19 (–0.20–0.60)

Abbreviations: PANAS-S: Positive and Negative Affect Scale, short form; SWLS: Satisfaction with Life Scale. Note: Each row run as separate model. Models adjusted for age, sex, education, secondary health conditions of person with SCI, and mutual adjustment for control in other productive activities.

\*  $p \leq .05$ , \*\*  $p \leq .01$ , \*\*\*  $p \leq .001$ .

<sup>a</sup>  $p$ -value in main analysis (Appendix A for actor effects; Table 2 for partner effects)  $> 0.05$ ; <sup>b</sup>  $p$ -value in main analysis  $\leq 0.05$ .

**Appendix C. Directed acyclic graphs (DAGs) displaying the example of interrelationships between control at work, well-being and candidate confounders. Figure a) shows the starting conceptual model including literature-based assumptions on associations between variables of interest. Figure b) shows the validated DAG containing associations confirmed by bivariate analysis. Figure c) shows the causal inference based on the implementation of the minimal adjustment set**

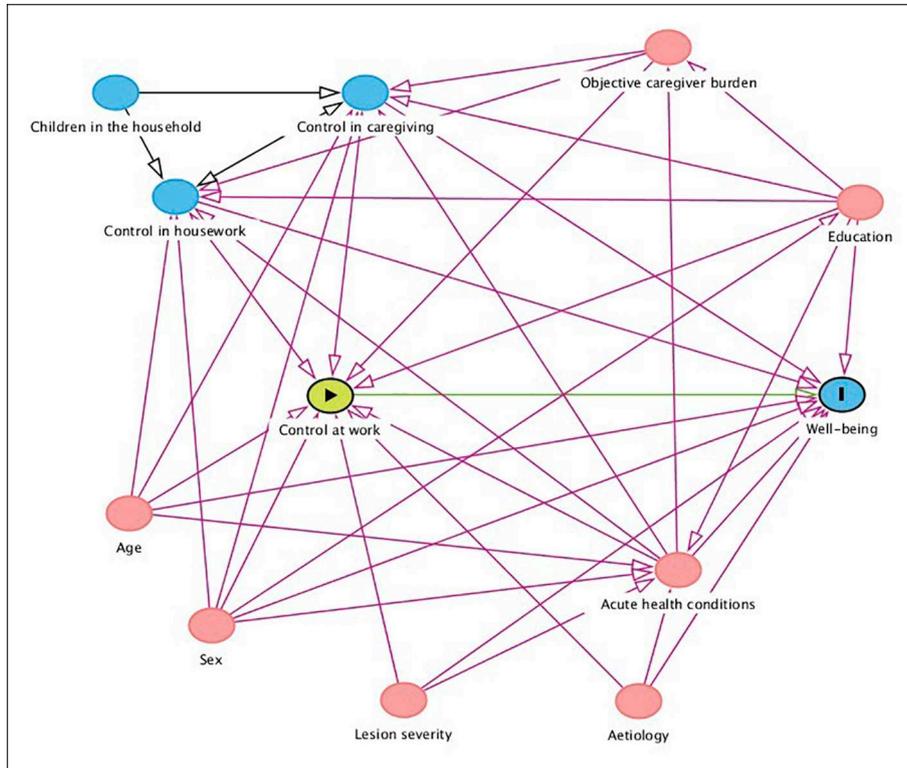


Fig. a): Conceptual DAG.

