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Reanalysis of a tailored web-based exercise programme for office workers with sub-acute low back pain: Assessing the stage of change in behaviour

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Objective: To reanalyse a web-based intervention for physically untrained office workers with sub-acute non-specific low back pain in low back pain-related exercise behaviour terms. *Design*: Reanalysis of a randomized controlled trial. *Setting*: Occupational Preventive Medicine of University. *Methods*: Participants were randomized to an intervention group (proposed intervention plus standard care) or a control group (usual care only). The intervention exercise and education materials were developed as an online resource, and included video demonstrations recorded in a laboratory. Resources were loaded onto a dedicated section of the University Preventive Medicine Service website. All sessions included stretching, and exercises to improve postural stability (abdominal, lumbar, hip and thigh muscles) strength, flexibility and mobility. Outcome measures were self-reported health status (visual analogue scale (VAS) of the Euroquol-5D questionnaire); functional health status (Oswestry disability questionnaire); and the stage of change questionnaire. At nine months, outcomes in the intervention group were analysed and compared with baseline and outcomes in controls. *Results*: In the intervention group, significant positive effects were observed at nine-month follow up for stage of change in the behavioural domain as related with low back pain for all phases except for the contemplation phase. The positive change in the stage of change questionnaire correlated with the improvement observed in Oswestry ($r = .388$) and VAS ($r = -.612$). *Conclusions*: The reanalysis of the trial suggests that exercise behaviour related to low back pain improve after the intervention period. This improvement correlates with changes in clinical low back pain-related outcomes.

Keywords: workplace health promotion; exercise; backache; lifestyle

Introduction

Physical inactivity is associated with increased morbidity and mortality from cardiovascular disease in the general population (Fogelholm, 2010). In office workers, physical inactivity was shown to have a negative impact on health (Wilkerson, Boer, Smith, & Heath, 2008). The physically inactive nature of office work predisposes workers to musculoskeletal disorders such as low back pain (LBP) and discomfort (Macedo, Trindade, Brito, & Socorro Dantas, 2011). This impacts on the quality of life of the affected indi-

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viduals (Payne, Gledhill, Katzmarzyk, & Jamnik, 2000), and on their ability to perform tasks of daily living (Kovacs, Abraira, Zamora, & Fernandez, 2005; van der Roer, Ostelo, Bekkering, van Tulder, & de Vet, 2006). Therefore, effective interventions to promote an active lifestyle and physical activity among high-risk groups and the general population are warranted (Hodgins, Battel-Kirk, & Asgeirsdottir, 2010). As well as evaluating the clinical outcome of workplace health promotion programmes in special populations, it is necessary to evaluate outcomes such as exercise-related behaviour. Within the context of health promotion, the transtheoretical model is a standard model used to assess the effectiveness of physical activity interventions in terms of change in the behaviour dimension. This model has been largely used for physical activity promotion (Hutchison et al., 2009).

Traditionally, business and public office managers have tended to focus on productivity, and have attributed little importance to the health of employees. However, major absenteeism due to work-related diseases has led to increased attention to this issue (Macedo et al., 2011). Furthermore, several studies show the effectiveness and cost-effectiveness of health promotion programmes in the workplace (Cho, Kang, Park, Paek, & Choi, 2009; Logan, Milne, Achber, Campbell, & Haynes, 1981; MacKinnon et al., 2010; Poole, Kumpfer, & Pett, 2001; Robroek, Bredt, & Burdorf, 2007). Research suggests that exercise programmes of short duration are most appropriate for employees who work long shifts (Bell and Burnett, 2009).

The internet and email are promising media for the delivery of health information and health promotion programmes. The internet is useful for providing health information to large specific populations (Napolitano and Marcus, 2002; Wanner Martin-Diener, Braun-Fahrlander, Bauer, & Martin, 2009; Yap, Hemmings, & Davis, 2009). Use of the internet and email is increasing among the work-age adult population (Napolitano et al., 2003). Research suggests that the internet is becoming the preferred method of obtaining health information in both the general population (Fotheringham, Wonnacott, & Owen, 2000) and specific populations (McKay, Feil, Glasgow, & Brown, 1998). Furthermore, the internet enables low-cost and wide dissemination of interventions (de Vries and Brug, 1999). We, therefore, consider the internet a potential channel for delivering a worksite health promotion intervention to specific populations.

