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# Does Graded Return to Work Improve Disabled Workers' Labour Market Attachment?

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## Abstract

Using Danish register and survey data, we examine the effect of a graded-return-to-work program on sick-listed workers' probability of returning to regular working hours. During program participation, the worker receives the normal hourly wage for the hours worked and sickness benefit for the hours off work. When the worker's health improves, working hours are increased until the sick-listed worker is able to work regular hours. Previous studies either concern specially designed programs with a limited population of disabled workers or they do not take into account the unobserved differences between program participants and non-participants. Taking account of such unobserved differences, the authors find that participation in the program significantly increases the probability of returning to regular working hours.

## 1. Introduction

Work disability inflicts huge economic and human costs to society. In a study of 19 OECD countries, in average 14 percent of the working-age population reported to be disabled (OECD, 2003). While 71 percent of the adult population of non-disabled people was employed, this figure was only 44 percent among people with disabilities (Ibid). In response to disability-related labour market inactivity policymakers, administrators, and researchers invest many resources in finding ways to improve the labour market attachment of disabled people. Economists have especially focused on how vocational rehabilitation (e.g., Berkowitz, 1988, Dean *et al.*, 1999, Aakvik *et al.*, 2005) and economic incentives of cash benefit programs influence disabled peoples' labour market status (e.g., Meyer *et al.*, 1995, Oleinick *et al.*, 1996, Johnson *et al.*, 1998, Galizzi and Boden, 2003). In contrast, economists have only to a very limited extent studied how workplace accommodations, including graded return to work, affect the labour market attachment of disabled people.

This paper studies how a national program of graded return to work affects long-term sick-listed workers' probability of returning to regular working hours, i.e. pre-sick leave hours. The program allows sick-listed workers to return to work on reduced working hours. When the worker's health improves, the working hours are gradually increased until the sick-listed worker is able to work regular working hours. During the period on reduced working hours, the participant receives his or her normal hourly wage for the hours worked (e.g. 20 hours per week) and sickness benefit for the hours off work (e.g. 17 hours a week). The sick-listed worker is assumed to leave the program and return to regular working hours as quickly as possible.

To our knowledge no one has studied the employment effects of a national graded-return-to-work program. In terms of population and workplace intervention the Canadian study of Butler *et al.* (1995) is the most comparable to our study. However, in contrast to Butler *et al.* (1995), we adjust for unobserved heterogeneity.

We use data on 934 workers who were sick-listed for more than 8 weeks. We simultaneously estimate the duration until the sick-listed workers enter the graded-return-to-work program and the duration until they return to regular working hours. To obtain an unbiased estimate of the program effect without having to rely on the instrumental variable approach, we use the timing-of-event method developed by Abbring and Van den Berg (2003). We find that program participation has a significant and positive employment effect.

Our findings illustrate the importance of correcting for unobserved heterogeneity. Without such correction the risk ratio of returning to regular working hours during program participation is overestimated by 20 percent. Similarly, for workers that have left the graded-return-to-work program before returning to regular working hours, the subsequent risk ratio of returning to work is overestimated by 7 percent. This finding has important bearings on the conclusion that we can make. While the positive effect during program participation remains significant after controlling for unobserved heterogeneity, the post program effect for workers who did not return to regular working hours during program participation becomes insignificant.

## 2. Previous literature

The Danish graded-return-to-work program is a workplace intervention: sick-listed workers return to their pre-sick leave job on temporarily reduced working hours. Three systematic literature reviews of studies from 1975 to 2003 conclude that workplace interventions significantly increase sick-listed workers' chance of returning to work (Krause *et al.*, 1998, Krause and Lund, 2003, Franche *et al.*, 2005). These findings indicate that the Danish graded-return-to-work program may also increase sick-listed workers' labour market attachment. However, there are several reasons why the findings of previous studies cannot be generalized to the Danish program.

First, in contrast to the Danish program, the vast majority of previous studies concern specially designed programs restricted to a limited population of disabled workers (e.g. Gice and Tompkins, 1989, Loisel *et al.*, 1997, Bernacki *et al.*, 2000, Arnetz *et al.*, 2003). These programs are often designed by medical or occupational experts and the programs rest on special principles executed by trained professionals. Consequently, the findings of these programs may not be valid in a national setting.

Second, as noted by Franche *et al.* (2005) studies of sufficient scientific quality all concern disabled workers with musculoskeletal disorders. Consequently, the findings of these studies may not be valid for programs also including workers with other non-musculoskeletal disorders.

Third, nearly all previous studies concern programs with several interventions, e.g. workplace adaptations in combination with worksite ergonomic visits and early employer-contact with the sick-listed worker. This makes it difficult to make inferences about the effectiveness of a specific intervention such as reduced working hours (Franche *et al.*, 2005).

With these qualifiers in mind the study of Butler *et al.* (1995) appears to be of most relevance to our study. Their study does not focus on a specially designed program restricted to a limited population of disabled workers and they provide separate estimates of different workplace accommodations, including reduced working hours. 1,850 injured workers with permanent partial impairments in Ontario, Canada, were interviewed between 3 and 15 years after injury. Modified equipment, light work loads, and reduced working hours affected the workers' labour market attachment after injury. Thus, workers returning to reduced hours had significantly more stable labour market attachment than workers who did not have their hours reduced. This finding suggests that the Danish graded-return-to-work program may increase sick-listed workers' chances of resuming work on ordinary conditions.

