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The effect of a multimodal group programme in hospital workers with persistent low back pain: a prospective observational study

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Key words
Low back pain; multimodal treatment; nurses; disability assessment

Parole chiave
Lombalgia; trattamento multimodale; infermieri; valutazione della disabilità

Summary
Background: *Low Back Pain (LBP) is a very common disorder in hospital workers. Several studies examined the efficacy of multimodal interventions for health care providers suffering from LBP; nevertheless their results did not appear to be consistent.* **Objective:** *The aim of the study was to determine the effect of a multimodal group programme (MGP) on pain and disability in a sample of hospital workers with persistent LBP.* **Methods:** *A prospective cohort study was conducted to compare baseline measurements with changes over an eight-month period. The study focused on 109 workers suffering from persistent LBP with or without radiating pain: 62 nurses and 47 blue collars not involved in health care. The MGP consisted of six group sessions including supervised exercises, an at-home programme and ergonomic advice. The primary outcome measurement was the level of disability recorded with the Roland & Morris Disability Questionnaire, while the secondary outcome measurement was the evaluation of lumbar physical discomfort with the Visual Analogue Scale. Data were analyzed using the Multiple Imputation method for dropouts.* **Results:** *At the short-term follow-up participants showed a statistically significant reduction (from baseline) of all outcome measurements, particularly for the nurses group. Moreover, about a third of the subjects showed clinically significant improvement. No significant reduction in pain and disability (from baseline) was observed at the mid-term follow-up in either group.* **Conclusions:** *An MGP dedicated to hospital workers seems to be partially useful only for short-term follow-up, particularly for health care providers.*

Riassunto
«L'effetto di un programma multimodale di gruppo in lavoratori ospedalieri con dolore lombare persistente: uno studio osservazionale prospettico». **Introduzione:** *La lombalgia è un disturbo comune nei lavoratori ospedalieri. Diversi studi hanno esaminato l'efficacia degli interventi multimodali, tuttavia i loro risultati sono conflit-*

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tuali. **Obiettivo:** *L'obiettivo dello studio è stato quello di investigare l'effetto di un programma multimodale di gruppo (MGP) sul dolore e la disabilità in lavoratori ospedalieri affetti da lombalgia persistente.* **Metodi:** *È stato condotto uno studio prospettico di coorte, per confrontare le misurazioni di base con i cambiamenti intercorsi in un periodo di otto mesi. Lo studio ha indagato 109 lavoratori ospedalieri con lombalgia persistente, con o senza sintomi irradiati: 62 infermieri e 47 impiegati come blue collars, non coinvolti nell'assistenza. Il MGP consisteva di sei sedute di gruppo comprendenti esercizi attivi, un programma domiciliare e consigli ergonomici. L'end point primario era rappresentato dal livello di disabilità misurato con il Roland & Morris Disability Questionnaire, mentre la misura di esito secondaria era la valutazione del dolore lombare con la Visual Analogue Scale. I dati sono stati analizzati utilizzando il metodo Multiple Imputation per i dropout.* **Risultati:** *Il follow-up a breve termine ha evidenziato una riduzione statisticamente significativa (rispetto al baseline) in tutte le misure di outcome, in particolar modo per il gruppo degli infermieri. Circa un terzo dei soggetti ha riportato un miglioramento clinicamente rilevante. Nessuna riduzione significativa del dolore e della disabilità (rispetto al baseline) è stata osservata al follow-up a medio termine.* **Conclusioni:** *Un MGP rivolto a lavoratori ospedalieri sembra essere parzialmente utile solo a breve termine, in maniera particolare per gli infermieri.*

Introduction

Low back pain (LBP) is a common musculoskeletal disorder affecting both genders and most age groups; it entails significant direct and indirect costs for the person, the work environment and society (39). The one-year prevalence of a first episode of LBP varies from 6.3% to 15.4%, while the one-year prevalence of an episode of LBP ranges from 1.5% to 36% (20). The percentage of remission after one year ranges from 54% to 90%, while recurrences after one year range from 24% to 80% (49, 50).

Heavy manual work is considered to be a factor leading to a slightly higher number of episodes of LBP compared to other jobs (54). However, the effects of a physically demanding job in terms of symptoms, complaints, absenteeism and onset of chronic pain seem to be influenced by psychosocial factors, relating both to the worker and to the work environment. Among the workers at high risk for occupational LBP, there is a significant emphasis on hospital staff. Whereas in manual workers an LBP prevalence of 39% was observed, among health care nurses an annual prevalence of 40-50% and a life prevalence of between 35% and 80% were estimated (11, 37, 41). A high prevalence of LBP was also reported among Italian nursing personnel (29, 31).