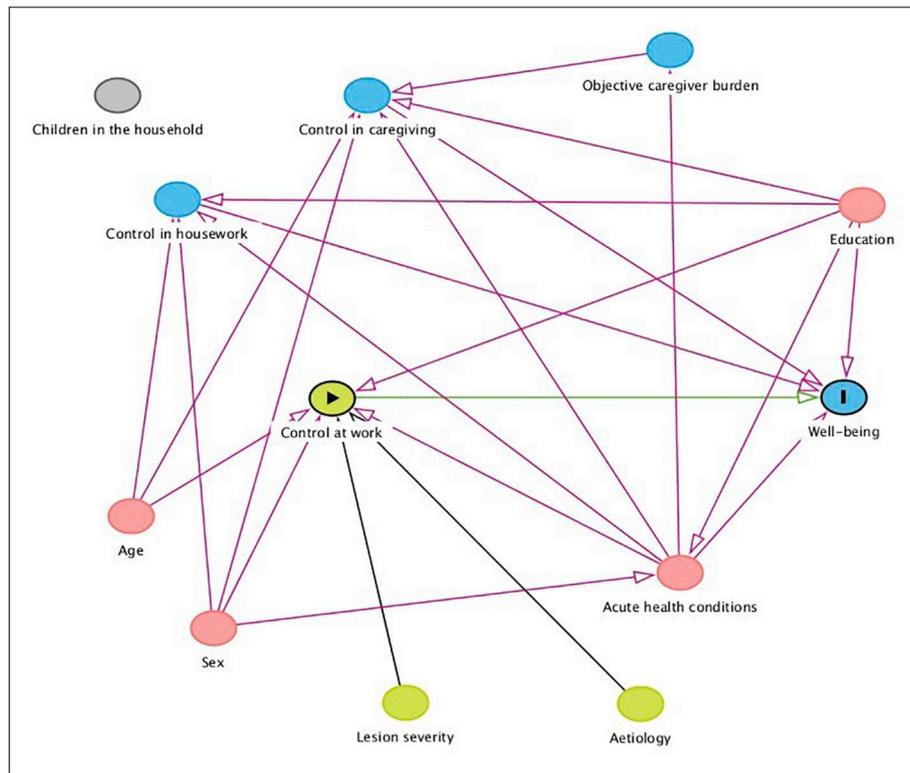


Fig. b): Validated DAG.

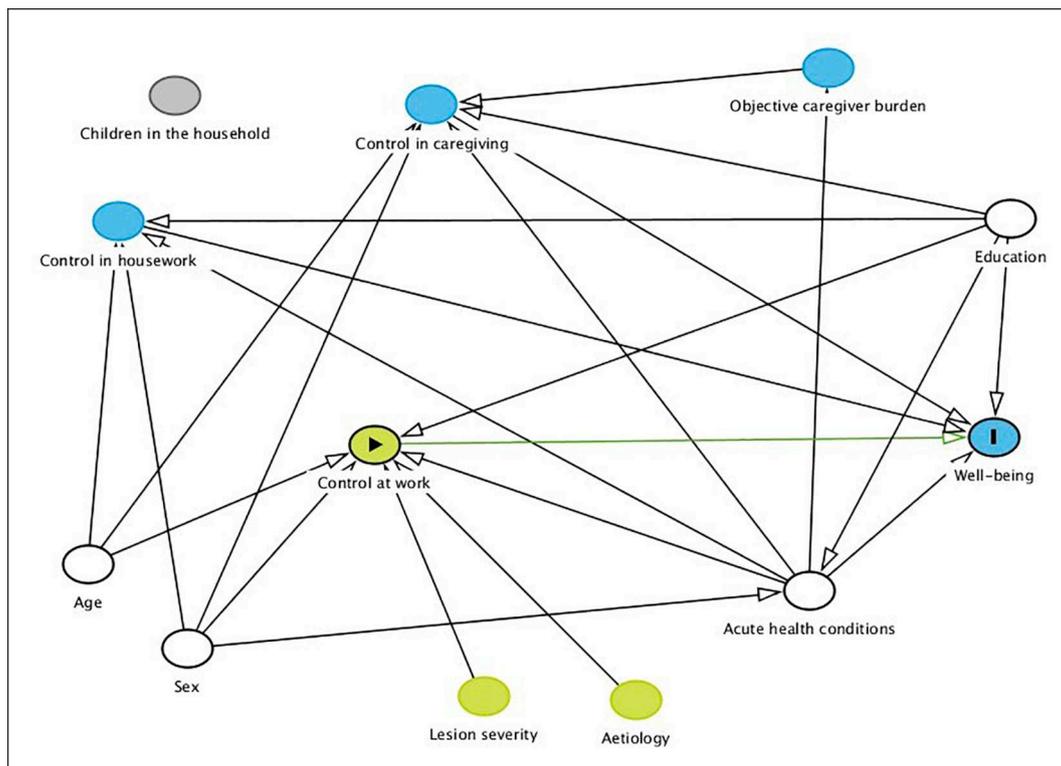


Fig. c): Validated DAG showing the minimal sufficient adjustment set (i.e., age, sex, acute health conditions, education).

