ABSTRACT

Objective To investigate whether general group exercise (GGE) offers the same outcomes compared with a specific spinal group exercise (SSGE) for chronic low back pain (CLBP) in a military population.

Design Retrospective service evaluation using routine service activity data.

Setting A UK military rehabilitation centre.

Participants A total of 106 patients with CLBP.

Interventions Three-week intensive (5 days per week, 15-day intervention) rehabilitation course for patients with CLBP. Six SSGE groups (n=64); CLBP only. Six GGE groups (n=42); CLBP patients grouped with chronic lower limb (LL) injuries.

Outcome measures Oswestry Disability Index (ODI), Numerical Pain-Rating Scores and the Modified Multi-Stage Fitness Test (Mod-MSFT). Long-term effects were measured by Medical Employment Standard (MES) status and physiotherapy follow-up at 3 and 12 months.

Results A between-group analysis showed no significant difference in GGE compared with SSGE. Mean changes (SD) in pain were −2.71±2.35 and −1.20±1.99 (p=0.018), ODI were −3.6±5.7 and −4±8.5 respectively (p=0.649) and Mod-MSFT 28.4±30.8 and 29.7±31.7 respectively (p=0.792). At 3 months, a greater proportion of the GGE were having ongoing physiotherapy; GGE=50%, SSGE=30.2%, (p=0.016) although some differences were evident across MES with 32.5% of GGE compared with 20.6% of SSGE being medically fit with no restrictions. At 12 months, groups were largely comparable for follow-up physiotherapy and MES; 22.5% of GGE and 20.6% of SSGE continued to have physiotherapy input; 47.5% of GGE and 50.8% of SSGE were medically fit with no restrictions.

Conclusion Patients with CLBP who completed a 3-week rehabilitation programme had comparable outcomes when grouped with patients with LL, although only improvements in pain in the GGE group achieved a meaningful change. Further evaluation of potential costs and savings to service costs is now required.

INTRODUCTION

As well as the leading cause of disability in the general working-age population globally, chronic low back pain (CLBP) is also the most common musculoskeletal presentation in the US and UK armed forces.1,2 In 2009, 7% of UK armed forces had chronic back pain (CLBP) compared with 20.6% of LL injuries.3

Of note, group exercise therapy is a core component in CLBP management within the Defence Medical Rehabilitation Programme (DMRP).11,12 Regional Rehabilitation Units (RRU) provide 3-week intensive rehabilitation courses (3 days per week, 15-day intervention) for patients with chronic musculoskeletal conditions, including CLBP, with evidence of support for a wide variety of exercise interventions, including yoga, Pilates, strength/resistance training and stability/co-ordination exercises.10

Key messages

Comparable outcomes are achieved if patients with chronic low back pain (CLBP) complete a 3-week exercise programme when grouped with patients with lower limb injuries compared with a group comprising patients with CLBP only.

Efficiency savings could be made by grouping mixed military musculoskeletal presentations together for group exercise therapy earlier in the care pathway.
DMRP. Based on the available research evidence at that time, amalgamating the LL and SSGE into a general group exercise (GGE) course was a justifiable course of action to afford positive outcomes for patients with CLBP. Additionally, the ability to offer courses more regularly could reduce the socioeconomic burden of CLBP in a military population, hastening return to duties and reducing healthcare usage.

From a detailed literature search, the authors identified one study that investigated the effectiveness of exclusively LL exercise in the treatment of CLBP. Cai et al.\textsuperscript{13} demonstrated that LL strengthening was equally effective to lumbar extensor or lumbar stabilisation exercises for improving lumbar multifidus muscle activation and superior for running functional outcomes in a recreational running population with CLBP (n=84). No study was identified specifically investigating outcomes in exercise groups comprising both CLBP and LL conditions or in a more representative population. In view of these findings, and in line with the identified DDR research priorities, the aim of this service evaluation (SE) was to evaluate the outcomes of the GGE for patients with CLBP compared with existing data for SSGE.

**METHODS**

**Design**

A retrospective SE was designed using routine service activity data. In the absence of reporting guidelines,\textsuperscript{14} the Standards for Reporting Implementation Studies document was used to inform the methods of the SE.\textsuperscript{15} An a priori protocol was developed with expertise from the University of Birmingham and approved by the Academic Department of Military Rehabilitation.