The duties carried out by the nurses who were identified as being at high risk for LBP were: remaking beds, repositioning patients in beds or wheelchairs, lifting or transferring patients, activities involving standing for long periods of time, lifting and carrying supplies and equipment, pushing/pulling wheelchairs or mechanical lifts (13, 33). Educational intervention and training alone did not appear to be effective in reducing occurrence of LBP related to manual handling of patients (3, 8, 16, 19). Concerning exercises, although some studies reported positive results of exercises on the perception of pain, their effect was not always statistically significant (52). Conflicting evidence was reported on the effectiveness of a Multimodal Group Programme (MGP) on workers complaining of LBP. Some studies showed positive results for multidisciplinary interventions (training, education on correct manual handling and exercises) in terms of decrease in frequency and intensity of LBP (9, 24, 53). Other studies did not confirm these conclusions (25, 36).

The current guidelines also stress the importance of helping the subjects suffering from LBP in managing their condition through specific exercises and cognitive-behavioural changes (1, 7, 22). Some previous studies were conducted on multimodal interventions for health care providers suffering from LBP; nevertheless to the authors' knowledge no study has investigated the efficacy of these treatments also for hospital workers who are not assigned to health care.

On the basis of these considerations, a MGP for hospital workers suffering from persistent LBP was set up in the S. Orsola-Malpighi Hospital of Bologna (Italy). To measure the efficacy of this multimodal treatment, a prospective observational study was conducted on a sample of hospital workers.

Subjects and methods

Study Design

A prospective cohort study was conducted on workers of the S. Orsola-Malpighi Hospital of Bologna suffering from persistent LBP during the period September 2010-June 2011. This study was reviewed and exempted from specific approval by the Ethics Committee as the MGP is regularly offered within the occupational health surveillance programme provided by the Hospital for its employees and we conducted a retrospective review from previously collected clinical data.

Study population

Eligible subjects were all hospital workers affected by persistent LBP (lasting for at least 3 months) without any chronic degenerative disease or spinal malformation, who were referred to the Occupational Health Unit.

The study population was classified into groups: one including nurses and the other blue collars not involved in health care (electricians, plumbers, gardeners, warehouse workers, etc.).

Exclusion criteria were cardiovascular, metabolic, neoplastic, or respiratory co-morbidities, vertebral and/or spinal cord diseases (e.g. cauda equina syndrome or spinal stenosis), previous spinal surgery or trauma, peripheral neuropathies and patients receiving workers' compensation benefits.

The following information was collected for each individual: basic demographic data (age and gender), job title (nurse or blue collar), clinical characteristics such as height, weight, and lifestyle information (smoking habits and physical activity). Moreover, we divided our study participants into 3 categories of "underweight or normal weight" (BMI $\leq$ 24.9 kg/m^2), "overweight" (25.0 $\leq$ BMI $\leq$ 29.9 kg/m^2), and "obese" (BMI > 30.0 kg/m^2).

Intervention

The MGP consisted of six graded sessions, once a week, for six consecutive weeks. Sessions, each lasting an hour, were conducted after working hours in a large room of the Hospital by a physiotherapist specialized in the treatment of LBP. There were five to eight persons in each group. The sessions covered three areas: muscular training, cognitive-behavioural notions for managing pain, and ergonomic advice. The exercises were aimed at emphasizing lumbar extension and exercising the main stabilizers of the spine (transversus abdominis, oblique abdominal, multifidus, quadratus lumborum and erector spinae muscles) (40). For example, the exercises consisted of lumbar extension from the prone and upright positions, extension of the hip in the quadrupedal position, and isometric contraction of the abdominal muscles while lying down, standing, and leaning against the wall. The physiotherapist encouraged the subjects to perform three exercises selected from the programme once a day at home, for fifteen minutes overall. Moreover, the subjects were provided with cognitive-behavioural notions for managing pain. The physiotherapist explained the risk factors of LBP and provided some instructions to guide the subjects in a process of desensitization of fear and worry. A process of correct re-learning and cognitive reconditioning was used to transfer the subjects' attention from pain to increasing the level of activity and recovering function. Finally, ergonomic advice was given in order to facilitate the modification of daily living and working activities.

Outcome measurements

To evaluate physical disability and pain, the Roland & Morris Disability Questionnaire (RMDQ) and the Visual Analogue Scale (VAS) were used (21, 38, 46, 45, 51). These scales were applied during the enrollment examination (baseline time, T_0), at the end of the two-month treatment period (1st follow-up, T_1), and six months after the end of the treatment period (2nd follow-up, T_2).

