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Does graded return to work improve disabled workers' labor market attachment?

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ABSTRACT

Using Danish register and survey data, we examine the effect of a national graded return-to-work program on the probability of sick-listed workers 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. Taking account of unobserved differences between program participants and non-participants, we find that participation in the program significantly increases the probability of returning to regular working hours.

JEL codes: C41, I18, J64.

Introduction

Work disability inflicts huge economic and human costs on society. In a study of 19 OECD countries, on average 14 percent of the working-age population reported being 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 labor market inactivity policy makers, administrators, and researchers invest many resources in finding ways of improving the labor 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' labor 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 labor market attachment of disabled people.

This paper studies how a national program of graded return to work affects the probability of long-term sick-listed workers returning to regular working hours, i.e., pre-sick leave hours. The program allows sick-listed workers to return to work at 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 of 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 expected 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.

Using data on 934 workers who were sick-listed for more than eight 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.

We do find that program participation significantly increases the probability of sick-listed workers returning to regular working hours. Furthermore, our findings illustrate the importance of correcting for unobserved heterogeneity. Without such correction the program effect is significantly overestimated.

The rest of the paper is organized as follows. The next section provides an overview of the relevant literature. Section 3 describes the Danish sick leave policy, while Section 4 outlines how the graded return-to-work program may affect the labor market attachment of sick-listed workers. Section 5, describes the data, and Section 6 explains our econometric model and how we identify the treatment effect. Section 7 presents our findings and the results of robustness checks to our empirical model. Section 8 concludes.

2. Literature review

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 2005 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' labor market attachment. However, there are several reasons for 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, who instruct trained professionals in how to implement the specific program. Consequently, the findings of these programs may not be valid in a national setting.

Second, as Franche et al. (2005:628) note, studies of sufficient scientific quality all concern disabled workers with musculoskeletal disorders. Consequently, the findings of these studies may not be valid for programs that also include workers with 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 broad scope makes it difficult to make inferences about the effectiveness of a specific intervention such as reduced working hours (Franche et al. 2005:627).

With these qualifiers in mind, the study of Butler et al. (1995) appears 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. Their study interviewed 1,850 injured workers with permanent partial impairments in Ontario, Canada, between 3 and 15 years after injury. Modified equipment, light work loads, and reduced working hours affected the workers' labor market attachment after injury. Thus workers returning to reduced hours had significantly more stable labor 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 under ordinary conditions.

Despite these important similarities, important differences hamper 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 take place under a formal program. As the program regulates the sick-listed workers' economic compensation during the period on reduced hours the program may affect the duration of this period, thereby affecting the time before return 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 people, and people receiving unemployment insurance benefits. The program replaces wages up to a ceiling that equals the maximum unemployment benefit. Often employers raise the benefits to meet the wage level. Sick-listed individuals can normally receive sickness benefits for up to one year within a period of 18 months.

By law the municipalities are obliged to followup all cases within eight weeks after the first day of the sick leave. Thereafter, the municipality must perform followup 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 for the benefit, i.e., is work incapacitated, and help the sick-listed individual to return to work as quickly as possible. The followup assessment must rely on updated medical, social, and vocational information, and take place in cooperation with the sick-listed individual and other relevant agents, such as the employer, medical experts, vocational rehabilitation institutions, unions, and labor market experts.

To promote a swift return to work, the caseworker can apply various vocational rehabilitation measures. These measures include job counseling, test of work capacity, wage-subsidized 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 him or her to a permanently wage-subsidized job under special conditions, e.g., reduced working hours and special job tasks (*fleksjob)*. To be eligible for a *fleksjob*, the sick-listed worker must have a 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 at 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. Normally, the graded return-to-work period cannot exceed the one-year sickness benefit period. Graded return to work must take place in agreement among the employer, the sick-listed worker, and the municipality. In practice, a graded return to work may be established in one of 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 agree with the employer about graded return to work. The sick-listed worker and the employer may also make such an agreement on their own initiative and then ask the municipality to approve it.