Despite these important similarities, there are also important differences hampering direct comparison of our study with the study of Butler *et al.* (1995). One difference concerns the outcome variable. While we study return-to-work durations, Butler *et al.* (1995) studied employment patterns. Another difference concerns the treatment variable: we study a temporary reduction of working hours, whereas no demands with respect to the duration of the reduction in working hours were reported in the Canadian study. Furthermore, in contrast to the Canadian treatment, the Danish workplace accommodations are taking place under a formal program. As the program regulates the sick-listed workers' economic compensation during the period on reduced hours it may affect the duration of this period thereby affecting the time until returning to regular working hours (see section 4).

Finally, Butler *et al.* (1995) did not correct for unobserved differences between workers who received workplace accommodations and workers who did not, meaning that the estimated employment effects may be biased. In contrast to their study, we adjust for unobserved heterogeneity.

### **3. The Danish sick leave policy**

The Danish sickness benefit program covers wage earners, self-employed, and people receiving unemployment insurance benefit. The program replaces wages up to a ceiling cap that equals the maximum unemployment benefit. Often employers top up benefits to the wage level. Sick-listed individuals can normally receive sickness benefit for up to one year within a period of 18 months.

By law the municipalities are obliged to follow-up all cases within eight weeks after the first day of the sick leave. Thereafter, the municipality must perform follow-up assessments every fourth

week in complicated cases and every eighth week in uncomplicated cases. The municipal caseworker must verify that the sick-listed individual is eligible to the benefit, i.e. is work incapacitated, and facilitate that the sick-listed individual returns to work as quickly as possible. The follow-up assessment must rely on updated medical, social, and vocational information, and it must take place in cooperation with the sick-listed individual and other relevant agents, such as the employer, medical experts, vocational rehabilitation institutions, unions, and labour market experts.

To promote a swift return to work, the caseworker can apply various vocational rehabilitation measures. These measures comprise job counselling, test of work capacity, wage-subsidised job-training, courses, educational measures, economic support to workplace accommodations, aids, and graded return to work. If the sick-listed worker, despite medical treatment and vocational rehabilitation, is unable to return to ordinary employment, the municipality may refer the sick-listed individual to a permanently wage-subsidized job on special conditions, e.g. reduced working hours and special job tasks (*fleksjob*). To be eligible to a fleksjob, the sick-listed worker must have permanently reduced work capacity of at least 50 percent. If the sick-listed individual cannot return to a fleksjob, the municipality may award a disability benefit.

The graded-return-to-work measure allows the sick-listed worker to return to the pre-sick leave job on reduced working hours. During the period on reduced working hours, the worker receives his or her normal hourly wage for the hours worked and sickness benefit for the hours off work. The sick-listed worker is supposed to return to regular working hours as soon as possible, i.e. with full employer-financed wage payment and pre-sick leave working hours. In any case the graded-return-to-work period can normally not exceed the one-year sickness benefit period. Graded return to work must take place in agreement between the employer, the sick-listed worker, and the municipality. In practice a graded return to work may be established in two ways. The municipality may assess that the sick-listed worker is able to work part-time and therefore ask the sick-listed worker to make an agreement about graded return to work with the employer. The sick-listed worker and the employer may also on their own initiative make an agreement about a graded return to work and then get the agreement approved by the municipality.

#### 4. Possible effects of the graded return to work

In an economic perspective, a graded-return-to-work program may yield positive employment outcomes because of human capital effects. Assuming that a person's total labour market inactivity results in degeneration of the person's skills and qualifications, graded return to work may slow down or hinder such loss of skills and qualifications. A sick-listed individual working reduced hours will therefore have more human capital and better employment prospects than an otherwise identical fully sick-listed worker.

However, such positive employment effects may be hampered by perverse economic incentives of the graded-return-to-work program. Compared to fully sick-listed workers, workers on graded return to work have smaller economic incentives to return to regular working hours. This is so because during program participation the workers are working part-time but receive an income (wage payments plus supplementary sickness benefit) close to the pre-sick leave wage, while fully sick-listed workers receive sick leave benefit.<sup>1</sup> Furthermore, if the program makes sick-listed workers return to graded work before they have recovered sufficiently, their health problems may increase and force them to return to fully sick-listed again (Pransky *et al.*, 2002). Consequently, in certain cases the program may be expected to prolong the sick leave period.

#### 5. Data and descriptive statistics

We use a matched survey-register sample of workers sick-listed for more than eight weeks. The sample of 1,220 sickness benefit cases that were closed during January 2006 and July 2006 was randomly drawn from 39 out of 271 municipalities. The municipalities were stratified with respect to size and geographically location. The 39 municipalities were asked to answer a small questionnaire about each of the 1,220 sick-listed workers. These data comprise information about case management activities, including the date of the graded return to work. Information was gathered for 1,086 persons (89 percent).

We matched the survey data to two types of register information. From the national register of payments of sickness benefits (KMD) we gathered information about the first and the last day of the sick leave. The information in the KMD register originates from the municipalities' payments of sickness benefit. From Statistic Denmark's 'Integrated Database for Labour Market Research' and

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<sup>1</sup> However, in general white-collar workers and some skilled workers receive full wage during sick leave. For these workers the program has no economic incentive effects.



‘the Database of Health Care Services’ we collected data about socio-demographic characteristics, previous labour market attachment, and the number of visits to general practitioners and to specialists before the sick leave. The register data was obtained for 1,083 persons.

We restrict our analysis to 1,019 workers who were under 60 years and fully work incapacitated at the onset of the sick leave period. We exclude 85 workers with missing or inconsistent information on the timing of graded return to work, leaving 934 persons in our analytical sample.