Outcome measurements were collected by health care professionals not involved in the treatment. The primary outcome measurement was the perceived level of disability recorded with the RMDQ in its validated Italian version. This questionnaire comprises 24 items in which higher levels of disability correspond to higher numbers on a 24-point scale (38). The RMDQ has been shown to yield reliable measurements which are valid for inferring the level of disability, and to be sensitive to change (45).

The secondary outcome measurement was the evaluation of lumbar physical discomfort with a 100 mm VAS. The VAS scores ranged from 0 mm (no pain) to 100 mm (the worst possible pain). VAS has been proved to be reliable and satisfactory in the measurement of pain (21). This scale is the one most often used in the measurement of pain in the lumbar area (55, 56) and, in spite of several controversies concerning its use and application (5, 6, 14), there are numerous arguments in its favour (5, 6, 14, 15, 55).

Lastly, a good correlation between the results of VAS and those of RMDQ has been demonstrated (38).

Data analysis

Descriptive statistics of the anthropometric and clinical characteristics and of the outcome measurements at baseline were generated.

The continuous variables were expressed as averages and standard deviations (SD), while the categorical variables were expressed both in absolute and percentage values.

Analyses were carried out separately for the short-term and mid-term differences in disability and pain scores from baseline.

In order to evaluate the statistical significance of reduction in disability and pain, Student's t-test was performed on RMDQ and VAS score differences from baseline.

Variations in scale scores were reported both in absolute and percentage values.

Incomplete RMDQ and VAS scores data were completed following a Multiple Imputation (MI) approach (47, 48). The MI algorithm creates a high number of imputed data sets by running an iterative imputation technique based on recorded variables. Statistical inference is performed on each of these imputed data sets, then analysis results from each of them are combined to achieve a final single set of estimates *(Multiple Imputation Analysis)*.

This made it possible to study a larger sample which included the subjects lost to follow-up.

Data were also analyzed according to two other approaches, in order to assess the effect that missing data could have on our final statements.

First, only the workers who had filled in short-term or mid-term scales were analyzed (*Completed Follow-Up Analysis*). In order to produce correct results, this approach requires the missing pattern to be completely at random (43).

Subsequently, a kind of Sensitivity Analysis (32) used to study the "intention to treat" in the randomized controlled trials was developed. We established a scenario different from the real one ("worst scenario") through the attribution of fictitious outcome measurement scores to the subjects lost to follow-up.

We assigned them a worse outcome measurement score obtained from the sum of the last recorded value and the average of the score difference in the scale scores of the worsened subjects who underwent complete follow-up, consequently worsening the expected result *(Worst Scenario Analysis)*.

The subjects who completed the follow-up and those who were lost to follow-up were also compared.

Student's t-test was used for the continuous variables: age (in years), weight (in kilogrammes), height (in centimetres), and VAS and RMDQ scores.

For the category variables, such as gender, BMI classes, smoking and sedentary habits, the chi-square test was used.

Non-relevance of these comparisons is required by the Missing Completely At Random (MCAR) assumption underlying the *Completed Follow-Up Analysis*.

According to proposed cut-off values for minimal important change of frequently used measurements of pain and functional status in LBP (35), a 30% change from baseline was considered a clinically meaningful improvement.

The subjects were classified in three classes based on improvement in disability (RMDQ) and pain intensity (VAS): i) *definitely improved* with a reduction of at least 30% in their RMDQ and VAS scores from baseline, ii) *possibly improved* with a reduction of at least 30% in their RMDQ score from baseline and at least a better VAS score, and iii) *not improved* (4, 23).

To evaluate the likelihood of improvement for distinct values of the recorded variables, an ordered logistic regression model (also reported as the proportional odds model) was performed using the classification into ordered categories of improvement (from low to high) defined above as a dependent variable.

This method was applied to each of the 100 imputed data sets created by the Multiple Imputation algorithm, combining results in a final single set of odds ratios (OR) with 95% confidence interval (95% CI).

Analysis of the ordered logistic regression was also conducted on the sample of subjects who completed the follow-up and on the *Worst Scenario Analysis* imputed sample, so as to provide a comparison.

SAS 9.1 software (SAS Institute) was used for all analyses, with a significance level set at 95%.

Results

From September 2010 to June 2011, 118 subjects were evaluated by a clinician of the Occupational Health Unit; 9 of them were ineligible because they did not meet the inclusion criteria due to their clinical conditions.

In particular, 2 suffered from spinal stenosis, 1 from peripheral neuropathy, 3 had undergone previous spinal surgery and 3 previous trauma.

A total of 109 subjects were thus included in the study. Of these, 15 (equal to 13.8%) had not filled in the scales at time T_1 and 30 (equal to 27.5%) had not done so at time T_2 (figure 1).