**Circles:** Green with triangle: exposure variable; Blue with bar: outcome variable; Red: ancestor of exposure and outcome (i.e., confounding variables); Blue: ancestor of the outcome; Green: ancestor of the exposure; Grey: other variable (neither associated with exposure nor with outcome). White: adjusted variable.

**Paths:** Pink: biasing paths; Green: causal path.

## References

- [1] A. Steptoe, L. Poole, G. Fink (Eds.), *Stress: Concepts, Cognition, Emotion, and Behavior*, Elsevier, Amsterdam, 2016, pp. 73–80 Control and stress.
- [2] E. Skinner, A guide to constructs of control, *Pers. Soc. Psychol.* 71 (1996) 549–570.
- [3] M. Bobak, H. Pikhart, C. Hertzman, R. Rose, M. Marmot, Socioeconomic factors, perceived control and self-reported health in Russia. A cross-sectional survey, *Soc. Sci. Med.* 47 (2) (1998) 269–279.
- [4] K. Nieuwenhuijsen, D. Bruinvels, M. Frings-Dresen, Psychosocial work environment and stress-related disorders, a systematic review, *Occup. Med.* 60 (4) (2010) 277–286.
- [5] J.H. Pejtersen, H. Burr, H. Hannerz, A. Fishta, N. Hurwitz Eller, Update on work-related psychosocial factors and the development of ischaemic heart disease, *Cardiol. Rev.* 23 (2015) 94–98.
- [6] A. Steptoe, M. Kivimäki, Stress and cardiovascular disease: an update on current knowledge, *Annu. Rev. Public Health* 34 (2013) 337–354.
- [7] S.A. Stansfeld, H. Bosma, H. Hemingway, M.G. Marmot, Psychosocial work characteristics and social support as predictors of SF-36 health functioning: the Whitehall II study, *Psychosom. Med.* 60 (3) (1998) 247–255.
- [8] J. Siegrist, T. Lunau, M. Wahrendorf, N. Dragano, Depressive symptoms and psychosocial stress at work among older employees in three continents, *Glob. Health* 8 (2012) 27.
- [9] S.A. Stansfeld, R. Fuhrer, M.J. Shipley, M.G. Marmot, Work characteristics predict psychiatric disorder: prospective results from the Whitehall II study, *Occup. Environ. Med.* 56 (5) (1999) 302–307.
- [10] U. Bultmann, I.J. Kant, P.A. Van den Brandt, S.V. Kasl, Psychosocial work characteristics as risk factors for the onset of fatigue and psychological distress: prospective results from the Maastricht Cohort Study, *Psychol. Med.* 32 (2) (2002) 333–345.
- [11] J.M. Griffin, R. Fuhrer, S.A. Stansfeld, M. Marmot, The importance of low control at work and home on depression and anxiety: do these effects vary by gender and social class? *Soc. Sci. Med.* 54 (5) (2002) 783–798.
- [12] T. Chandola, E. Brunner, M. Marmot, Chronic stress at work and the metabolic syndrome: prospective study, *BMJ.* 322 (7540) (2006) 521–525.
- [13] T. Chandola, H. Kuper, A. Singh-Manoux, M. Bartley, M. Marmot, The effect of control at home on CHD events in the Whitehall II study: gender differences in psychosocial domestic pathways to social inequalities in CHD, *Soc. Sci. Med.* 58 (8) (2004) 1501–1509.
- [14] R. Schulz, S.R. Beach, T.B. Cook, L.M. Martire, J.M. Tomlinson, J.K. Monin, Predictors and consequences of perceived lack of choice in becoming an informal caregiver, *Aging Ment. Health* 16 (16) (2012) 712–721.
- [15] M.I. Wallhagen, Perceived control and adaptation in elder caregivers: development of an explanatory model, *Int. J. Aging Hum. Dev.* 36 (3) (1992) 219–237.
- [16] World Health Organization, *World Report on Disability*, World Health Organization, Geneva, 2011.