We use KMD’s register of payments of sickness benefits to construct the dependent variable measuring the time until first return to regular working hours. We consider a person to have returned to regular working hours when the sickness benefit case is closed because the sick-listed worker reported ready to work pre-sick leave working hours. By definition we treat sickness benefit cases that are terminated for all other reasons as right censored when payment of the benefit ends. Other reasons to stop benefit payment include: receipt of disability benefit, employment in a permanently wage subsidised job (*fleksjob*), exhaustion of the legal benefit period, participation in vocational rehabilitation, temporary suspension of benefit payment because of holidays, and termination because the municipality assesses that the sick-listed worker is not work incapacitated. The fact that we only use an indirect return-to-work measure is clearly a drawback that introduces uncertainty in the measurement. Furthermore, receipt of disability benefit and employment in a *fleksjob* are absorbing exit states that prevent people from returning to ordinary employment at a later point in time. Consequently, it would be appropriate to estimate a random effect competing risk model (van den Berg, 2001) with two exit states, i.e. returning to regular working hours and disability benefit or *fleksjob* employment. Unfortunately, we were unable to identify the random effect distribution for this model. Therefore, we only work with one exit state (returning to regular working hours), and we right censor all other exits.

Six hundred twenty nine sick-listed workers (67 percent) returned to regular working hours after in average 20 weeks.

We use the municipal survey data to construct two graded-return-to-work variables. One variable measures whether the individual enrolls into the program. It is coded as 0 until program enrollment and 1 during participation and 0 after program participation. Another variable measures whether the individual has left the program. The variable is 0 until program termination and 1 afterwards.

265 (28 percent) of the sick-listed workers participated in the graded-return-to-work program after in average 16 weeks of sick leave. The graded-return-to-work period lasted in average 11

weeks. Of those who participated in the program 20 percent ended the program without returning to regular working hours, i.e. they stopped program participation and reported fully sick-listed again. Figure 1 and 2 show the unadjusted hazard rates to the graded-return-to-work program and to regular working hours, respectively.

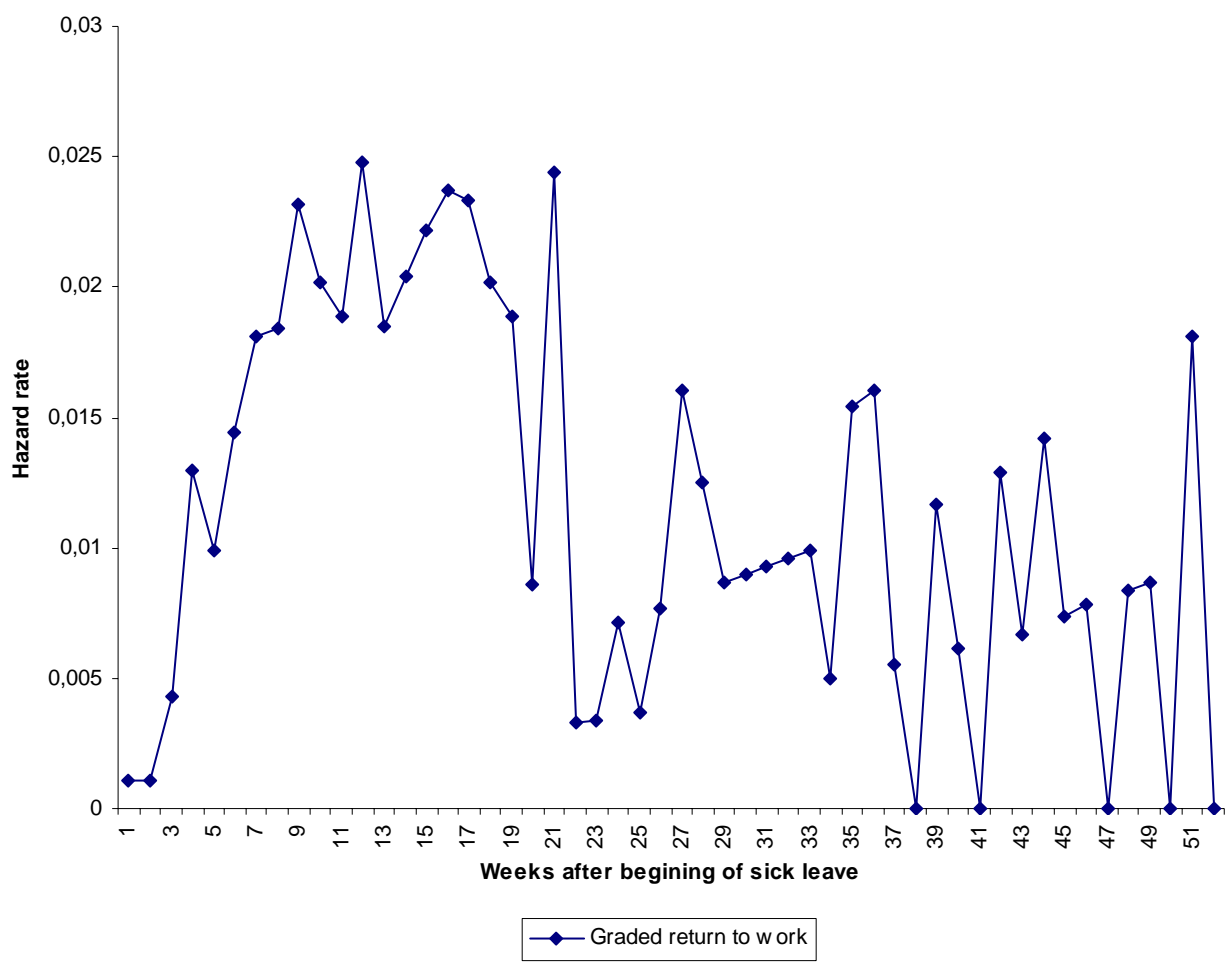


Fig. 1. Unadjusted hazard rate to graded return to work.