4. Possible effects of graded return to work

From 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 labor market inactivity results in the degeneration of an individual'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. The reason is that during program participation, the workers are working only part-time but still receiving an income (wage payments plus supplementary sickness benefit) close to the pre-sick leave wage. By contrast, fully sick-listed workers receive the sick leave benefit.[1] Furthermore, if the program makes sick-listed workers return to graded work before they have recovered sufficiently, their health problems may increase, forcing them to

[1] 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.

becoming 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, variables, and descriptive statistics

5.1. Data

We use a matched survey-register sample of workers sick-listed for more than eight weeks.[2] The sample of 1,220 sickness benefit cases that were closed through January 1 to July 31, 2006 was randomly drawn from 39 out of 271 municipalities. The municipalities were stratified with respect to size and geographical location. The 39 municipalities were asked to fill out 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 and about the reason for benefit closure. The information in the KMD register originates from the municipalities' payments of sickness benefits. From Statistic Denmark's "Integrated Database for Labor Market Research" and "the Database of

[2] 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. We return to this issue in Section 7.1.

Health Care Services" we collected data about socio-demographic characteristics, previous labor market attachment, and the number of visits to both general practitioners and 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 old 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.

5.2 Dependent and Explanatory Variables

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. This indirect measurement may introduce measurement error.

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 payments include receipt of disability benefit, employment in a permanently wage subsidized 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 decides that the sick-listed worker is not work incapacitated. Receipt of disability benefit and employment in a *fleksjob* are absorbing exit states that prevent people from returning to ordinary employment at a later time. Thus estimating a random effects competing risk model (van den Berg 2001) with two exit states, i.e., returning to regular working hours and disability benefit or *fleksjob* employment, is appropriate. 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 and twenty-nine sick-listed workers (67 percent) returned to regular working hours after an average of 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. The variable is coded as 0 until program enrollment, 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.

Two hundred and sixty-five (28 percent) of the sick-listed workers participated in the graded return-to-work program after an average of 16 weeks of sick leave. The graded return-to-work period lasted an average of 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.

The sick-listed worker's health condition is measured in two variables: The number of visits the year before the present sick leave to: (1) General practitioners and (2) specialists.[3] The socio-demographic characteristics constitute gender, age, cohabitation status, citizenship, educational background and previous employment experience, measured as the number of full-time equivalent years of employment since 1964. These variables are also measured for 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

[3] We lack information about the sick leave diagnosis. As the diagnosis could potentially affect the probability of both program enrolment and returning to regular working hours, this could bias the estimated program effect. However, Høgelund (2008) finds no significant association between medical diagnosis and participation in the graded return-to-work program.

of returning to work. This time-varying variable, measured as the lagged unemployment rate, follows changes in the observed unemployment rate every sixth month.[4]

5.3. Descriptive Statistics

To get a first impression of whether the graded return-to-work program has a positive impact on sick-listed workers' chance of returning to regular working hours, Figure 1 shows the unadjusted hazard rates to regular working hours for program participants and for non-participants.

<<<<< Figure 1 >>>>>>

Figure 1 clearly shows that sick-listed workers participating in the program have a significantly higher hazard rate to regular working hours than sick-listed workers who do not participate. In other words, the program appears to increase the sick-listed workers' labor market attachment. However, there are two reasons why the apparent program effect in Figure 1 may be biased. The figure does not take into account that some participants leave the program before they return to regular working hours. Therefore, the effect shown in Figure 1 is an average of the effect of being enrolled in the program and of having ended the program without returning to regular working hours. More important, the graphs in Figure 1 do not take into account that program participants may have better a priori employment prospects than non-participants. If, for example, program participation presupposes a certain health

[4] 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.

status, program participants will be healthier than non-participants. Consequently, if health status affects the probability of returning to regular working hours, the program effect in Figure 1 will be upward biased.

Table 1, which shows means and standard deviations of the explanatory variables, suggests that there are observed differences between participants and non-participants.

<<< Table 1 >>>

The sick-listed workers participating in the program are more often females, more often have a secondary education, are more often living with a spouse, and have more previous labor market experience than non-participants. If, for example, previous labor market experience influences the chance of returning to regular working hours, then to obtain an unbiased estimate of the program effect we must correct for previous labor market experience and other observed and unobserved heterogeneity.

