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Substantial sick leave cost savings due to a graded activity intervention for workers with non-specific subacute low back pain

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Abstract

Objectives
The objective of this study is to compare the costs and benefits of a graded activity intervention to usual care for sick-listed workers with non-specific low back pain.

Methods
The study is a single blind, randomized controlled trial with 3-year follow-up. A total of 134 (126 men and 8 women) predominantly blue collar workers, sick-listed due to low back pain were recruited and randomly assigned to either graded activity ($N = 67$; mean age 39 ± 9 years) or to usual care ($N = 67$; mean age 37 ± 8 years). The main outcome measures were the costs of health care utilization during the first follow-up year and the costs of productivity loss during the second and the third follow-up year.

Results
At the end of the first follow-up year an average investment for the graded activity intervention of €475 per worker, only €83 more than health care utilization costs in usual care group, yielded an average savings of at least €999 (95% CI: -1073; 3115) due to a reduction in productivity loss. The potential cumulative savings were an average of €1661 (95% CI: -4154; 6913) per worker over a 3-year follow-up period.

Conclusion
It may be concluded that the graded activity intervention for non-specific LBP is a cost-beneficial return-to-work intervention.

Work-related low back pain (LBP) is usually a benign, self-limiting condition which resolves spontaneously within a few weeks. The incidence and prevalence of work-related LBP are particularly high in industries characterized by manual labor[1 2]. In a small subset of workers, work-related LBP may result in extended periods of work-absenteeism and greater utilization of health care services, two consequences which have a significant socio-economic impact[1 3-6]. The prevention of the occurrence of chronic LBP and the minimization of work-absenteeism is a common goal for workers, employers, policy makers and health care providers. Most economic evaluations have been performed from the societal perspective where all relevant costs are summed together without consideration for who actually pays. However, this approach has limited relevance for the company, where knowing who pays what is of critical interest and importance for decision-making[5 7-9]. From the literature, it appears that the initiation of return-to-work interventions (RTW), such as graded activity (GA) during the sub-acute phase of LBP (4 – 6 weeks after the onset of work absenteeism) may be promising[10]. For instance, the recent studies have shown that RTW interventions for sub-acute LBP are more effective in reducing short- and long-term absence from work than usual care (UC)[7 8 11-17]. However, the available information about the costs and benefits of such interventions is still limited.

The aim of this study was to compare the long term costs and benefits of a GA intervention for subacute work-related LBP to UC from the perspective of the employer.

Methods

Study design

The study design, the content of the GA intervention and clinical outcomes have been reported in detail elsewhere[17]. In short, the study was a single-blind, randomized controlled trial conducted at the Royal Dutch Airlines between April 1, 1999 and December 31, 2000. Sick-listed employees who had suffered LBP complaints for a minimum of 4 weeks were recruited by in-house occupational physicians and randomized by means of block randomization and stratification on the level of department to either UC or GA. All subjects received routine guidance from their occupational physician. In addition, the GA subjects followed twice a week a 60-minute physical exercise session with a cognitive behavioral approach under the supervision of specifically trained physiotherapists. They stayed on program until they fully returned to their previous duties, or until the maximum therapy duration of 3-months was reached. The UC subjects were permitted to seek and receive any type of treatment with the exception of a GA program.

Definitions and Data Collection

Sick leave days, named as "lost productivity days (LPD)", were used as a proxy measure of productivity loss. Recurrences were defined as partial or full sick-leave due to LBP following a full return to work for at least 28 calendar days. Disabled workers were those who were completely or partially sick-listed for more than 52 weeks. Baseline data included age, gender, job assignment, wage group, and the number of sick leave days due to the present episode of LBP accumulated before randomization. During all follow-up years, recurrences, the total number of sick leave days as well as the number of disabled workers were obtained from the electronic database of the occupational services. Health care utilization data were collected by cost diaries during the first follow-up year.

Economic evaluation

Health care utilization (HCU) costs were estimated using the Dutch guidelines for cost analysis in health care research[18]. The unit prices of treatments and medications, were derived from the available tariffs publications[19 20].

The total LPD's were quantified as gross and net LPD's. The number of gross LPD's (GLPD) reflects the total number of calendar days that workers were completely or partially sick-listed. The partial LPD was counted for its percentage of work absence and expressed as net LPD's (NLPD).

The cost of LPD's of each worker was calculated by multiplying the mean daily wage increased by an additional 80% for secondary benefits. The costs of NLPD's were recalculated after correction for a possible 25% or 50% decrease in productivity, because of the possibility that the workers may perform at a lower level than usual when they were partially recovered or were working in reassigned duty or in therapeutic position.