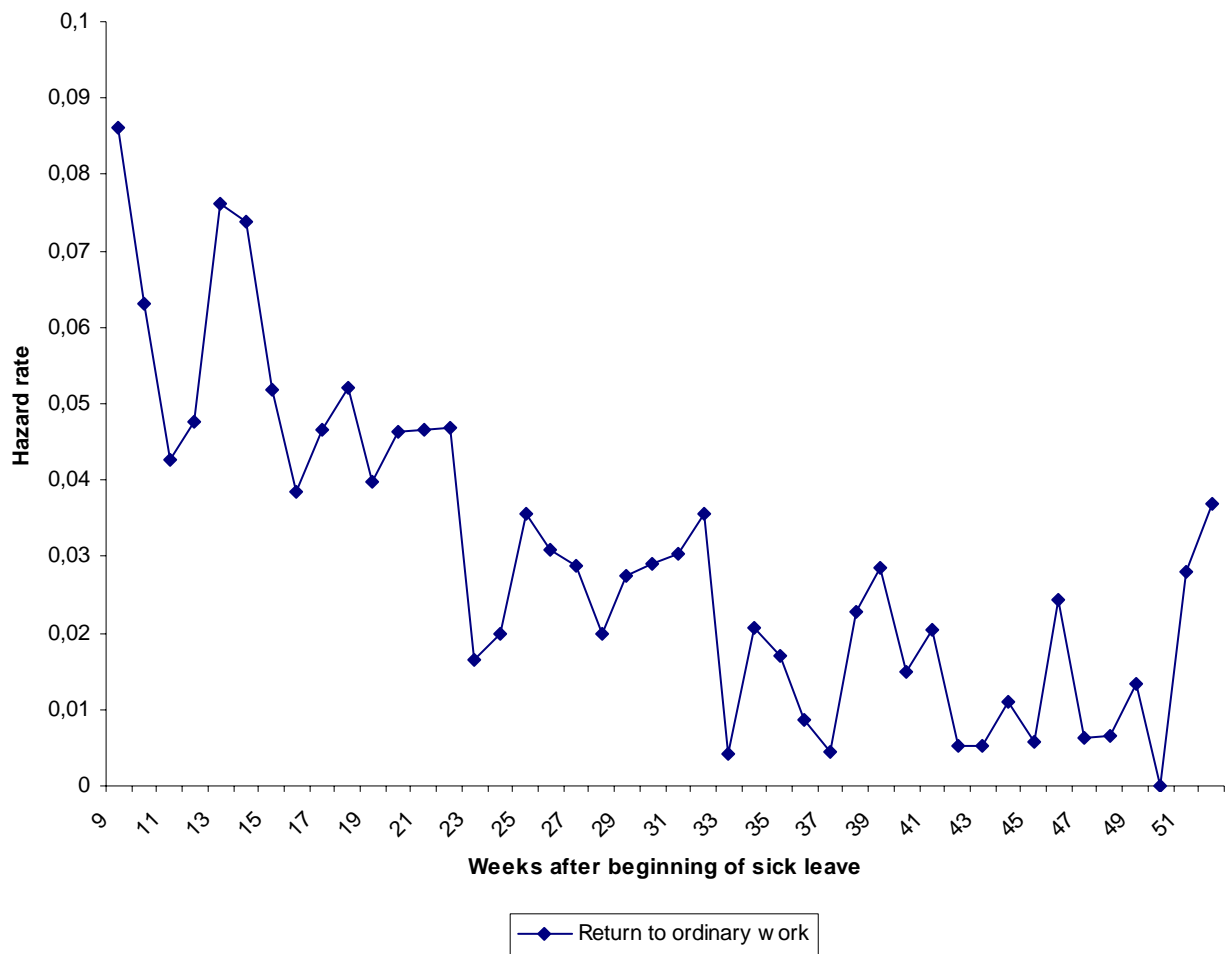


Fig. 2. Unadjusted hazard rate to regular working hours.

The transition to the graded-return-to-work program increases during the first nine weeks<sup>2</sup> and remains at a relatively high level until the 21<sup>st</sup> week; thereafter it decreases to a somewhat lower level during the remainder of the first year of the observation period. The hazard rate to regular working hours is high right after the sick-listed workers were admitted to the study; thereafter it gradually decreases throughout the observation period. The unadjusted hazard rates give no clear indication of the possible employment effects of the program. Thus, the hazard rates to the program

<sup>2</sup> The fact that the sick-listed workers in this study are sampled after eight weeks of sick leave may bias the estimated treatment effect. If the graded-return-to-work program has a positive employment effect some program participants may not be included in our sample because they returned to regular working hours before the ninth week. In contrast, other early program participants will be in the sample because they did not return to regular working hours before the ninth week. Consequently, program participants with a low return-to-work potential will be overrepresented in the sample and our estimate of the treatment effect will therefore be a lower bound of the true treatment effect. To assess if this proposition is correct, we re-estimate our model on a sample restricted to graded-return-to-work durations of 9 weeks or more. This analysis supports that the estimated treatment effect is a lower-bound estimate, i.e. the coefficient of the variable measuring the effect during program participation is 0.548 in the restricted sample and 0.430 in the full sample, see table B2 in the Appendix and table 2 in section 7.

and to regular working hours largely follow the same development: they are at a high level between the 10<sup>th</sup> and the 21<sup>st</sup> week and at a somewhat lower level during the remainder of the observation period.