Several studies in the general population have evaluated web-based workplace health promotion interventions aimed at improving self-reported health status, promoting a healthy lifestyle or improving lifestyle behaviour (Colkesen, Ferket et al., 2011; Colkesen, Niessen et al., 2011; Perez, Phillips, Cornell, Mays, & Adams, 2009). Some studies have used an email reminder to improve patient's adherence (Lenert, Munoz, Perez, & Bansod, 2004; Plotnikoff, McCargar, Wilson, & Loucaides, 2005; Yap et al., 2009). However, the effectiveness of such interventions in special populations is not yet established. Within this context, our group developed a new trial of nine months of web-based multidisciplinary programme, including exercise and postural education. In an initial report from this 36-week trial, we concluded that the intervention was effective to clinically improve the HRQoL, risk of chronicity and functional disability in patients with non-specific low back pain (Del Pozo-Cruz, Adsuar et al., 2012; Del Pozo-Cruz, Gusi et al., 2012; Del Pozo-Cruz, Parraca et al., 2012). To broaden this knowledge, the present analysis aims to provide further understanding of the effects of this intervention in two possible ways: Firstly, by analysing the feasibility and safety of nine months of our web-based intervention to induce additional benefits by improving the exercise-related behaviour related to improving LBP; and secondly, to test if this improvement correlated with the improvement of functional disability and self-reported

health status as clinical outcomes for low back pain patients. This latter knowledge will allow researchers and clinicians to better characterize changes induced by this intervention. Within this new analysis, we hypothesized that our intervention is also effective to improve LBP-related exercise behaviour and that this improvement correlates with the specifics outcomes of the disease.

Methods

The method for this trial has been reported previously elsewhere (Del Pozo-Cruz, Adsuar et al. 2012; Del Pozo-Cruz, Gusi et al. 2012; Del Pozo-Cruz, Parraca et al. 2012). A single-blind randomized controlled trial was performed (ISRCTN40949689). Figure 1 shows the flow of participants through the study. The study population was recruited from the four administrative offices of the University of Extremadura in Southern Spain. To ensure correct implementation, a manual describing the study protocol was produced and made available to all study researchers. Prior to the commencement of the study, two technicians received two-week training in all aspects of the study protocol. The study was performed in accordance with the Declaration of Helsinki, as revised in 2000 in Edinburgh, and was approved by the research ethics committee of the University of Extremadura.