Data Analysis

Non-cost data were analyzed using SPSS (version 11.0; SPSS Inc., Chicago, Ill). The economic evaluation was performed according to the intention-to-treat principle. The HCU costs, and lost productivity costs were analyzed using a bias-corrected and accelerated bootstrapping method with 2000 replications. The mean costs of HCU were analyzed for the entire study population after imputation of missing data via the hot deck method and after interpolation for non-observed months[21].

Results

Subjects

During the 21-month enrollment period, 150 workers were eligible to participate in the study. Ultimately, 134 employees were randomized to either usual care (N = 67) or graded activity (N = 67). During the second follow-up year three subjects and in the third year another two subjects left the company and were lost to follow-up (figure 1).

Baseline measurements

As reported in detail elsewhere, there were no relevant between-group differences with respect to age, gender or job, nor in the mean number of GLPD's and NLPD's prior to randomization.

Health care utilization

The return rate of the cost diaries was 84% and there were 93 workers who returned all diaries (UC = 46; GA = 47). Non-responders did not significantly differ from responders in terms of baseline characteristics. The HCU data during the first year of follow-up are presented in table 1. During the first three months, the GA subjects received significantly (p = 0.001) more physiotherapy than the UC. GA subjects attended an average of 13 GA sessions of one hour duration, which is an equivalent to 26 (SD = 11) standard physiotherapy sessions of 30 minutes. UC subjects attended on average 9 (SD = 9) standard physiotherapy sessions. However, in the subsequent months, the UC subjects attended a larger number of physiotherapy sessions, and by the end of the 12-month follow-up period, the difference between the groups was no longer significant.

Figure 1. Flow chart of the participants and dropouts during the 3-year follow-up period. *Asterisk* indicates number of workers.