6. The econometric model and identification strategy

6.1. The econometric model

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 interdependent 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:

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

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 β_1 is a corresponding row vector of regression coefficients. The parameter δ_{1t} is a time-specific intercept term measuring duration dependence in the hazard rate to graded return to work, and ε_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.[5] 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:

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

[5] As the selection into the program may differ from the selection out of the program, we should model both selection processes 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 may underestimate the program effect, γ_2, for sick-listed workers leaving the program.

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 β_2 as the two corresponding row vectors of regression coefficients. The coefficients γ_1 *and* γ_2 measure the effect of entering and ending the graded return-to-work program on the hazard rate to ordinary employment. The parameter δ_{2t} is a time-specific intercept term measuring duration dependence in the hazard rate to regular working hours, and the coefficient ε_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 $\bar{\varepsilon}_{11}, \bar{\varepsilon}_{12}$, $\bar{\varepsilon}_{21}, \bar{\varepsilon}_{22}$,…. The values (mass points) are distributed with probability $p_{0,0}$ $p_{\bar{\varepsilon}_{11},\bar{\varepsilon}_{12}}$, $p_{\bar{\varepsilon}_{21},\bar{\varepsilon}_{22}}$,…., with $\Sigma_j p_{\bar{e}_{j1},\bar{e}_{j2}} = 1$. Both mass points and probabilities are estimated as parameters in the likelihood function. Assuming a finite number of mass points, see Frühwirt-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:

$$\ln L_i = \ln\left[\sum_{j=1}^{j=J} p_{\bar{e}_{j1},\bar{e}_{j2}} \prod_{t=1}^{T_i} P\left(D_1(t) = d_1 \mid \bar{e}_{j1}\right)^{1-d_2^t} \times P\left(D_3(t) = d_3 \mid \bar{e}_{j2}\right)\right] \quad (3)$$

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. Consequently, we take into account selection effects as they are conditioned upon in the model, meaning that the estimates of program participation have a causal interpretation.

In the discussion of our results, we test whether the random effects are time invariant, cf. the Robustness Checks section. In Appendix A we outline a model with time-varying random effects.

6.2. Identification strategy

Researchers often use the instrumental variables (IV) method to obtain an unbiased treatment effect. This method presupposes the existence of a variable that influences the assignment to the treatment but that does not influence the outcome variable, except indirectly through the treatment. However, this assumption is often difficult to fulfill. Using the IV method is also a problem in this study, because all the variables measuring the sick-listed worker's characteristics may influence not only 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 realization of the outcome is sufficient to measure the treatment effect without bias. In our study, the no-anticipation assumption means that the sick-listed workers, at the beginning of the sick leave period, do not know the exact timing of their enrolment in the graded return-to-work program. We believe that this assumption is met, as 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 graded work feasible. Furthermore, a sick-listed worker's participation in the program demands the employer's and the municipal case manager's approval. 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 whether 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 A1 in Appendix B shows the results of a similar model without random effects.

<<<Table 2>>>

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 post-secondary education, and much previous labor market 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 practitioner) and human capital (educational attainment and labor market 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, low regional unemployment increases the chance of participating in the program, suggesting that labor shortage may induce employers to retain sick-listed workers through 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, a loss that otherwise may occur when illness results in total 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 labor market attachment. Together, these findings suggest that program participation increases the sick-listed workers' labor market attachment, without harming the labor 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 who 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 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.

7.1. Robustness checks

We perform two checks of the robustness of our findings. First, we may underestimate the treatment effect because our data only comprises sick leave periods above eight weeks. Thus, if the graded return-to-work program has a positive employment effect, sick-listed workers who participated in the program before the ninth week may be underrepresented in our data, meaning that we underestimate the treatment effect. To assess whether this proposition is correct, we re-estimate our model on a sample restricted to graded return-to-work durations above eight weeks (see table A2 in Appendix B). This analysis supports the assumption 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.