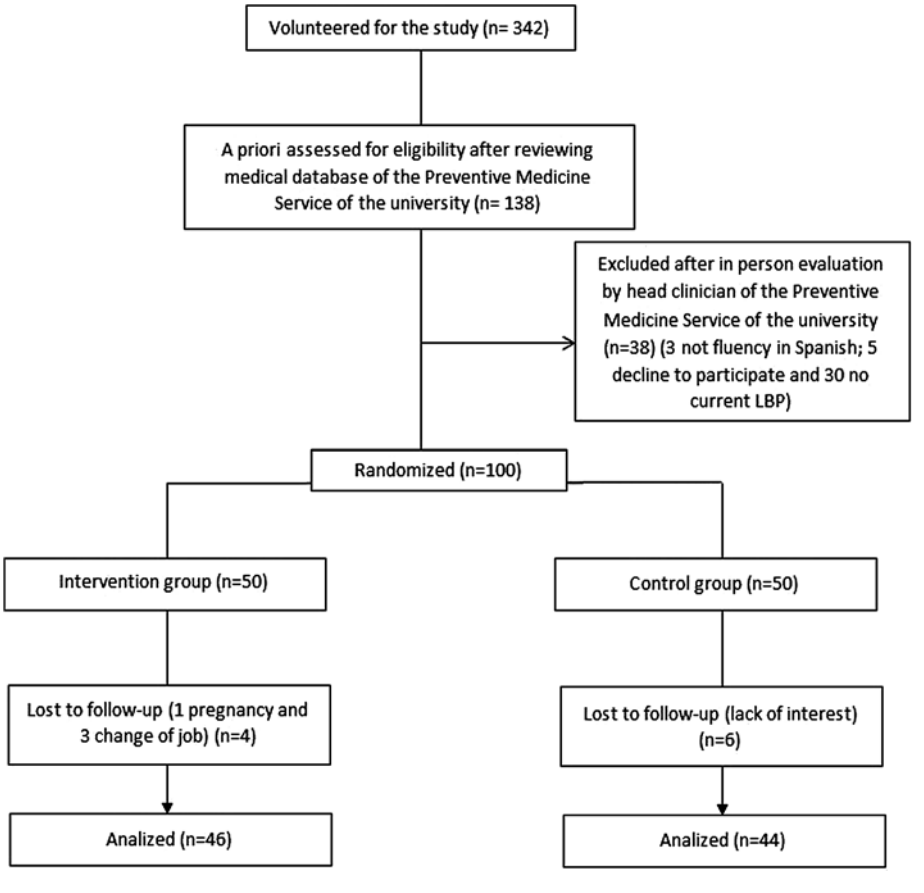

Figure 1. Flow diagram of participants.

Participants

Participants were recruited via the University Preventive Medicine Service. An advertisement alerted potential participants to the project. Sub-acute non-specific LBP was defined as current LBP with or without radiating leg pain of 6–12 week duration (Kovacs et al., 2005). The study inclusion criteria were: a diagnosis of sub-acute LBP in the absence of any major neurological deficit; age 18–64 years; physical inactivity (less than two 30-min exercise sessions per week) (Westcott et al., 2009); informed consent; office employee status; and more than 6 h of computer work per day. Exclusion criteria were: a diagnosed cause of backache; chronic backache; disc or other major disease; or lack of fluency in Spanish. A total of 342 interested individuals sent an email with their contact information to the research team. After reviewing the Preventive Medicine medical database (i.e., the staff from Preventive Medicine checked their medical database to determine if the interested individuals fulfilled the inclusion/exclusion criteria), 138 of the 342 interested individuals were found to, *a priori*, fulfil the inclusion/exclusion criteria and were contacted for an in person evaluation. Following the in-person evaluation, an additional 38 potential participants were excluded. The remaining 100 patients were randomly allocated 1:1 to an online occupational exercise intervention group or a control group.

Interventions

The exercise and education reminders used in the intervention programme were developed as an online resource, and included video demonstrations recorded in a laboratory. The resources were loaded onto a dedicated section of the University Preventive Medicine Service website. The physical exercise routine was designed and arranged by an experienced physical training instructor under the supervision of the head of the Preventive Medicine Service. All sessions included stretching, and exercises to improve postural stability (abdominal, lumbar, hip, and thigh muscles), muscle strength, flexibility and mobility. Mobility exercises involved large movements of the joints and the postural stability muscles. Flexibility exercises were performed according to static work methodology. Strength exercises were performed using progressive shortening:stretching and speed:motion ratios (1:1, 1:2, 1:3, 2:1, 3:1. A ratio 1:1 means 1 time spent in shortening the muscle and 1 time spent in stretching the muscle. This explanation could be further extended for all ratios involved.) and slight isometric contractions of all involved muscle groups. The session ended with moderate stretching of all muscles used during the session. The video provided a verbal and subtitled explanation of all exercises. Postural education reminders (how best to sit at a computer) were designed by the University Preventive Medicine Service clinician. Data on programme participation were collected automatically when access to the programme was registered. Both study groups had access to the usual routine care offered by the University Preventive Medicine Service. This included a routine annual medical examination by the lead clinician, and specific online information on self-care in the work-place.

Intervention group

All participants received a brief daily email. This contained a reminder message (which remained unchanged throughout the intervention) and a link to the online "session of the day". The sessions were structured in real time. First, a video of postural reminders was viewed (2 min). This was followed by a video of the exercise(s) for the day (7 min).

Finally, a repetition of postural reminders was provided (2 min). The videos were available from Monday to Friday every week for nine months. Each participant was assigned a user name and a password to access the system, and received a detailed explanation of the treatment programme (in written and verbal forms). Participants were asked not to engage in any formal physical activity routine during the nine-month study period.

Control group

The control group had access to usual preventive medicine care only.