In the *Multiple Imputation Analysis*, 100 data sets with 109 records each were analyzed.

There were 94 subjects whose information was complete (*Completed Follow-up Analysis)* (86.2% of the enrolled subjects) in the short-term follow-up and 78 (72.5%) in the mid-term follow-up, while the group evaluated for the *Worst Scenario Analysis* consisted of 109 subjects.

Baseline characteristics of the 109 participants are reported in table 1.

No significant differences were detected between participants who were lost to follow-up and those who were followed up, in both short-term (table 2) and mid-term analyses (table 3).

As a further confirmation of the MCAR assumption, physicians who followed up patients declared they had not observed any pattern in the lost to follow-up subjects.

The outcome measurements at baseline and at short-term follow-up are reported in table 4, while the baseline and mid-term scores are reported in table 5.

The short-term follow-up showed a statistically significant decrease from baseline in the average scores of both the outcome measurements.

This result is shared by all of the three approaches considered and is more evident in the *Multiple Imputation Analysis* and *Completed Follow-Up Analysis* (-1.56 and -1.57 for VAS and -1.18 and -1.23 for RMDQ) than in *the Worst Scenario Analysis* (-1.21 for VAS and -0.93 for RMDQ).

In *Multiple Imputation Analysis*, such results corresponded to an average decrease of 28.7% (95% CI: 38.5% – 18.9%) in VAS scores and 17.1% (95% CI: 25.0% - 9.1%) in RMDQ scores, as reported in table 6.

No significant reduction from baseline was reported at the mid-term follow-up for either analysis.

The distribution of subjects in the three categories based on improvement of disability and pain intensity is shown, only for *Multiple Imputation Analysis*, in figure 2 (short-term follow-up) and figure 3 (mid-term follow-up). Based on these data, 25.7% of the subjects had clinically improved at short-term and 14.7% at mid-term follow-up.