Second, it is likely that some sick-listed workers experience an improvement of their health condition during the sick leave, thereby enabling them to participate in the graded return-to-work program. If our health measures and the random effects do not fully capture such health developments during the sick leave, the estimated treatment effect may be spurious and reflect improvements in the sick-listed workers' health rather than a program effect. We therefore estimate a model with time-varying random effects. Table A3 in Appendix B shows the results of a model with two mass points in the equation of returning to regular working hours, i.e., one mass point for durations up to 15 weeks and one mass point for durations above 15 weeks.[6] This analysis does not support the hypothesis that health changes during the sick leave influence the estimated effect of program participation.

8. Conclusion

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 again. 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 whether 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

[6] A more comprehensive model would comprise time-varying random effects both in the equation of returning to regular working hours and in the equation of program enrolment. Unfortunately, we were unable to identify the random effect distribution for such a model. A model with time-varying random effects only in the equation of program enrolment yields similar results as the model without time-varying random effects (not shown).

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 the hypothesis that the program has a human capital effect, i.e., that program participation reduces or hinders 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 labor market attachment of those participants who do not 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). Our study adds to this literature in two respects. The vast majority of previous studies concern specially designed workplace-based programs with a limited population of disabled workers. While these studies find that the programs yield positive employment effects, our study suggests that national workplace-based programs may yield similar, positive employment outcomes. Furthermore, our findings illustrate that non-experimental evaluations of reduced working hours and other workplace-based interventions may overestimate the effect of these measures unless the effect of unobserved variables is taken into account.

This study benefited from municipality-based data about payments of sickness benefits and case management activities. We may therefore assume that the data has a high reliability. However, some drawbacks should be noted. First, 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 weakness 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, a restriction that may also 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, doing so would demand a huge sample, because the lion's share of sick-listed workers would return to work shortly after inclusion in the study without having entered the program.

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Table 1

Descriptive statistics.

Variable	*Participants* Mean	*Participants* Std.dev	*Non-participants* Mean	*Non-participants* Std.dev
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
Foreign citizen (yes=1)	0.026	0.161	0.042	0.200
Primary education [b)] (yes=1)***	0.268	0.444	0.363	0.481
Secondary education [b)] (yes=1)**	0.460	0.499	0.389	0.488
Postsecondary education [b)] (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
Unemployment rate in percent, 9-26th week	5.322	1.171	5.262	1.128
Unemployment rate in percent, 27-52th week**[c)]	5.092	1.205	5.436	1.142
Unemployment rate in percent, 53-78th week[d)]	4.977	1.156	5.353	1.176
Unemployment rate in percent, 79th week+[e)]	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%. a): Calculation based on 176 participants and 453 non-participants who returned to regular working hours. b): 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. c): Calculation based on 107 participants and 211 non-participants with return-to-work durations longer than 26 weeks. d): Calculation based on 35 participants and 96 non-participants with return-to-work durations longer than 52 weeks. e): Calculation based on 5 participants and 36 non-participants with return-to-work durations longer than 78 weeks.

Table 2

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

Variable	*Graded return to work*		*Regular 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	(0.152)	0.030	(0.135)
Danish citizen (yes=1)	-0.380	(0.406)	-1.516	(0.463)***
Secondary education	0.370	(0.154)**	-0.034	(0.137)
Postsecondary education	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[a)]	0.870	(0.179)***	0.703	(0.198)***
Baseline, period 3[a)]	1.008	(0.200)***	0.419	(0.248)*
Baseline, period 4[a)]	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 (0.063)***			