Measurement

Both groups were evaluated at baseline and on completion of the nine-month study period. Socio-demographic and health characteristics were documented at baseline, including age, sex and smoking habits. The study questionnaires were administered by a trained researcher (Gusi Prieto, Madruga, Garcia, & Gonzalez-Guerrero, 2009) who was independent of the study team and blind to treatment allocation. The stage of change questionnaire, originally developed for smoke cessation, (Prochaska and DiClemente, 1984) has been adapted for exercise (Marcus and Simkim, 1993; Cardinal 1995). This questionnaire comprises five questions and assessed change in the behaviour domain in terms of exercise allowing for a classification into five possible stages of LBP-related exercise behaviour change: pre-contemplation, contemplation, preparation, decision/action, and maintenance. At the end of the nine-month study period, the global stage of change status (as referred to exercise-related behaviour related to improving LBP) was determined according to three possible scores: −1, considered a negative behavioural change; +1, considered a positive behavioural change; and 0, considered no change. At the end of the study, all participants in the intervention group were asked if they would like to continue with the programme. The Visual Analogue Scale (VAS) from the Euroquol-5D questionnaire (EQ-5D) (Brooks, 1996; Herdman Badia, & Berra, 2001) and the Oswestry Disability Index (ODI) (Fairbank, Couper, Davies, & O'Brien, 1980; Fairbank and Pynsent, 2000) were used only for correlational purposes, as described below.

Statistical analysis

All analyses were performed using SPSS version 19.0. (SPSS, Inc., Chicago, IL). For independent measures, baseline comparisons were made using the Student's (*t*) test for continuous variables, and the chi square test for nominal variables. The distribution of the data was examined using the Kolmogorov–Smirnov test with Lilliefors correction. The null hypothesis of no difference in the stage of change between treatment conditions at nine months was evaluated using chi square analysis. The same analysis was used to evaluate differences in the global stage of change at nine months. Correlations between the main study outcome (stage of change) and both VAS and ODI were evaluated using the Spearman correlation coefficient. The significance level was set at $p < .05$ for all tests.

Results

One hundred subjects were randomized (Figure 1). A session was considered to have been completed if the participant remained logged in for at least 11 min. Participants in

Table 1. Characteristics of participants in the study at baseline ($n = 90$).

Group	Control group ($n = 44$)	Intervention group ($n = 46$)	$p^{\dagger}$
Age (years)*	45.50 (7.02)	46.83 (9.13)	.441
Sex (%)	11.4 (M); 88.6 (F)	15.2 (M); 84.8 (F)	.590
Smoke (%)	50 (Y); 50 (N)	56.5 (Y); 43.5 (N)	.532
ODI (percentage)*	28.77 (2.69)	28.13 (2.23)	.220
VAS (points)*	59.22 (11.96)	59.25 (11.38)	.961
Pre-contemplation, yes, *n* (%)	20 (45.43)	21 (45.65)	.830
Contemplation, yes, *n* (%)	21 (47.71)	19 (41.30)	.669
Preparation, yes, *n* (%)	3 (6.81)	6 (13.04)	.291
Action, yes, *n* (%)	0	0	
Maintenance, yes, *n* (%)	0	0	

*Value expressed as Mean (SD); ODI: Oswestry disability questionnaire score; VAS: visual analogical score from Euroqol-5D quality of life questionnaire; Smoke: percentage of smokers; M: male; F: female; Y: yes; N: not.
†*p* values from Student's (*t*) test for independents measures or chi square test.

Table 2. Effects of nine months of web-based intervention on behaviour domain ($n = 90$).

	Baseline		Post-treatment		
Outcomes measure	Control group ($n = 44$)	Intervention group ($n = 46$)	Control group ($n = 44$)	Intervention group ($n = 46$)	$p^{\dagger}$
Stage of change					
Pre-contemplation, yes, *n* (%)	20 (45.43)	21 (45.65)	28 (63.64)	2 (4.34)	<.001
Contemplation, yes, *n* (%)	21 (47.71)	19 (41.30)	3 (6.81)	6 (13.04)	.291
Preparation, yes, *n* (%)	3 (6.81)	6 (13.04)	11 (25.00)	3 (6.52)	.020
Action, yes, *n* (%)	0	0	2 (4.55)	11 (23.91)	.007
Maintenance, yes, *n* (%)	0	0	0 (0)	24 (52.20)	<.001

Values expressed as %.
†*p* values chi square analysis.