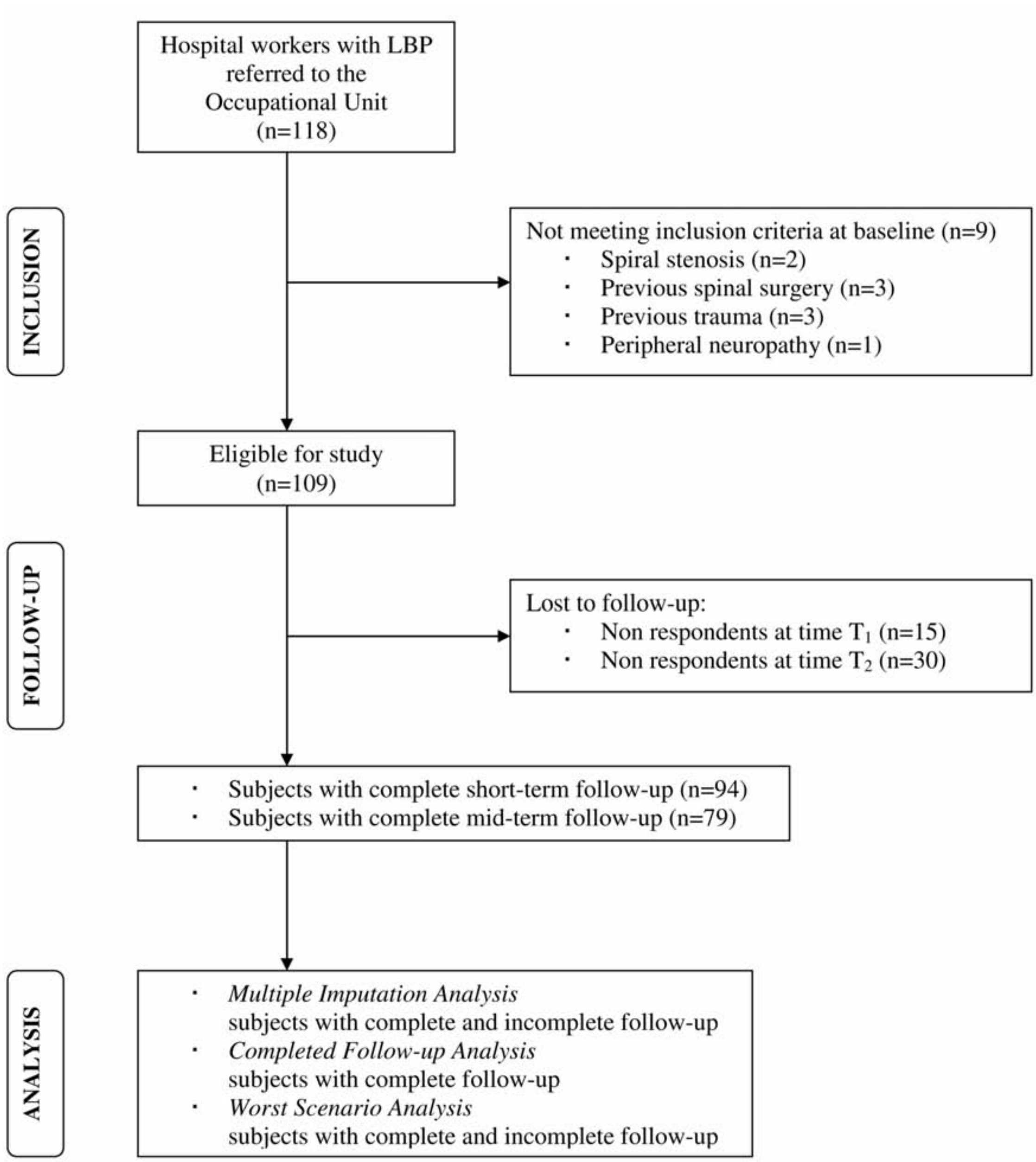

Figure 1 - Flow-Chart

The ordered logistic regression model in the short-term follow-up showed an increased likelihood of definite improvement (at least 30% reduction in RMDQ and VAS scores from the baseline) for the nurses group compared to the blue collars group (OR 2.62, 95% CI: 1.02 - 6.69 in *Multiple Imputation Analysis*).

None of the other recorded variables were ob-

Table 1 - Baseline characteristics and outcome measurements of the study group

		Study Group (n = 109)
Age (yrs)	mean (SD)	45.31 (7.47)
Weight (kg)	mean (SD)	69.12 (13.21)
Height (cm)	mean (SD)	164.69 (8.51)
VAS [0-10]	mean (SD)	5.43 (2.42)
RMDQ [0-24]	mean (SD)	6.88 (3.92)
Gender	n (%)	
	female	86 (78.9)
	male	23 (21.1)
Job title	n (%)	
	nurses	62 (56.9)
	blue collars	47 (65.1)
Smoking habits	n (%)	
	current smoker	38 (34.9)
	non smoker	71 (65.1)
Physical activity	n (%)	
	sportsman	21 (19.3)
	sedentary	88 (80.7)
BMI class	n (%)	
	obese	14 (12.8)
	overweight	42 (38.5)
	underweight or normal weight	53 (48.7)

served to have any effect on improvement in disability and pain. Such results are common to all kinds of analysis, as shown in table 7.

At mid-term follow-up, proportional odds models did not highlight any significant effect of recorded variables on clinical improvement.

Discussion

This study shows that an MGP conducted in the work environment can contribute to reducing perceived pain and disability in hospital workers suffering from persistent LBP, only in the short term and particularly for health care providers.

The low RMDQ score obtained at the baseline is in contrast to the relatively high level of VAS for LBP. This incongruity may be due to an overestimation of symptoms by participants on the VAS scale, whereas the RMDQ scores reflect the real level of disability. Nevertheless, congruity was observed in the partial values obtained in the different measurements, which highlight (38) the good correlation between the two tools in the assessment of LBP. The improvement observed in the study group was clinically significant in 25.7% of these workers (figure 2). However, these results were not maintained at the mid-term follow-up (figure 3), with 14.7% of subjects who had clinically improved. Therefore, our statistically significant results may not lead to clinically significant improvement in the whole study population.

Compared to the blue collars group, the nurses showed a higher probability of clinical improvement.

A number of reasons may explain these different results between groups. First of all, the higher age of the blue collar workers compared to the nurses may have adversely affected recovery (28). Another reason may be related to the homogeneity of the nurses group in terms of workloads and health care activities: a similar MGP in a previous study was also effective in a homogeneous group of nursery school teachers (39). The blue collars involved in the present study were, on the contrary, non-homogeneous regarding work and mechanical loads: as a consequence, ergonomic advice may have less impact.

Furthermore, the education level of the nurses stresses the importance of active adherence to treatments and advice aimed at improving health status. Even if we could not measure the compliance of the subjects involved in this study, it is reasonable to suppose that nurses would follow the suggestions to a greater extent, at least in the short term.

The subject's compliance is stressed as a significant factor for maintaining the results that were obtained in the short term (27, 42). Non-observance of advice provided may have a negative influence on maintaining the clinical condition and, in this study, may be a contributing factor to the worsening of the results obtained at the follow-up.