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

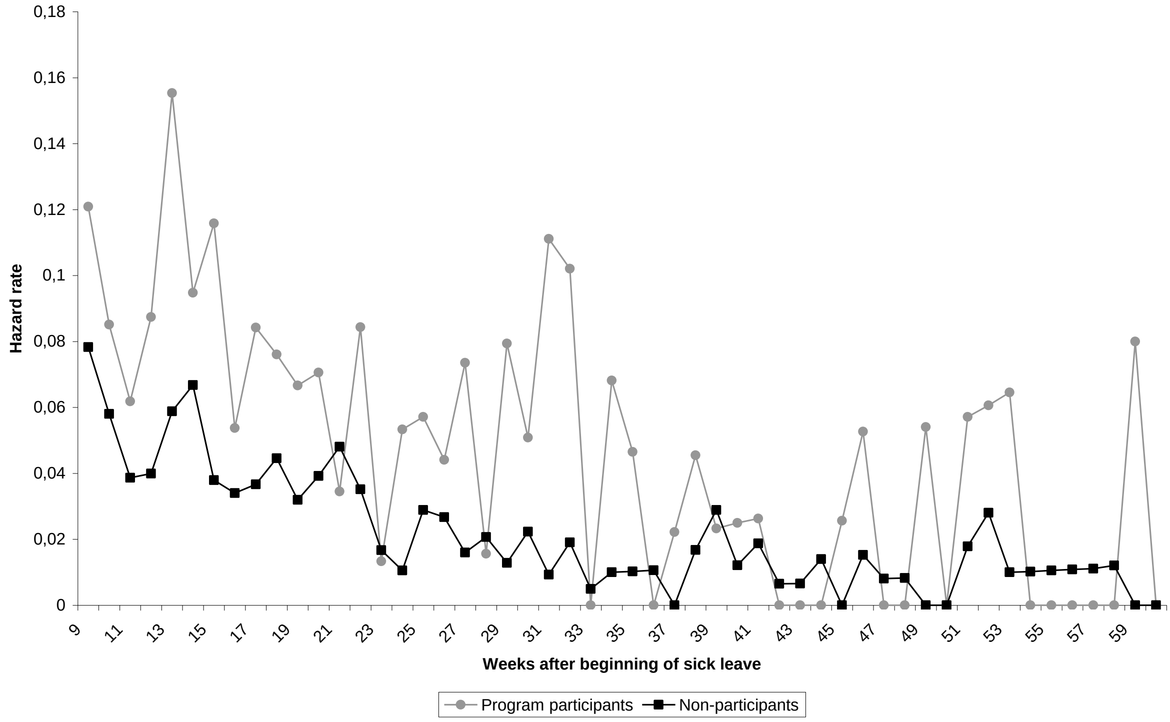

Fig. 1. Unadjusted hazard rates to regular working hours for graded return-to-work participants and non-participants.

Note: For program participants, the hazard rate in a given period, *t*, equals the number of persons returning to regular working hours in period *t*, divided by the number of persons who are enrolled in the program in period *t* or were enrolled before period *t*. For non-participants, the hazard rate in period, *t*, equals the number of persons returning to regular working hours in period *t*, divided by the number of persons who never participate in the program and of persons who enroll in the program after period *t*.

Appendix A. Proportional hazard rate model with time dependent random effects

We allow the random effects to vary in predefined intervals. More specifically the random effects are constant in the interval (0,c) and constant in the interval (c+1, ∞), meaning that the magnitude of the random effects may differ between the two intervals. We then obtain the following hazard rates for the duration into graded return:

$$P(D_1(t)=d_1^t \mid t\le c)=\frac{\exp\left(\delta_{1t}+\beta_1 x_1+\varepsilon_1^1\right)^{d_1^t}}{1+\exp\left(\delta_{1t}+\beta_1 x_1+\varepsilon_1^1\right)};P(D_1(t)=d_1^t \mid t> c)=\frac{\exp\left(\delta_{1t}+\beta_1 x_1+\varepsilon_1^2\right)^{d_1^t}}{1+\exp\left(\delta_{1t}+\beta_1 x_1+\varepsilon_1^2\right)}$$

and for the duration until returning to regular working hours:

$$P(D_3(t)=d_3^t \mid t\le c)=\frac{\exp\left(\delta_{2t}+\gamma_1 d_1^t+\gamma_2 d_2^t+\beta_2 x_2+\varepsilon_2^1\right)^{d_3(t)}}{1+\exp\left(\delta_{2t}+\gamma_1 d_1^t+\gamma_2 d_2^t+\beta_2 x_2+\varepsilon_2^1\right)};$$