the intervention group remained logged in for at least 11 min for 85.71% of all sessions. In the intervention group, 92% (46 of 50) of the participants completed the programme. Of the four intervention group participants who dropped out, three were women who changed jobs, and the other was a woman who stopped due to pregnancy. In the control group, 88% (44 of 50) of the participants completed the study. The remaining six participants dropped out through apparent lack of interest. No statistically significant differences in baseline measurements were found between the two study groups (Table 1). In the intervention group, a positive association was found between the wish to continue with the programme and maintenance phase status according to the stage of change questionnaire (Odd ratio 5.4; 95% CI: 1.372 to 21.260; $p = .012$). In the intervention group, significant positive effects were found for mean scores for all phases in the behaviour domain (Table 2). Figure 2 shows the difference between treatments in

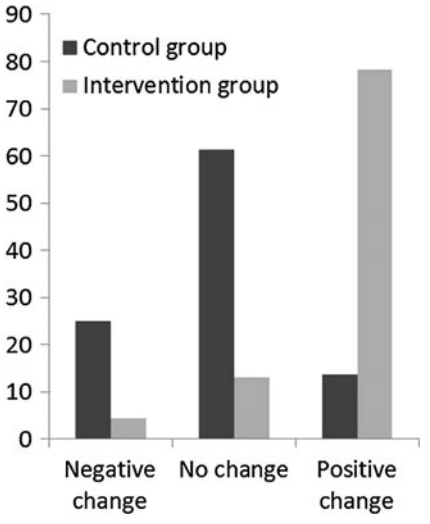

Figure 2. Changes in the stage of changes questionnaire through groups.

Table 3. Spearman correlation coefficient between global stage of change, self-reported functional disability levels and self-reported health status after treatment among office workers suffering sub-acute non-specific low back pain* ($n = 90$).

Outcomes measures	Global stage of change (%)	Oswestry questionnaire	VAS
Global stage of change (%)	1.000	.367**	−.609**
Oswestry questionnaire		1.000	−.517**
VAS			1.000

*Spearman correlations coefficients. Global stage of change: participants whose change their behaviour status after treatment; Oswestry questionnaire: Oswestry disability questionnaire score difference after treatment; VAS: visual analogical scale points differences after treatment.
**Correlation is significant at .001 level.

terms of the global stage of change. In the intervention group, significant positive effects were found for stage of change in behaviour at nine-month follow up ($p < .001$). Table 3 shows the Pearson correlation coefficients for the study outcome measures. A high correlation was found between VAS and global stage of change at nine months ($r = -.612$). Moderate correlation was found between ODI and global stage of change at nine months ($r = .388$).

Discussion

The present reanalysis of the trial study suggests that this intervention is effective to improving exercise behaviour in office workers with sub-acute non-specific LBP, i.e., physically untrained office workers in the intervention group became more physically active in the workplace. This improvement was moderately and highly correlated with improvements in self-reported health status and self-reported functional disability, respectively.

Although our University offers a range of out-of-work general physical activity programmes to its employees and its occupational preventive service offers advice concern-

ing enhancement of physical activity, all of the study participants were physically untrained at baseline. The high level of adherence observed in the intervention group may have been due to the specificity of our occupational intervention (for secondary prevention of LBP) (Hudon, Fortin, & Soubhi, 2008). Participants in the intervention group performed an 11-min session addressing health education and physical activity five days per week. Previous research suggests that exercise programmes of short duration are preferable for employees who work long shifts (Bell and Burnett, 2009).

The present study was performed under "real Internet conditions" and, thus, no personal contact between participants and the research team was necessary during the period of training. Since office work involves receipt of multiple emails daily, employees may have been expected not to react to email contact from the study team, and to be reluctant to enrol in a study that has little direct relevance to their work (Marshall, Leslie, Bauman, Marcus, & Owen, 2003; Leslie, Marshall, Owen, & Bauman, 2005). However, to mimic the real-life implementation as much as possible, only one email was sent per day to improve adherence (Dunton and Robertson, 2008).

The current intervention has previously revealed the effectiveness on improve self-reported health status and functional disability perception. The correlation model used to determine the correlation between the investigated variables (Table 3) revealed that the change in the behaviour domain was correlated with functional disability perception and self-reported health status. Maybe the improvement observed in the intervention group regarding functional disability perception could affect self-reported health status (Kovacs et al., 2004) and these improvements affect the behaviour of participants in the study.