Table 2 - Comparison of baseline characteristics and outcome measurements between participants who were lost to follow-up and those who were followed up (1st Follow-Up)

		Lost to Short-term Follow-Up (n = 15)	Completed Short-term Follow-Up (n = 94)	*P-value*
Age (yrs)	mean (SD)	43.47 (9.29)	45.61 (7.15)	0.305[a]
Weight (kg)	mean (SD)	70.73 (11.48)	68.86 (13.50)	0.613[a]
Height (cm)	mean (SD)	164.00 (6.67)	164.79 (8.79)	0.737[a]
VAS [0-10]	mean (SD)	5.93 (2.37)	5.35 (2.42)	0.388[a]
RMDQ [0-24]	mean (SD)	6.73 (4.30)	6.90 (3.89)	0.876[a]
Gender	n (%)			
	female	13 (86.7)	74 (78.7)	0.427[b]
	male	2 (13.3)	21 (21.3)	
Job title	n (%)			
	nurses	8 (53.3)	54 (57.4)	0.765[b]
	blue collars	7 (46.7)	40 (42.6)	
Smoking habits	n (%)			
	current smoker	8 (53.3)	30 (31.9)	0.106[b]
	non smoker	7 (46.7)	64 (68.1)	
Physical activity	n (%)			
	sportsman	4 (26.7)	17 (18.1)	0.434[b]
	sedentary	11 (73.3)	77 (81.9)	
BMI class	n (%)			
	obese	3 (20.0)	11 (11.7)	0.661[b]
	overweight	5 (33.3)	37 (39.4)	
	underweight or normal weight	7 (46.7)	46 (48.9)	

[a] t-test; [b] chi-squared test

Nevertheless, we do not know if our short-term results in the nurses group depended on the multimodal characteristic of this programme, or on the exercise component. In fact, it is unclear what kind of treatment would be the best: current literature provides evidence for the effectiveness both of an extension-oriented treatment approach (10, 26, 30) and of strengthening exercises (17, 18) in reducing LBP recurrence and disability as compared to a classic approach or to no approach. A multimodal programme was demonstrated to be superior to a general exercise programme in influencing the process leading to chronic LBP in a population of nurses with a history of pain (12). However, a recent review by Ravenek and colleagues (44) suggested conflicting evidence for the efficacy of multidisciplinary programmes to improve employment outcomes in chronic LBP.

We do not know if and to what extent this multimodal programme will prevent further LBP episodes. The literature suggests strong evidence for the efficacy of exercise on pain and disability, but only limited evidence in terms of reduction of the recurrences (2).

To our knowledge, this is the first study which compares the efficacy of a multimodal programme

Table 3 - Comparison of baseline characteristics and outcome measurements between participants who were lost to follow-up and those who were followed up (2nd Follow-Up)

		Lost to Mid-Term Follow-Up (n = 30)	Completed Mid-Term Follow-Up (n = 79)	P-value
Age (yrs)	mean (SD)			
Weight (kg)	mean (SD)	70.79 (12.40)	68.49 (13.63)	0.483[a]
Height (cm)	mean (SD)	165.09 (9.58)	164.51 (7.99)	0.753[a]
VAS [0-10]	mean (SD)	5.47 (2.41)	5.41 (4.84)	0.901[a]
RMDQ [0-24]	mean (SD)	6.58 (3.54)	7.03 (4.11)	0.581[a]
Gender	n (%)			
	female	23 (76.7)	63 (79.7)	0,483[b]
	male	7 (23.3)	16 (20.3)	
Job title	n (%)			
	nurse	17 (56.7)	45 (57.0)	0.829[b]
	blue collar	13 (43.3)	34 (43.0)	
Smoking habits	n (%)			
	current smoker	12 (40.0)	26 (32.9)	0.536[b]
	non smoker	18 (60.0)	53 (67.1)	
Physical activity	n (%)			
	sportsman	7 (23.3)	14 (17.7)	0.286[b]
	sedentary	23 (76.7)	65 (82.3)	
BMI class	n (%)			
	obese	4 (13.3)	10 (12.7)	0.586[b]
	overweight	13 (43.3)	29 (36.7)	
	underweight or normal weight	13 (43.3)	40 (50.6)	

[a] t-test
[b] chi-squared test

on two different groups of hospital workers. Our results emphasize a clinically significant difference between groups in favour of nurses.

The interpretation of our results must, in any case, be considered in the light of the following study limitations. The first limit of this study is consistent with the study design: it is a prospective observational study and not a randomized controlled trial. No measurements related to important psychosocial variables (fear, anxiety, catastrophizing, etc.) were assessed during the study. Moreover, we used only the severity of pain and disability as outcome measures; we did not take into consideration patient satisfaction and work disability, as suggested by Ostelo and de Vet (34). Another important limit is the low sample number. In addition, the patients' adherence to the home exercise programme could not be monitored. Furthermore, we made only short- and mid-term follow-ups, and we could not report any new episodes of LBP. Finally, we had a high number of dropouts, even if this aspect was managed with the Multiple Imputation and Worst Scenario approaches.