The sick-listed workers' health condition is measured in two variables: the yearly number of visits to general practitioners and to specialists the year before the present sick leave. The socio-demographic characteristics comprise sex, age, cohabitation status, citizenship, educational background and previous employment experience, measured as the number of fulltime equivalent years of employment since 1964. These variables are also measured the year before the present sick leave. Finally, we include the regional unemployment rate as a proxy for regional labor market demand fluctuations, which may influence the probability of returning to work. This time-varying variable is measured as the lagged unemployment rate, and it follows changes in the observed unemployment rate every sixth month.<sup>3</sup> Table 1 shows means and standard deviations of the dependent and explanatory variables for program participants and non-participants.

**Table 1. Descriptive statistics**

	Participants		Non-participants	
	Mean	Std.dev	Mean	Std.dev
Time until graded return to work (in weeks)	16.408	15.336		
Duration of graded return to work (in weeks)	10.669	13.553		
Returning to regular working hours (yes=1)	0.664	0.473	0.677	0.468
Duration until returning to regular working hours*** <sup>1)</sup>	22.568	13.216	19.055	14.154
Visits to general practitioner in the year before the sick leave	8.140	7.037	8.809	8.029
Visits to specialists in the year before the sick leave	0.721	1.709	0.949	2.690
Female (yes=1)*	0.657	0.476	0.587	0.493
Age	44.426	9.695	43.354	10.825
Living with spouse (yes=1)**	0.774	0.419	0.709	0.455
Danish citizen (yes=1)	0.026	0.161	0.042	0.200
Educational attainment				
Primary <sup>2)</sup> (yes=1)***	0.268	0.444	0.363	0.232
Secondary <sup>2)</sup> (yes=1)**	0.460	0.499	0.389	0.488
Postsecondary <sup>2)</sup> (yes=1)	0.272	0.446	0.248	0.432
Previous employment experience since 1964 (years employed)***	19.428	9.765	17.372	10.361

<sup>3</sup> The variable is based on information about the quarterly unemployment rate. The average of the unemployment rate in the two quarters before the beginning of a sick leave period is allowed to affect the probability of returning to work during the first 26 weeks of the sick leave. Similarly, the average unemployment rate during the two first quarters of the sick leave period is allowed to affect the probability of returning to work during the next 26 weeks etc.

Unemployment rate in percent, 9-26 <sup>th</sup> week	5.322	1.171	5.262	1.128
Unemployment rate in percent, 27-52 <sup>th</sup> week <sup>**3)</sup>	5.092	1.205	5.436	1.142
Unemployment rate in percent, 53-78 <sup>th</sup> week <sup>4)</sup>	4.977	1.156	5.353	1.176
Unemployment rate in percent, 79 <sup>th</sup> week <sup>+5)</sup>	4.880	0.983	5.378	1.376

Note: Calculations based on 265 program participants and 669 non-participants. Significance levels: \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

1): Calculation based on 176 participants and 453 non-participants who returned to regular working hours.

2): Primary education covers the compulsory school period, i.e. nine years of basic school, and other preparatory schooling such as high school. Secondary education includes all ‘terminal’ educations (preparing the students for entry directly into working life) except university degrees. Postsecondary education includes all types of university degrees.

3): Calculation based on 107 participants and 211 non-participants with return-to-work durations longer than 26 weeks.

4): Calculation based on 35 participants and 96 non-participants with return-to-work durations longer than 52 weeks.

5): Calculation based on 5 participants and 36 non-participants with return-to-work durations longer than 78 weeks.

Table 1 indicates that there seems to be a selection to program enrolment. The sick-listed workers participating in the program are more often females, living with a spouse, they more often have secondary education and also have more previous labour market experience than non-participants.

## 6. The econometric model

### 6.1. A model of program participation and returning to regular working hours

If the selection into the graded-return-to-work program is partly determined by unobserved variables, it is important to correct for the selection into the treatment. Without such correction the identified effect may not represent a causal relation between program participation and the probability of returning to regular working hours. Instead the observed effect may reflect that treated and untreated individuals differ with respect to unobserved characteristics that both affect the selection into the program and the probability of returning to regular working hours.

We use a discrete mixed proportional hazard rate model to simultaneously estimate the sick-listed worker’s transition to graded return to work and to regular working hours. The unobserved heterogeneity is captured in a discrete distribution with a finite number of mass points. This procedure allows the random effects of the two durations to be depended without imposing assumptions about the structure of the dependence.

The transition to graded return to work is given by a logit model with time-dependent constant terms:

$$P(D_1(t) = d_1^t) = \frac{\exp(\delta_{it} + \beta_1 x_1 + \varepsilon_1)^{d_1^t}}{1 + \exp(\delta_{it} + \beta_1 x_1 + \varepsilon_1)} \quad (1)$$

where

$t$  is the time after the first day of the sick leave measured in weeks

$$d_1^t = \begin{cases} 1 & \text{if in the graded-return-to-work program in period } t \\ 0 & \text{otherwise} \end{cases}$$