The present study has several limitations. First, in order to can control as much as possible the exercise programme of participants, we decided to only have the videos available from Monday to Friday and, therefore, a key feature of accessibility in internet-based interventions (Leykin et al., 2012) was not taken into account under the current intervention. Furthermore, an email containing a link to the URL of the session of the day was sent to remind the intervention group participants each day, and to encourage performance of the exercises. Although this reinforcement was done by non-behaviour stage of change-based message, our data indicate that there was a positive improvement in the behaviour domain in terms of exercise. In accordance with our data, Heelen et al., (Spittaels, De Bourdeaudhuij, Brug, & Vandelanotte, 2007) found that a web-based physical activity intervention carried out at the workplace improved the level of physical activity and lifestyle behaviour among a population of healthy office workers, although addition of a tailored email in comparison with standard advice did not influence outcome. Moreover, a key characteristic of the transtheoretical model is its multidimensional design including the facets of the stages of change, the processes of change, self-efficacy and decisional balance. Therefore, to develop behaviour change interventions, a good understanding of each dimension and how they interact with one another needs to be demonstrated. For study purposes, only the variable stage of change was used limit the understanding on why the change has occurred. Further research is needed to determine whether tailored interventions including an email reminder that are based on behaviour change theories are more effective than the present intervention. Since most of the participants in the intervention group wished to continue with the present programme, we did not enquire whether they would like to participate in other types of exercise programmes and we did not test a follow up without reminders to elucidate if this intervention could be also feasible without. Despite this, the first step towards greater LBP-related exercise among physically untrained office workers was successfully achieved in the intervention group. Further research is warranted to eluci-

date whether this strategy for promoting LBP-specific exercise in physically untrained office workers could be used to achieve the amount of physical activity meeting in the physical activity guidelines among LBP patients and other populations, also with a further period of training without reminders.

Conclusion

The present reanalysis of the trial suggests that the LBP-related exercise behaviour among physically untrained office workers with non-specific sub-acute LBP improve after the intervention period. Moderate to high correlation was found between behaviour respect to the Oswestry disability index and self-reported health status.

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References

Bell, J.A., & Burnett, A. (2009). Exercise for the primary, secondary and tertiary prevention of low back pain in the workplace. A systematic review. *Journal of Occupational Rehabilitation, 19*, 8–24.

Brooks, R. (1996). EuroQol: The current state of play. *Health Policy, 37*, 53–72.

Cardinal, B.J. (1995). The stages of exercise scale and stages of exercise behavior in female adults. *Journal of Sports Medicine and Physical Fitness, 35*, 87–92.

Cho, S.W., Kang, J.Y., Park, Y.K., Paek, Y.M., & Choi, T.I. (2009). A 12-week worksite health promotion program reduces cardiovascular risk factors in male workers with the apolipoprotein E2 and apolipoprotein E3 genotypes, but not in apolipoprotein E4 genotype. *Nutrition Research, 29*, 542–550.

Colkesen, E.B., Ferket, B.S., Tijssen, J.G., Kraaijenhagen, R.A., van Kalken, C.K., & Peters, R.J. (2011). Effects on cardiovascular disease risk of a web-based health risk assessment with tailored health advice: A follow-up study. *Vascular Health and Risk Management, 7*, 67–74.

Colkesen, E.B., Niessen, M.A., Peek, N., Vosbergen, S., Kraaijenhagen, R.A., van Kalken, C.K., et al. (2011). Initiation of health-behaviour change among employees participating in a web-based health risk assessment with tailored feedback. *Journal of occupational medicine and toxicology, 6*, 5.

de Vries, H., & Brug, J. (1999). Computer-tailored interventions motivating people to adopt health promoting behaviours: Introduction to a new approach. *Patient Education and Counselling, 36*, 99–105.

Del Pozo-Cruz, B., Adsuar, J.C., Del Pozo-Cruz, B., Adsuar, J.C., Parraca, J., Del Pozo-Cruz, J., Moreno, A., & Gusi, N. (2012). A web-based intervention to improve and prevent low back pain among office workers: A randomized controlled trial. *Journal of Orthopaedic and Sports Physical Therapy, 42*, 831–841.

Del Pozo-Cruz, B., Gusi, N., Del Pozo-Cruz, J., Adsuar, J.C., Hernandez-Mocholí, M., & Parraca, J.A. (2012). Clinical effects of a nine-month web-based intervention in subacute non-specific low back pain patients: A randomized controlled trial. *Clinical Rehabilitation*. [Epub ahead of print].