- [17] A.E. Scharlach, K. Gustavson, T.S. Dal Santo, Assistance received by employed caregivers and their care recipients: who helps care recipients when caregivers work full time? *Gerontol.* 47 (6) (2007) 752–762.
- [18] W. Cook, D. Kenny, The actor-partner interdependence model: a model of bidirectional effects in developmental studies, *Int. J. Behav. Develop.* 29 (2) (2005) 101–119.
- [19] N. Dragano, M. Wahrendorf, K. Muller, T. Lunau, Work and health inequalities: the unequal distribution of exposures at work in Germany and Europe, *Bundesgesundheitsbl. Gesundheitsforsch. Gesundheitsschutz.* 59 (2) (2016) 217–227.
- [20] M.G. Marmot, H. Bosma, H. Hemingway, E. Brunner, S. Stansfeld, Contribution of job control and other risk factors to social variations in coronary heart disease incidence, *Lancet.* 350 (9073) (1997) 235–239.
- [21] J. Bickenbach, A. Officer, T. Shakespeare, P. Von Groote, *International Perspectives on Spinal Cord Injury*, World Health Organization, Geneva, 2013.
- [22] J. Lynch, R. Cahalan, The impact of spinal cord injury on the quality of life of primary family caregivers: a literature review, *Spinal Cord* 55 (11) (2017) 964–978.
- [23] M.W. Post, J. Bloemen, L.P. de Witte, Burden of support for partners of persons with spinal cord injuries, *Spinal Cord* 43 (5) (2005) 311–319.
- [24] C. Fekete, M.W. Brinkhof, H. Tough, J. Siegrist, Longitudinal study of social participation and well-being among persons with spinal cord injury and their partners (pro-WELL), *BMJ Open* 7 (1) (2017) e011597.
- [25] C. Fekete, W. Segerer, A. Gemperli, M.W. Brinkhof, Participation rates, response bias and response behaviours in the community survey of the Swiss Spinal Cord Injury Cohort Study (SwiSCI), *BMC Med. Res. Methodol.* 15 (1) (2015) 80.
- [26] M.W.G. Brinkhof, C. Fekete, J.D. Chamberlain, M.W.M. Post, A. Gemperli, Swiss national community survey of functioning after spinal cord injury: protocol, characteristics of participants and determinants of non-response, *J. Rehab. Med.* 48 (2016) 120–130.
- [27] M.W. Post, M.W. Brinkhof, E. von Elm, C. Boldt, M. Brach, C. Fekete C, et al., Design of the Swiss Spinal Cord Injury Cohort Study, *Am. J. Phys. Med. Rehabil.* 90 (11 Suppl 2) (2011) S5–16.
- [28] R. Karasek, C. Brisson, N. Kawakami, I. Houtman, P. Bongers, B. Amick, The job content questionnaire (JCQ): an instrument for internationally comparative assessments of psychosocial job characteristics, *J. Occup. Health Psychol.* 3 (4) (1998) 322–355.
- [29] E. Diener, R.A. Emmons, R.J. Larsen, S. Griffin, The satisfaction with life scale, *J. Pers. Assess.* 49 (1) (1985) 71–75.
- [30] R. Kobau, J. Sniezek, M. Zack, R.E. Lucas, A. Burns, Well-being assessment: an evaluation of well-being scales for public health and population estimates of well-being among US adults, *Appl. Psychol. Health Well. Being.* 2 (3) (2010) 272–297.
- [31] E.R. Thompson, Development and validation of an internationally reliable short-form of the positive and negative affect schedule (PANAS), *J. Cross-Cult. Psychol.* 38 (2) (2007) 227–242.
- [32] UNESCO, *International Standard Classification of Education (ISCED)*, UNESCO, Paris, 1997.
- [33] A.K. Hagenaars, K. de Vos, M.A. Zaidi, *Poverty Statistics in the Late 1980s: Research Based on Micro-Data*, Office for Official Publications of the European Communities, Luxembourg, 1994.