In addition,  $x_1$  is a vector of variables affecting the hazard to graded return to work, and  $\beta_1$  is a corresponding row vector of regression coefficients. The parameter  $\delta_{it}$  is a time-specific intercept term measuring duration dependence in the hazard rate to graded return to work, and  $\varepsilon_1$  is an unobserved random effect. We assume that the unobserved heterogeneity is independent of observed variables and time invariant. Conditional on the transition to the graded-return-to-work program, we also assume that the transition out of the program before returning to regular working hours is exogenous.<sup>4</sup> Ending participation in the program is indicated by:

$$d_2^t = \begin{cases} 1 & \text{if program participation ends before period } t \\ 0 & \text{otherwise.} \end{cases}$$

The transition to regular working hours is described by the following logit model with time-dependent constant terms:

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<sup>4</sup> As the selection into the program may differ from the selection out of the program, both selection processes should be modelled to obtain an unbiased estimate of the program effect. However, we were unable to model the selection out of the program because relatively few persons leave the program before returning to regular working hours. Sick-listed workers leaving the program without having returned to regular working hours will probably have fewer unobserved resources than other program participants, meaning that we probably underestimate the program effect,  $\gamma_2$ , for sick-listed workers leaving the program.

$$P(D_3(t) = d_3^t) = \frac{\exp(\delta_{2t} + \gamma_1 d_1^t + \gamma_2 d_2^t + \beta_2 x_2 + \varepsilon_2)^{d_3^t}}{1 + \exp(\delta_{2t} + \gamma_1 d_1^t + \gamma_2 d_2^t + \beta_2 x_2 + \varepsilon_2)} \quad (2)$$

where:

$$d_3^t = \begin{cases} 1 & \text{if returning to ordinary work in period } t \\ 0 & \text{otherwise.} \end{cases}$$

and  $x_2$  are observed variables with  $\beta_2$  as the two corresponding row vectors of regression coefficients. The coefficients  $\gamma_1$  and  $\gamma_2$  measure the effect of entering and ending the graded-return-to-work program on the hazard rate to ordinary employment. The parameter  $\delta_{2t}$  is a time-specific intercept term measuring duration dependence in the hazard rate to regular working hours, and the coefficient  $\varepsilon_2$  measures the unobserved effects in the hazard rate.

Following Heckman and Singer (1984) for the univariate case and van den Berg *et al.* (2002) for the multivariate extension, we assume that  $\varepsilon_1, \varepsilon_2$  takes on a finite number of values, the first being  $(0,0)$  and subsequently  $(\bar{\varepsilon}_{11}, \bar{\varepsilon}_{12}), (\bar{\varepsilon}_{21}, \bar{\varepsilon}_{22}), \dots$ . The values (mass points) are distributed with probability  $p_{0,0}, p_{\bar{\varepsilon}_{11}, \bar{\varepsilon}_{12}}, p_{\bar{\varepsilon}_{21}, \bar{\varepsilon}_{22}}, \dots$ , with  $\sum_j p_{\bar{\varepsilon}_{j1}, \bar{\varepsilon}_{j2}} = 1$ . Both mass points and probabilities are estimated as parameters in the likelihood function. Assuming a finite number of mass points, see Frühwirth-Schnatter (2006), standard likelihood regularity conditions holds.

Denoting the discrete duration until returning to regular working hours or censoring as  $T_i$ , we calculate the individual contribution to the log-likelihood function as:

$$\ln L_i = \ln \left[ \sum_{j=1}^{j=J} p_{\bar{\varepsilon}_{j1}, \bar{\varepsilon}_{j2}} \prod_{t=1}^{T_i} P(D_1(t) = d_1 | \bar{\varepsilon}_{j1})^{1-d_1^t} \times P(D_3(t) = d_3 | \bar{\varepsilon}_{j2}) \right] \quad (3)$$

This likelihood is optimized with respect to the regression parameters in the two logit models for the time until entering the graded-return-to-work program (1) and until returning to full time work (2) and the parameters capturing the discrete mixture distribution of unobserved random effect. By allowing the random effects to be correlated, the model jointly determines the selection process into the program and the process of returning to full time work. By doing this we take into

account selection effects as they are conditioned upon in the model, meaning that the estimates of program participation have a casual interpretation.

## *6.2. Identification*

Researchers often use the instrumental variables method to obtain an unbiased treatment effect. This method presupposes the existence of a variable that influences the assignment to the treatment but does not influence the outcome variable, except indirectly through the treatment. However, this assumption is often difficult to accomplish. This is also a problem in this study, because all the variables measuring the sick-listed worker's characteristics may not only influence program participation but also the subsequent probability of returning to regular working hours.

To obtain an unbiased estimate of the treatment effect, we use the timing-of-event approach. In their seminal work, Abbring and van den Berg (2003) show that if individuals cannot anticipate the exact timing of the treatment the joint mixed proportional hazard rate model of both the duration until program participation and the event of interest yields an unbiased estimate of the treatment effect. In such a model the information about variation in the timing of both the treatment and the realisation of the outcome is sufficient to measure the treatment effect without bias. In our study, the no-anticipation assumption means that, at the beginning of the sick leave spell, the sick-listed workers do not know the exact timing of their enrolment in the graded-return-to-work program. We believe that this assumption is met. It seems unlikely that sick-listed workers should be able to forecast their health status with such precision that they can determine when their future health condition has improved so much that it makes a graded work feasible. Furthermore, a sick-listed worker's participation in the program demands the employer's and the municipal case manager's sanctioning. Thus, even if the sick-listed workers were able to forecast when their health condition would allow them to return to graded work, they cannot with certainty predict if they will be admitted to the program.

## **7. Findings**

Table 2 shows the results of the random effects hazard rate model of program enrolment and of returning to regular working hours. Table B1 in the Appendix shows the results of a similar model without random effects.