Del Pozo-Cruz, B., Parraca, J.A., Del Pozo-Cruz, J., Adsuar, J.C., Hill, J., & Gusi, N. (2012). An occupational, internet-based intervention to prevent chronicity in subacute lower back pain: A randomised controlled trial. *Journal of Rehabilitation Medicine, 44*, 581–587.

Dunton, G.F., & Robertson, T.P. (2008). A tailored Internet-plus-email intervention for increasing physical activity among ethnically-diverse women. *Preventive Medicine, 47*, 605–611.

Fairbank, J.C., & Pynsent, P.B. (2000). The oswestry disability index. *Spine* (*Phila Pa 1976*), *25*, 2940–2952; discussion 2952.

Fairbank, J.C., Couper, J., et al. (1980). The Oswestry low back pain disability questionnaire. *Physiotherapy, 66*, 271–273.

Fogelholm, M. (2010). Physical activity, fitness and fatness: Relations to mortality, morbidity and disease risk factors. A systematic review. *Obesity Reviews, 11*, 202–221.

Fotheringham, M.J., Wonnacott, R.L., & Owen, N. (2000). Computer use and physical inactivity in young adults: Public health perils and potentials of new information technologies. *Annals of Behavioral Medicine, 22*, 269–275.

Gusi, N., Prieto, J., Madruga, M., Garcia, J.M., & Gonzalez-Guerrero, J.L. (2009). Health-related quality of life and fitness of the caregiver of patient with dementia. *Medicine and Science in Sports and Exercise, 41*, 1182–1187.

Herdman, M., Badia, X., & Berra, S. (2001). EuroQol-5D: A simple alternative for measuring health-related quality of life in primary care. *Atencion Primaria, 28*, 425–430.

Hodgins, M., Battel-Kirk, B., & Asgeirsdottir, A.G. (2010). Building capacity in workplace health promotion: The case of the Healthy Together e-learning project. *Global Health Promotion, 17*, 60–68.

Hudon, C., Fortin, M., & Soubhi, H. (2008). Single risk factor interventions to promote physical activity among patients with chronic diseases: Systematic review. *Canadian Family Physician, 54*, 1130–1137.

Hutchison, A.J., Breckon, J.D., and Johnson, L.H. (2009). Physical activity behavior change interventions based on the transtheoretical model: A systematic review. *Health Education & Behavior, 36*, 829–845.

Kovacs, F.M., Abraira, V., Zamora, J., Teresa Gil del Real, M., Llobera, J., Fernandez, C., and Rodriguez, E. (2004). Correlation between pain, disability, and quality of life in patients with common low back pain. *Spine (Phila Pa 1976)*, *29*, 206–210.

Kovacs, F.M., Abraira, V., Zamora, J., & Fernandez, C. (2005). The transition from acute to subacute and chronic low back pain: A study based on determinants of quality of life and prediction of chronic disability. *Spine* (*Phila Pa 1976*), *30*, 1786–1792.

Lenert, L., Munoz, R.F., Perez, J.E., & Bansod, A. (2004). Automated e-mail messaging as a tool for improving quit rates in an internet smoking cessation intervention. *Journal of the American Medical Informatics Association, 11*, 235–240.

Leslie, E., Marshall, A.L., Owen, N., & Bauman, A. (2005). Engagement and retention of participants in a physical activity website. *Preventive Medicine, 40*, 54–59.

Leykin, Y., Thekdi, S.M., Shumay, D.M., Muñoz, R.F., Riba, M., & Dunn, L.B. (2012). Internet interventions for improving psychological well-being in psycho-oncology: Review and recommendations. *Psychooncology, 21*, 1016–1025.

Logan, A.G., Milne, B.J., Achber, C., Campbell, W.B., & Haynes, R.B. (1981). Cost-effectiveness of a worksite hypertension treatment program. *Hypertension, 3*, 211–218.

Macedo, A.C., Trindade, C.S., Brito, C.S., & Socorro Dantas, M. (2011). On the effects of a workplace fitness program upon pain perception: A case study encompassing office workers in a Portuguese context. *Journal of Occupational Rehabilitation, 21*, 228–233.