Inclusion criteria

All patients with CLBP accepted for residential rehabilitation from December 2014 to June 2013 were admitted to six established SSGE courses; patients accepted from December 2015 to June 2016 were admitted to six GGE courses. Inclusion criteria: Army, Royal Air Force (RAF) or Royal Navy (RN) personnel, aged 17–55. All patients were seen by a general practitioner and physiotherapist at PCRF and, in 69% of cases, an exercise therapist. Each course is led by a designated senior physiotherapist and exercise therapist. Exercise prescription, progression and intensity is controlled and monitored by the physiotherapist and exercise therapist, and always conducted in a group environment. In line with normal service delivery, one-to-one treatment was available, if required. The main difference between the SSGE and GGE was that unlike the GGE the SSGE had daily, mat-based, spinal mobility sessions.

**Outcome measures**

Pain: Numerical Pain-Rating Score (NPRS)

A valid and responsive self-report measure of pain intensity (0–10) where 0=no pain and 10=worst possible pain with values recorded at pre-rehabilitation and post-rehabilitation course.\textsuperscript{18}

Disability: Oswestry Disability Index (ODI)

The ODI is a back-specific patient-reported questionnaire, consisting of 10 questions that assess the level of pain interference with physical activities of daily living.\textsuperscript{19} Test–retest reliability is reported to be excellent intraclass correlation coefficient (ICC) 0.88 (95%CI 0.77 to 0.94) and ICC 0.94 (95%CI 0.89 to 0.97).\textsuperscript{20,21}

Long-term outcomes of the intervention were assessed using individual’s Medical Employment Standard (MES) status at 3 and 12 months. MES categories are listed below,\textsuperscript{12} although this SE had a specific focus on medical fitness with no restrictions (P2):

| MES Category | Description |
|--------------|-------------|
| P0           | Medically unfit for duty and under medical care |
| P2           | Medically fit for unrestricted service worldwide |
| P3           | Medically fit for duty with minor employment limitations |
| P4           | Medically fit for duty within the limitations of pregnancy |
| P7           | Medically fit for duty with major employment limitations |

Figure 1  Summary of Defence Medical Rehabilitation Centre (DMRC) model. PCRF, Primary Healthcare Rehabilitation Facilities; RRU, Regional Rehabilitation Units

Surtees JE, Heneghan NR. BMJ Mil Health 2020;166:140–145. doi:10.1136/jramc-2018-001011
Fitness: Modified Multi-Stage Fitness Test (Mod-MSFT)

A measure physical function, the Mod-MSFT is a modification of the established MSFT. It was first used with traumatic brain injuries demonstrating excellent reliability and validity. Markers are place at 0, 10 and 20 m where the test involves walking, and then running the 20 m distance in time to a shortening frequency of beeps, played out on an audio device. The test is terminated by the patient due to pain or fatigue and has been used in a CLBP military population. The MSFT is used by the RAF and RN as measurement of physical fitness; achieving an age and sex appropriate pass mark is essential to achieve medical fitness with no restrictions (P2) MES.

Healthcare use including ongoing physiotherapy interventions was also evaluated at 3 and 12 months.

Procedure

ODI and Mod-MSFT were recorded by the individual course physiotherapist at the start and end of each course. The researcher extracted baseline demographic characteristics and all outcome measure data from a manual search of electronic defence medical records of all individuals participating in the six SSGE and six GGE courses.

Data analysis

Data were analysed using primarily descriptive methods, using the statistical analysis software SPSS V21. The alpha level was set at 0.05. Prior to statistical analysis, the Shapiro-Wilk test for normality was used due to the small sample size. As a result, the Mann-Whitney U test was selected as an appropriate non-parametric test.

RESULTS

A total of 106 patients with CLBP met the inclusion criteria and were included in the evaluation. The personal characteristics of participants are presented in Table 1.

Table 1 shows there was no between-group statistical significant difference for the following characteristics: age (p=0.864), waiting time (p=0.864) or male/female ratio (p=0.170). The most common clinical diagnosis was non-specific CLBP; 73 of the 106 sample; SSGE 70.3%, GGE 65.9%. There was no statistically significant difference between groups in the clinical presentation (p=0.413). The frequency of non-specific LBP was lower than the commonly reported 90% of all presentations (p=0.864).