**Table 2.****Random effects hazard rate model of participation in graded return to work and of returning to regular working hours**

	Graded return to work		Regular working hours	
Enrolled in graded return to work			0.430	(0.168)**
Graded return to work completed			0.425	(0.262)
Visits to general practitioner in the year before the sick leave	-0.018	(0.009)**	-0.034	(0.009)***
Visits to specialists in the year before the sick leave	-0.052	(0.032)	-0.025	(0.031)
Female (yes=1)	0.403	(0.140)***	0.044	(0.133)
Age	-0.027	(0.010)***	-0.024	(0.009)***
Living with spouse (yes=1)	0.220	(0.153)	0.030	(0.135)
Danish citizen (yes=1)	-0.380	(0.406)	-1.516	(0.463)***
Educational attainment				
Secondary	0.370	(0.154)**	-0.034	(0.805)
Postsecondary	0.471	(0.175)***	0.490	(0.151)***
Previous employment experience since 1964 (years employed)	0.038	(0.011)***	0.020	(0.010)**
Unemployment rate	-0.116	(0.057)**	-0.482	(0.065)***
Baseline, period 2 <sup>1)</sup>	0.870	(0.179)***	0.703	(0.198)***
Baseline, period 3 <sup>1)</sup>	1.008	(0.200)***	0.419	(0.248)*
Baseline, period 4 <sup>1)</sup>	0.079	(0.227)	-0.482	(0.282)*
Constant	-4.310	(0.472)***	-0.768	(0.428)*
Random effects	0.762	(0.310)**	2.735	(0.287)***
Fraction of observations with random effect	0.273		0.273	

Note: N=934. The hazard rate models are estimated simultaneously. See table 1 for further information about the variables. Standard errors between brackets. Significance levels: \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

1): Baseline hazards in the equation for graded return to work: period 1: <9 weeks, period 2: 9-12 weeks, period 3: 13-19 weeks, period 4: >19 weeks. Baseline hazards in the equation for returning to regular working hours: period 1: <13 weeks, period 2: 13-19 weeks, period 3: 20-39 weeks, period 4: >39 weeks.

There is a systematic selection of sick-listed workers to the graded-return-to-work program. The selection is influenced both by observed and unobserved characteristics. Looking at the observed characteristics, we see that sick-listed workers with few previous visits to the general practitioner, low age, a postsecondary education, and much previous labour markets experience have a high probability both of participating in the program and of returning to regular working hours. These findings suggest that the sick-listed workers' health condition (visits to the general practitio-

ner) and human capital (educational attainment and labour markets experience) influence the probability of program participation. As these variables have a similar effect on the probability of returning to regular working hours, we may conclude that individuals with good employment prospects have a high probability of participating in the graded-return-to-work program.

Furthermore, a low regional unemployment increases the chance of participating in the program, suggesting that labour shortage may induce employers to retain sick-listed workers using the graded-return-to-work program.

Like the observed variables, the unobserved heterogeneity components also suggest that program participants have good employment prospects. Twenty seven percent of the sick-listed workers have unobserved characteristics that significantly increase the probability both of participating in the program and of returning to regular working hours. The random effects indicate that this selection is strong and significant: the coefficient to program participation is 0.762 with a p-value of 0.014 and the coefficient to regular working hours is 2.735 with a p-value of 0.000. These coefficients correspond to risk ratios of 2.1 and 15.4, respectively.

We find a significant and positive effect of the graded-return-to-work program on the probability of returning to regular working hours. The coefficient of the variable measuring the effect during program participation is 0.430 with a p-value of 0.011. Consequently, in each week during program participation the participants have a 54 percent higher probability of returning to regular working hours than sick-listed workers who do not participate. This effect supports the hypothesis that participation in the graded-return-to-work program may reduce or hinder the loss of skills and qualifications that otherwise may occur when illness results in total of inactivity.

The effect of having ended the program without returning to regular working hours is positive but insignificant at a 10 percent significance level. This finding contradicts the hypothesis that program participation may increase some participants' health problems and thus reduce their future labour market attachment. Together, these findings suggest that program participation increases the sick-listed workers' labour market attachment, without harming the labour market prospects of those program participants who are unable to complete the program.

Finally, the findings illustrate the importance of correcting for unobserved heterogeneity. A comparison of the model with and without random effects shows that without correction for unobserved heterogeneity the risk ratio of returning to regular working hours during program participation is overestimated by 20 percent. Similarly, for workers that have left the graded-return-to-work program before returning to regular working hours, the subsequent risk ratio of returning to work is

overestimated by 7 percent. This finding has important bearings on the conclusion that we can make. While the positive effect during program participation remains significant after controlling for unobserved heterogeneity, the post program effect for workers who did not return to regular working hours during program participation becomes insignificant.

## 8. Conclusions

In this paper we estimated the employment effects of a national graded-return-to-work program. The program allows sick-listed workers to return to work on reduced working hours. When the individual's work ability improves, the working hours are gradually increased until the sick-listed worker is able to work full hours. During program participation the sick-listed worker receives the normal hourly wage for the hours worked and sickness benefit for the hours off work. We examined if program participation increases the chance of returning to regular working hours. Using combined survey and register data, we estimated a mixed proportional hazard rate model of program participation and of returning to regular working hours. To identify the treatment effect, we used the timing-of-event approach, assuming that the sick-listed workers are unable to anticipate the exact timing of program enrolment. We argued that this assumption is fulfilled because an individual who is falling ill cannot forecast when his or her health condition will allow a graded return to work.