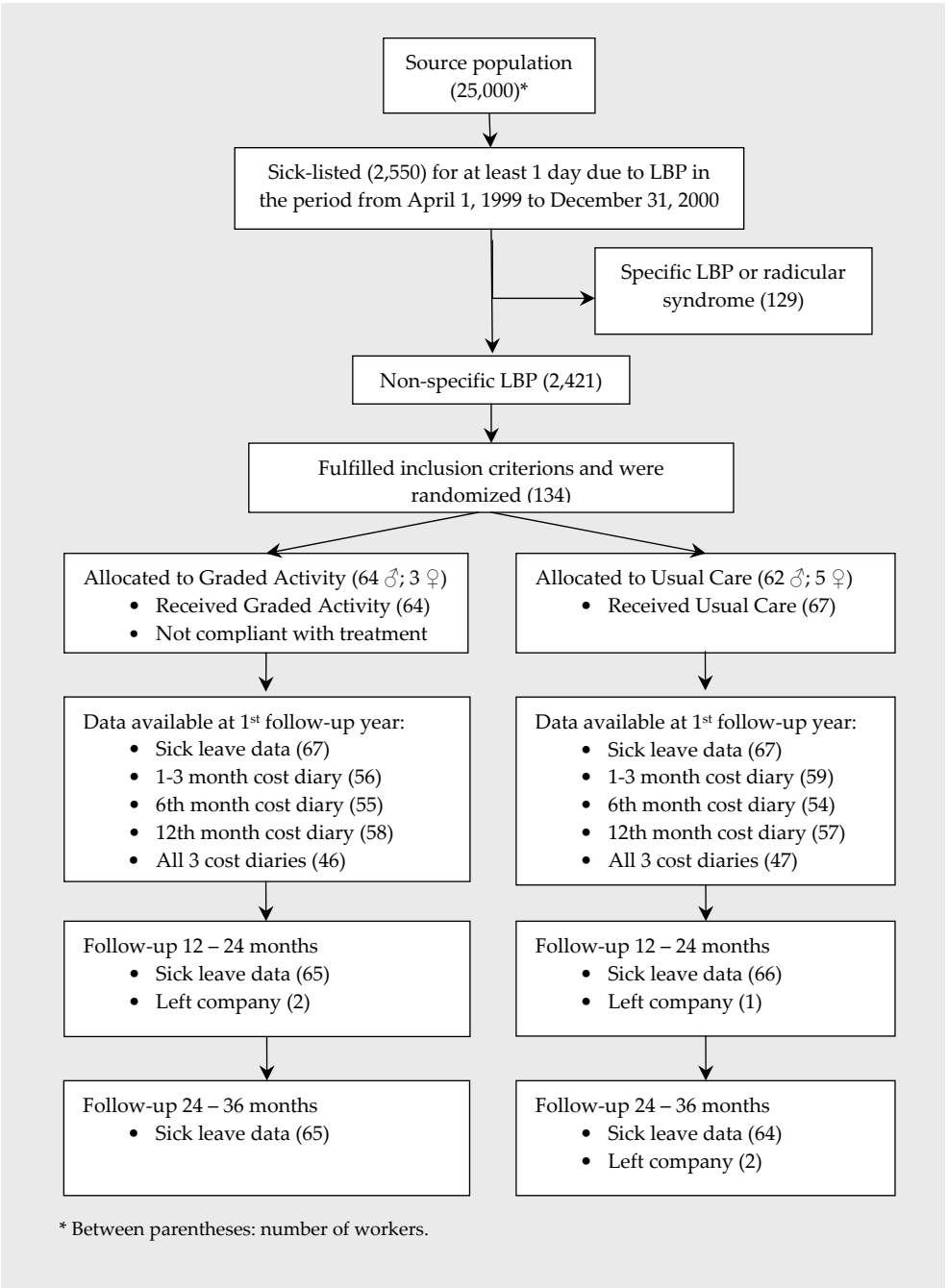

Table 1. Health care utilization (number of consultation, examinations or medications) during the first follow-up year.

Mean number consultations, examinations or therapies (SD)								
	GP[a]	**OP[a]**	**CT scans or MRI scans**	**X-ray of lumbar back**	**PT[a] or paramedical sessions**	**Specialist**	**Alternative therapist**	**Pain medication**
Graded activity (*N* = 67)	2.2 (4.1)	3.9 (3.5)	0.2 (0.9)	0.5 (1.8)	35.1 (21.9) [b]	0.3 (1.2)	0.7 (4.2)	1.2 (2.1)
Usual care (*N* = 67)	4.5 (6.9)	4.8 (4.1)	0.03(0.2)	0.4 (1.3)	27.6 (48.7)	0.3 (0.9)	1.4 (5.6)	1.6 (2.6)
p value [c]	0.008	0.16	0.22	0.86	0.25	0.94	0.38	0.32

[a] Abbreviations: GP = general practitioner; OP = occupational physician; PT = physiotherapist.
[b] One 60-minute Graded Activity session is an equivalent to two standard 30- minute physiotherapy sessions.
[c] ANOVA, level of significance $p < 0.05$.

Lost productivity days and recurrences

The mean difference in the number of GLPD's at each follow-up period was in absolute number of days in favour of the GA group. A similar pattern was observed for the NLPD's (table 2). During the three-year follow-up 69% of UC subjects and 67% of GA subjects suffered a recurrence of work absenteeism due to LBP. None of these differences were statistically significant.

Table 2. Mean difference between GA group and UC group of gross and net lost productivity days and costs during 3 years of follow-up.

Follow-up period	**Quantification**	**Mean difference of lost productivity days GA-UC, (95% CI)**	**Mean difference of costs of lost productivity in 1999 euros GA – UC (95% CI)**
First year (*N* = 134)	Net	9.1 (-14.8; 31.5)	999 (-1073; 3115)
	Gross	40.4 (4.7; 78.8)	3655 (157; 6933)
Second year (*N* = 131)	Net	-1.1(-24.6; 24.5)	118 (-2079; 2541)
	Gross	12.1(-27.6; 49.7)	1522 (-2315; 5126)
Third year (*N* = 129)	Net	2.8 (-15.6; 20.7)	467 (-1173; 2207)
	Gross	13.3 -24.7; 50.1	1685 (-1673; 5623)
Cumulative (*N* = 134)	Net	12.0 (-50.2; 64.9)	1661 (-4154; 6913)
	Gross	79.2 (-23.8; 192.3)	7581 (-3262; 17,348)

Work-disabled employees

In the first follow-up year, thirteen subjects (GA = 5; UC = 8) were deemed work-disabled due to LBP. By the end of the second follow-up year one additional worker from the GA group became work disabled. By the end of the third follow-up year the total number of work disabled subjects had decreased to 11 (GA = 5; UC = 6) as one subject had found a higher paying position within the company, and two subjects had left the company and were lost to follow-up.

Cost-benefit analysis

The mean differences in HCU costs between groups were similar for complete case analysis and imputed case analysis. Therefore, only the results of the latter will be reported.

The mean total cost of the GA intervention was €475. During the first three months of follow-up, the HCU costs were higher in the GA than in the UC. In the same period, the UC group has spent less on physiotherapy and more on other medical services. At the end of the first year the average between-group difference in HCU costs was €83 (95% CI: –467; 251) lower in the UC, but not statistically significant (table 3).

At the end of the first follow-up year the gross mean cost difference based on GLPD's and the net mean cost difference in terms of NLPD's was in favour of the GA group, i.e. €3655 (95% CI: 157; 6933) and €999 (95% CI: -1073; 3115), respectively. This direction of the between-group difference was maintained in the second and third follow-up years as well, but it was not statistically significant. The costs of productivity loss were the main cost driver in this study with 87% and 90% of the total net costs in GA and UC group, respectively.