In conclusion, our study shows that an MGP in an occupational environment seems to be effective

Table 4 - Comparison of outcome measurements at baseline and at short-term follow-up

		Multiple Imputation (n = 109)		Complete Follow-Up (n = 94)		Worst Scenario (n=109)	
		mean (SD)	P-value	mean (SD)	P-value	mean (SD)	P-value
VAS	T_0	5.43 (2.40)		5.35 (2.42)		5.43 (2.40)	
[0-10]	T_1	3.87 (2.63)		3.78 (2.68)		4.22 (2.85)	
	D_1	-1.56 (2.67)	<0.0001[a]	-1.57 (2.71)	<0.0001[a]	-1.21 (2.67)	<0.0001[a]
RMDQ	T_0	6.88 (3.90)		6.90 (3.88)		6.88 (3.90)	
[0-24]	T_1	5.70 (4.18)		5.67 (4.25)		5.95 (4.30)	
	D_1	-1.18 (2.69)	<0.0001[a]	-1.23 (2.69)	<0.0001[a]	-0.93 (2.61)	0.0003[a]

[a] t-test

Table 5 - Comparison of outcome measurements at baseline and at mid-term follow-up

		Multiple Imputation (n = 109)		Complete Follow-Up (n = 94)		Worst Scenario (n=109)	
		mean (SD)	P-value	mean (SD)	P-value	mean (SD)	P-value
VAS	T_0	5.43 (2.40)		5.41 (2.44)		5.43 (2.40)	
[0-10]	T_2	5.29 (2.52)		5.21 (2.60)		5.95 (2.74)	
	D_2	-0.14 (2.86)	0.649[a]	-0.20 (2.96)	0.555[a]	0.52 (2.63)	0.041[a]
RMQD	T_0	6.88 (3.90)		7.03 (4.11)		6.88 (3.90)	
[0-24]	T_2	6.62 (4.22)		6.40 (4.36)		7.44 (4.35)	
	D_2	-0.26 (4.58)	0.604[a]	-0.63 (4.68)	0.253[a]	0.56 (4.19)	0.159[a]

[a] t-test

Table 6 - Percent variation (from baseline) in average scores of outcome measurements at short-term follow-up

		Multiple Imputation % (95% CI)	Complete Follow-Up % (95% CI)	Worst Scenario % (95% CI)
VAS [0-10]	D_1	-28,7% (-38,5 ; -18,9)	-29,3% (-39,6 ; -18,7)	-22,3% (-31,5 ; -12,9)
RMDQ [0-24]	D_1	-17,2% (-25,0 ; -9,2)	-17,8% (-25,9 ; -9,9)	-13,5% (-20,6 ; -6,1)

Table 7 - Ordinal logistic regression model results at short-term follow-up

	Multiple Imputation (n = 109)		Complete Follow-Up (n = 94)		Worst Scenario (n=109)	
	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Job nurse vs blue collar	2.62 (1.02 - 6.69)	0.0452	2.77 (1.07 - 7.15)	0.0353	2.68 (1.06 - 6.77)	0.0370