We found a significant and positive effect of the graded-return-to-work program on the probability of returning to regular working hours. This effect supports that the program has a human-capital effect, i.e. that program participation reduce or hinder a loss of skills and qualifications.

We also found an insignificant effect of having ended the program without returning to regular working hours. This finding suggests that the program does not reduce the future labour market attachment of those participants who do not manage to complete the program.

Although our study is not directly comparable to other studies, our findings are in line with previous studies that found positive employment effects of workplace based interventions (e.g. Arnetz *et al.*, 2003) and of reduced working hours (Butler *et al.*, 1995).

This study benefited from municipality-based data about payments of sickness benefits and case management activities. We may therefore assume that the data have a high reliability. However, some drawbacks should be noted. First, the measurement of the outcome variable, the time until returning to regular working hours, was only measured indirectly from information about

when and why payment of sickness benefit ended. Clearly, this reduced the reliability of the measurement. Second, the measures of the sick-listed workers' health were based on register data about the number of previous visits to general practitioners and specialists. The study would have benefited from baseline data about the sick-listed workers' own health assessments. Future studies with better data may therefore reduce the potentially omitted variable bias of the estimated treatment effect. Finally, our study population was restricted to workers sick-listed for more than eight weeks, which also may have biased the estimated treatment effect. The solution to this problem could be to collect data when the workers have been sick-listed for a short period, e.g. two weeks. However, this would demand a huge sample because the lion's share of the sick-listed workers would return to work shortly after inclusion in the study without having entered the graded-return-to-work program.

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## Appendix

**Table B1.**

**Hazard rate model of participation in graded return to work and returning to regular working hours**

	Graded return to work		Regular working hours	
Enrolled in graded return to work			0.614	(0.100)***
Graded return to work completed			0.492	(0.234)**
Visits to general practitioner in the year before the sick leave	-0.017	(0.009)*	-0.022	(0.006)***
Visits to specialists in the year before the sick leave	-0.051	(0.031)	-0.020	(0.019)
Female (yes=1)	0.391	(0.138)***	0.014	(0.090)
Age	-0.026	(0.010)**	-0.012	(0.006)**
Living with spouse (yes=1)	0.227	(0.151)	0.054	(0.096)
Danish citizen (yes=1)	-0.312	(0.400)	-0.951	(0.304)***
Educational attainment				
Secondary	0.365	(0.153)**	-0.042	(0.100)
Postsecondary	0.438	(0.173)**	0.278	(0.109)**
Previous employment experience since 1964 (years employed)	0.037	(0.011)***	0.011	(0.007)*
Unemployment rate	-0.100	(0.056)*	-0.325	(0.040)***
Baseline, period 2 <sup>1)</sup>	0.779	(0.174)***	-0.074	(0.103)
Baseline, period 3 <sup>1)</sup>	0.809	(0.171)***	0.758	(0.111)***
Baseline, period 4 <sup>1)</sup>	-0.188	(0.178)	-1.762	(0.161)***
Constant	-4.168	(0.465)***	-0.727	(0.305)**

Note: N=934. See table 1 for further information about the variables. Standard errors between brackets. Significance levels: \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

1): Baseline hazards in the equation for graded return to work: period 1: <9 weeks, period 2: 9-12 weeks, period 3: 13-19 weeks, period 4: >19 weeks. Baseline hazards in the equation for returning to regular working hours: period 1: <13 weeks, period 2: 13-19 weeks, period 3: 20-39 weeks, period 4: >39 weeks.



**Table B2.****Random effects hazard rate model of participation in graded return to work and of returning to regular working hours estimated on a sample restricted to graded-return-to-work durations above 8 weeks**

	Graded return to work		Regular working hours	
Enrolled in graded return to work			0.548	(0.169)***
Graded return to work completed			0.306	(0.303)
Visits to general practitioner in the year before the sick leave	-0.017	(0.011)	-0.033	(0.010)***
Visits to specialists in the year before the sick leave	-0.087	(0.043)**	-0.017	(0.026)
Female (yes=1)	0.255	(0.159)***	0.002	(0.130)
Age	-0.013	(0.012)	-0.026	(0.010)***
Living with spouse (yes=1)	0.319	(0.180)*	0.047	(0.138)
Danish citizen (yes=1)	-0.309	(0.439)	-1.638	(0.512)***
Educational attainment				
Secondary	0.421	(0.179)**	-0.026	(0.141)
Postsecondary	0.521	(0.205)**	0.474	(0.158)***
Previous employment experience since 1964 (years employed)	0.029	(0.012)**	0.021	(0.010)**
Unemployment rate	-0.097	(0.065)	-0.441	(0.066)***
Baseline, period 2 <sup>1)</sup>			0.709	(0.220)***
Baseline, period 3 <sup>1)</sup>	0.057	(0.194)***	0.392	(0.267)
Baseline, period 4 <sup>1)</sup>	-0.920	(0.219)***	0.475	(0.299)
Constant	-3.894	(0.553)***	-0.912	(0.445)**
Random effects	0.354	(0.497)	2.873	(0.323)***
Fraction of observations with random effect	0.234		0.234	

Note: N=862. The hazard rate models are estimated simultaneously. See table 1 for further information about the variables. Standard errors between brackets. Significance levels: \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

1): Baseline hazards in the equation for graded return to work: period 1: 9-12 weeks, period 2: 13-19 weeks, period 3: >19 weeks. Baseline hazards in the equation for returning to regular working hours: period 1: <13 weeks, period 2: 13-19 weeks, period 3: 20-39 weeks, period 4: >39 weeks.