Sensitivity analysis

The recalculation with a 25% and 50% decrease in work performance in the first follow-up year, resulted in an increase in the mean difference in costs between the GA and UC from €999 to €1663 and €2327 in favour of the GA group for a 25% and 50% decrease in work performance, respectively. Comparable findings were observed for the second and third follow-up years.

In the first follow-up year an average investment in the GA intervention of €475 (SD = 203) per worker yielded a savings of € 999 (95% CI: -1073; 3115) due to a reduction in productivity loss. Over a three-year period, the potential saving was calculated at an average of €1661 (95% CI: -4154; 6913) per worker. When the first year difference in HCU costs between the groups is considered, an additional expense to GA intervention of €83 (95% CI: -467; 251) resulted in the aforementioned savings on sick leave benefits.

Discussion

Although the general direction of the cost-benefit findings in this study was robust and constantly in favour of the intervention group over all follow-up years and the GA group returned significantly faster back to work, the mean cost differences were not statistically significant. This is a common problem in trials which are underpowered for skewed data distribution such as costs of health utilization or productivity loss. The study was performed within a single company and the majority of the subjects were male, blue-collar workers. These factors should be taken in account when one will generalize the findings to other work situations.

We used sick leave days as a proxy measure for productivity loss. However, it is not clear how accurately this proxy measure reflects true production losses. First of all, the actual level of production loss may be influenced by the type of compensation mechanisms that exist within a job title. For example, work normally performed by the absent employee may be completed by colleagues, or made up upon RTW during usual working hours. In such a situation, the absenteeism of the employee would not lead to productivity loss and therefore, should not be considered a cost. In this study, a majority

Table 3. Mean HCU costs, in 1999 Euros, and between group differences during the first 3-months of follow-up and entire first year.

Follow-up	Group[a]	Cost of GA intervention mean (SD)[b]	Cost of physiotherapy mean (SD)[b]	Mean difference in intervention (UC-GA)	Other medical costs mean (SD)[b]	Mean difference in other medical costs	Total health care costs mean (SD)[b]	Mean difference in total health care costs (95% CI)[c]
3 months	GA	475 (203)	0	- 307	26 (62)	44	501 (215)	- 263 (-346; -172)
	UC	0	168 (169)		69 (89)		238 (218)	
12 months	GA	..[d]	631 (396)	- 151	168 (391)	67	800 (680)	- 83 (-467; 251)
	UC	0	481 (877)		236 (324)		716 (1096)	

[a] Group: GA = Graded Activity, UC = Usual Care; [b] SD = Standard deviation; [c] CI = Bootstrapped 95% Confidence Interval; [d] Included in total cost of physiotherapy interventions.

of employees had service-related jobs, e.g. airplane maintenance technicians, pilots, baggage handlers, where the possibility of postponing production until later or "doing more with less" were not viable options. Furthermore, the way in which productivity loss costs are estimated can lead to quite different results. In our study, we estimated productivity loss costs in four different ways: gross, net, and with an assumption of either 25% or 50% decreased work performance. The gross estimation is likely to be an overestimation as workers who return to their original duties on a part-time basis, or who perform alternative job tasks, conduct work in some format. On the other hand, the net cost estimation may be an underestimation as workers who are still not fully recovered may not be 100% productive. The sensitivity analysis in which a 25% or 50% decrease in work performance was assumed, albeit arbitrarily, takes this into consideration. This inaccuracy of lost productivity estimation could be partially solved by the use of recently developed questionnaires for measuring health-related work performance[22 23].

There are only few published cost-benefit and/or cost-effectiveness evaluations of RTW interventions for sub-acute LBP. Loisel et al. demonstrated that an occupational intervention in combination with participatory ergonomics and multidisciplinary work rehabilitation were cost-beneficial and cost-effective at mean follow-up of 6.4 years[8]. Gatchel et al. showed that an early intervention program for workers who were at high risk for developing chronic LBP significantly reduce the number of work disability days and the total costs at 12 months follow-up[11]. Recent Finnish research by Karjalainen et al. disclosed a reduction in the total number of sick leave days and total costs for workers who experienced hinder at their work due to sub-acute LBP and who participated in a mini-intervention when compared to UC[24]. The findings of our study that a RTW intervention for sub-acute LBP is cost-beneficial, although not statistically significant, in comparison to UC are in accordance with these studies.

The results suggest that GA is associated with a positive return on investment and this study provides a framework for further research. Such future research should not only concentrate on the evaluation of more trials, but also on further developing of methodology of economic evaluation for practical use by employers, occupational services and also by workers.

Conclusion

The GA intervention for non-specific LBP may be a cost-beneficial RTW intervention from the employer's point of view. This intervention was marginally more expensive than UC, while benefits were substantial and remained noticeable 3 years after the initial intervention. The costs of health utilization were only a fraction of the total cost of the LBP in the working population and the economic burden of productivity loss was the main cost driver.

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