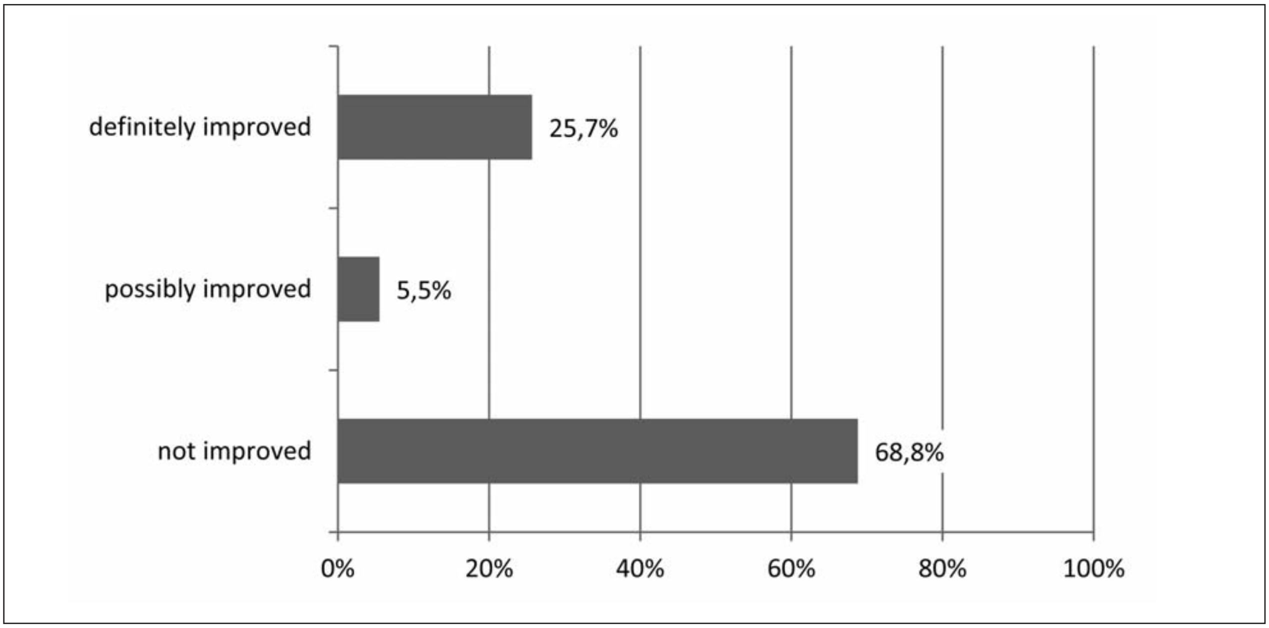

Figure 2 - Distribution of definitely improved, possibly improved, and not improved subjects (short-term follow-up)

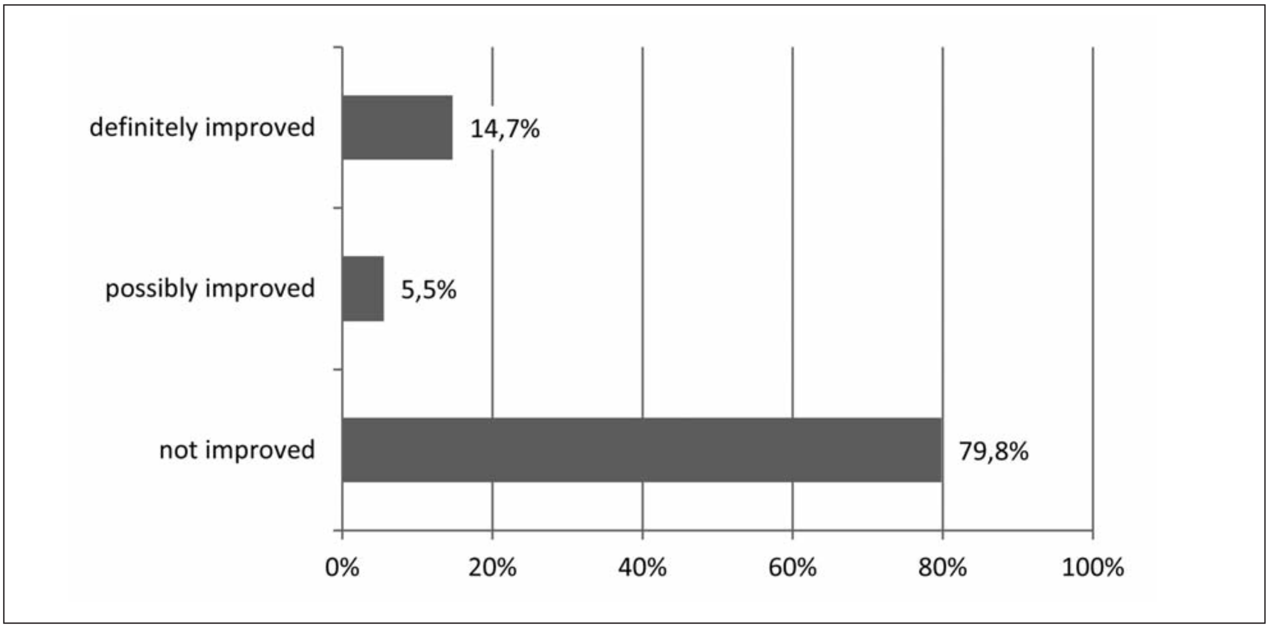

Figure 3 - Distribution of definitely improved, possibly improved, and not improved subjects (mid-term follow-up)

with a short-term follow-up, particularly for the nurses group. These results could not be extended to blue collar workers. This preliminary result could be verified by further studies on numerically larger sample groups, on specific worker groups, by comparison with a control group, and by using different approaches. To be more confident in future results, it would be advisable to quantify both the individual biomechanical workload and adherence of the subjects to the self-treatment exercises.

NO POTENTIAL CONFLICT OF INTEREST RELEVANT TO THIS ARTICLE WAS REPORTED

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