MacKinnon, D.P., Elliot, D.L., Thoemmes, F., Kuehl, K.S., Moe, E.L., Goldberg, L., and Ranby, K.W. (2010). Long-term effects of a worksite health promotion program for firefighters. *American Journal of Health Behavior, 34*, 695–706.

Marcus, B.H., & Simkim, L.R. (1993). The stage of change in behaviour. *Journal of Sports Medicine and Physical Fitness, 33*, 83–88.

Marshall, A.L., Leslie, E.R., Bauman, A.E., Marcus, B.H., Owen, N., et al. (2003). Print versus website physical activity programs: A randomized trial. *American Journal of Preventive Medicine, 25*, 88–94.

McKay, H.G., Feil, E.G., Glasgow, R.E., & Brown, J.E. (1998). Feasibility and use of an Internet support service for diabetes self-management. *The Diabetes Educator, 24*, 174–179.

Napolitano, M.A., Fotheringham, M., Tate, D., Sciamanna, C., Leslie, E., Owen, N., and Marcus, B. (2003). Evaluation of an internet-based physical activity intervention: A preliminary investigation. *Annals of Behavioral Medicine, 25*, 92–99.

Napolitano, M.A., & Marcus, B.H. (2002). Targeting and tailoring physical activity information using print and information technologies. *Exercise and Sport Sciences Reviews, 30*, 122–128.

Payne, N., Gledhill, N., Katzmarzyk, P.T., & Jamnik, V. (2000). Health-related fitness, physical activity, and history of back pain. *Canadian Journal of Applied Physiology, 25*, 236–249.

Perez, A.P., Phillips, M.M., Cornell, C.E., Mays, G., & Adams, B. (2009). Promoting dietary change among state health employees in Arkansas through a worksite wellness program: The Healthy Employee Lifestyle Program (HELP). *Preventing Chronic Disease, 6*, A123.

Plotnikoff, R.C., McCargar, L.J., Wilson, P.M., & Loucaides, C.A. (2005). Efficacy of an e-mail intervention for the promotion of physical activity and nutrition behavior in the workplace context. *American Journal of Health Promotion, 19*, 422–429.

Poole, K., Kumpfer, K., & Pett, M. (2001). The impact of an incentive-based worksite health promotion program on modifiable health risk factors. *American Journal of Health Promotion, 16* (1), 21–26, ii.

Prochaska, J.O., & DiClemente, C.C. (1984). Self change processes, self efficacy and decisional balance across five stages of smoking cessation. *Progress in Clinical and Biological Research, 156*, 131–140.

Robroek, S.J., Bredt, F.J., & Burdorf, A. (2007). The (cost-)effectiveness of an individually tailored long-term worksite health promotion programme on physical activity and nutrition: Design of a pragmatic cluster randomised controlled trial. *BMC Public Health, 7*, 259.

Spittaels, H., De Bourdeaudhuij, I., Brug, I., & Vandelanotte, C. (2007). Effectiveness of an online computer-tailored physical activity intervention in a real-life setting. *Health Education Research, 22*, 385–396.

van der Roer, N., Ostelo, R.W., Bekkering, G.E., van Tulder, M.W., & de Vet, H.C. (2006). Minimal clinically important change for pain intensity, functional status, and general health status in patients with nonspecific low back pain. *Spine (Phila Pa 1976)*, *31*(5), 578–582.

Wanner, M., Martin-Diener, E., Braun-Fahrlander, C., Bauer, G., & Martin, B.W. (2009). Effectiveness of active-online, an individually tailored physical activity intervention, in a real-life setting: Randomized controlled trial. *Journal of Medical Internet Research, 11*, e23.

Westcott, W.L., Winett, R.A., Annesi, J.J., Wojcik, J.R., Anderson, E.S., & Madden, P.J. (2009). Prescribing physical activity: Applying the ACSM protocols for exercise type, intensity, and duration across 3 training frequencies. *The Physician and Sportsmedicine, 37*, 51–58.

Wilkerson, G.B., Boer, N.F., Smith, C.B., & Heath, G.W. (2008). Health-related factors associated with the healthcare costs of office workers. *Journal of Occupational and Environmental Medicine, 50*, 593–601.

Yap, T.L., Hemmings, A., & Davis, L.S. (2009). The systematic development of a tailored e-mail intervention for health behavior change toward increasing intentional physical activity. *Western Journal of Nursing Research, 31*, 330–346.