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

Note that the super-script on the random effects now designates the time interval for which the random effects take effect. This yields the following log-likelihood function, using the same discrete representation for the random effects as in equation (3):

$$\ln L_i = \ln\left[\sum_{j=1}^{j=J} p_{\bar{e}_{j1},\bar{e}_{j2}} \prod_{t=1}^{c} P\left(D_1(t)=d_1 \mid \bar{e}_{j1}^1\right)^{1-d_2^t} \times P\left(D_3(t)=d_3 \mid \bar{e}_{j2}^1\right) \times \prod_{t=c}^{T_i} P\left(D_1(t)=d_1 \mid \bar{e}_{j1}^2\right)^{1-d_2^t} \times P\left(D_3(t)=d_3 \mid \bar{e}_{j2}^2\right)\right]$$

with $p_{\bar{e}_{j1},\bar{e}_{j2}}$ now being the joint probability of the random effects taking the values $\bar{e}_{j1}^1,\bar{e}_{j2}^1$ when $t \le c$ and $\bar{e}_{j1}^2,\bar{e}_{j2}^2$ when $t > c$.

Appendix B. Tables A1, A2, and A3

Table A1

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

Variable	*Graded return to work*		*Regular 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)***
Secondary education	0.365	(0.153)**	-0.042	(0.100)
Postsecondary education	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[a)]	0.779	(0.174)***	-0.074	(0.103)
Baseline, period 3[a)]	0.809	(0.171)***	-0.758	(0.111)***
Baseline, period 4[a)]	-0.188	(0.178)	-1.763	(0.161)***
Constant	-4.168	(0.465)***	-0.727	(0.305)**

Note: N=934. See table 1 for further information about the variables. Significance levels: *** significant at 1%, ** significant at 5%, * significant at 10%. a): 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 A2

Random effects hazard rate model of graded return to work and of returning to regular working hours using a sample of graded return-to-work durations above eight weeks

Variable	*Graded return to work*		*Regular 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)***
Secondary education	0.421	(0.179)**	-0.026	(0.141)
Postsecondary education	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[a)]	0.057	(0.194)	0.709	(0.220)***
Baseline, period 3[a)]	-0.920	(0.219)***	0.392	(0.267)
Baseline, period 4[a)]			-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 (0.120)**			

Note: N=862. The hazard rate models are estimated simultaneously. See table 1 for more information about the variables. Significance levels: *** significant at 1%, ** significant at 5%, * significant at 10%. a): 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.

Table A3

Hazard rate model with time-varying random effects

Variable	*Graded return to work*		*Regular hours*	
Enrolled in graded return to work			0.461	(0.176)***
Graded return to work completed			0.447	(0.264)*
Visits to general practitioner in the year before the sick leave	-0.018	(0.009)**	-0.032	(0.009)***
Visits to specialists in the year before the sick leave	-0.054	(0.032)*	-0.038	(0.033)
Female (yes=1)	0.401	(0.139)***	0.028	(0.129)
Age	-0.027	(0.010)***	-0.023	(0.009)**
Living with spouse (yes=1)	0.219	(0.152)	0.022	(0.136)
Danish citizen (yes=1)	-0.376	(0.405)	-1.356	(0.423)***
Secondary education	0.373	(0.154)**	-0.013	(0.137)
Postsecondary education	0.470	(0.176)***	0.493	(0.153)***
Previous employment experience since 1964 (years employed)	0.038	(0.011)***	0.019	(0.010)*
Unemployment rate	-0.120	(0.058)**	-0.484	(0.064)***
Baseline, period 2[a)]	0.862	(0.179)***	0.758	(0.203)***
Baseline, period 3[a)]	0.988	(0.201)***	0.467	(0.246)*
Baseline, period 4[a)]	0.056	(0.232)	-0.433	(0.283)
Constant	-4.281	(0.471)***	-0.878	(0.431)**
Random effects, graded return to work	0.695	(0.328)**		
Random effects, regular working hours before the 16th week			2.750	(0.306)***
Random effects, regular working hours after the 16th week			2.114	(0.465)***
Fraction of observations with random effect		0.290 (0.090)***		

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

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