- [34] N. Adler, J. Stewart, *The MacArthur Scale of Subjective Social Status*, <http://www.macses.ucsf.edu/research/psychosocial/subjective.php>, (2007) (accessed 12 February 2019).
- [35] H.L. Schofield, B. Murphy, H.E. Herrman, S. Bloch, B. Singh, Family caregiving: measurement of emotional well-being and various aspects of the caregiving role, *Psychol. Med.* 27 (3) (1997) 647–657.
- [36] J. Textor, J. Hardt, S. Knuppel, DAGitty: a graphical tool for analyzing causal diagrams, *Epidemiology.* 22 (5) (2011) 745.
- [37] C.Z. Kalpakjian, W.M. Scelza, M.B. Forchheimer, L.L. Toussaint, Preliminary reliability and validity of a spinal cord injury secondary conditions scale, *J. Spinal Cord Med.* 30 (2) (2007) 131–139.
- [38] D.A. Kenny, D.A. Kashy, W.L. Cook DA, J. Simpson, *Dyadic Data Analysis - Methodology in the Social Sciences*, Guilford, New York, 2006.
- [39] J. Tobin, Estimation of relationships for limited dependent variables, *Econometrica* 26 (1) (1958) 24–36.
- [40] J. Twisk, W. de Vente, Attrition in longitudinal studies. How to deal with missing data, *J. Clin. Epidemiol.* 55 (4) (2002) 329–337.
- [41] J.W. Twisk, *Applied Longitudinal Data Analysis for Epidemiology: A Practical Guide*, Cambridge University Press, Cambridge, 2013.
- [42] J.P. Henry, P. Stephens, *Stress, Health, and the Social Environment*, Springer, New York, 1977.
- [43] F.J. Infurna, D. Gerstorf, Perceived control relates to better functional health and lower cardio-metabolic risk: the mediating role of physical activity, *Health Psychol.* 33 (1) (2014) 85–94.
- [44] N.A. Turiano, B.P. Chapman, S. Agrigoroaei, F.J. Infurna, M. Lachman, Perceived control reduces mortality risk at low, not high education levels, *Health Psychol.* 33 (2014) 883–890.
- [45] L. Cameron, H. Leventhal, *The Self-Regulation of Health and Illness Behaviour*, Routledge, London, 2003.
- [46] T. Theorell, Reward, flow and control at work, in: J. Siegrist, M. Wahrendorf (Eds.), *Work Stress and Health in a Globalized Economy: The Model of Effort-Reward Imbalance*, Springer International Publications, Cham, 2016, pp. 315–332.
- [47] A. McMunn, Gender differences in the health effects of psychosocial factors, in: M. Kivimäki, D.G. Batty, I. Kawachi, A. Steptoe (Eds.), *The Routledge Handbook of Psychosocial Epidemiology*, Routledge, London, 2017.
- [48] C. Fekete, H. Tough, J. Siegrist, M.W. Brinkhof, Health impact of objective burden, subjective burden and positive aspects of caregiving: an observational study among caregivers in Switzerland, *BMJ Open* 7 (12) (2017) e017369.
- [49] O. Hammig, F. Gutzwiller, I. Kawachi, The contribution of lifestyle and work factors to social inequalities in self-rated health among the employed population in Switzerland, *Soc. Sci. Med.* 121 (2014) 74–84.
- [50] G. Davey Smith, S. Harding, Is control at work the key to socioeconomic gradients in mortality? in: G. Davey Smith (Ed.), *Health Inequalities: Lifecourse Approaches*, The Policy Press, Bristol, 2003, pp. 83–86.
- [51] D.G. Altman, J.M. Bland, Absence of evidence is not evidence of absence, *BMJ.* 311 (7003) (1995) 485.
- [52] R. Bourbonnais, C. Brisson, M. Vezina, Long-term effects of an intervention on psychosocial work factors among healthcare professionals in a hospital setting, *Occup. Environ. Med.* 68 (7) (2011) 479–486.
- [53] F.W. Bond, D. Bunce, Job control mediates change in a work reorganization intervention for stress reduction, *J. Occup. Health Psychol.* 6 (4) (2001) 290–302.