A between-group analysis, summarised in Table 2, showed no significant difference in the outcome measures compared with the SSGE group. Pain mean change was −2.71 and -1.20 (p=0.018), ODI mean change −3.6±5.7 and −4±8.5 respectively (p=0.649) and mod-MSFT mean change 28.4±30.8 and 29.7±31.7 respectively (p=0.792).

Physiotherapy and functional status at 3-month and 12-month follow-up

At 3 months a greater proportion of the GGE group were still having ongoing physiotherapy care (50%) compared with 30.2% in SSGE, although more of the GGE were medically fit with no restrictions (32.5%) compared with 20.6% of the SSGE, although more of the GGE were medically fit with no restrictions (32.5%) compared with 20.6% of the SSGE.

Missing data

Full data sets were available for ODI evaluation, although 3 values were missing for post-course Mod-MSFT SSGE, and 11 for NPRS pre and post SSGE, 13 pre and 19 post GGE.

DISCUSSION

The aim of this SE, the first of its kind, was to examine outcomes in patients with CLBP completing a 3-week course when grouped with patients with LL compared with a group of patients with CLBP only. Given the inherent difficulties of conducting clinical trials in a military setting, where participants may be deployed or posted at short notice, use of SE offers an alternative approach to evaluate practice and implement changes in a timely manner. Additionally, this offers a means to systematically assess activities and outcomes to examine efficiency and effectiveness of a service. While cost effectiveness is a key driver, a new multi-criteria decision analysis model incorporates a more comprehensive evaluation inclusive of access, equity, effectiveness of...
Table 3  Physiotherapy and functional status at 3-month and 12-month follow-up

| Percentage of physio follow-up at 3 and 12 months | GGE (n=40) (%) | SSGE (n=63) (%) |
|---------------------------------------------------|----------------|----------------|
| 3 month post course                                |                |                |
| Ongoing physio                                     | 30.2           | 50             |
| Discharged care complete                           | 41.3           | 15             |
| Admin discharge                                    | 28.5           | 35             |
| 12 months post course                              |                |                |
| Ongoing physio                                     | 20.6           | 22.5           |
| Discharged care complete                           | 54             | 40             |
| Admin discharge                                    | 25.4           | 37.5           |
| Percentage of post-intervention employment standard at 3 and 12 months |
| 3 month post course                                |                |                |
| P0                                                 | 3.2            | 2.5            |
| P1                                                 | 50.8           | 47.5           |
| P2                                                 | 22.2           | 20             |
| P3                                                 | 23.8           | 32.5           |
| P4                                                 | 1.6            | 0              |
| P5                                                 | 1.6            | 0              |

GGE, general group exercise; SSGE, specific spinal group exercise.

**Measures**

Selection, administration and interpretation of outcome measures are important facets in evaluation. In this SE outcome measures were informed by DDR policy, with four of the five well-established areas for measuring outcomes in LBP included: disability, back specific function, generic health status, pain and work represented. This SE therefore provides a robust evaluation of the impact of changes in patient outcomes in a military setting. In summary this SE found more than two point difference in pain scores in favour of GGE, although no between-group difference was found with respect to disability or physical function. A greater proportion of the SSGE were medically fit with no restrictions compared with only 20.6% of the GGE. At 12 months, although 32.5% of the GGE were medically fit with no restrictions, no between-group difference was found with respect to disability or physical function. A greater proportion of the SSGE was still not achieved by the end of the course. This SE therefore provides a robust evaluation of the impact of changes in patient outcomes in a military setting. In summary this SE found more than two point difference in pain scores in favour of GGE, although no between-group difference was found with respect to disability or physical function. A greater proportion of the SSGE were medically fit with no restrictions compared with only 20.6% of the GGE. At 12 months, although 32.5% of the GGE were medically fit with no restrictions, no between-group difference was found with respect to disability or physical function. A greater proportion of the SSGE was still not achieved by the end of the course.

**Pain**

Notwithstanding the extent of the missing data for NPRS change, scores achieved those reported in the wider literature for MCID. It is interesting that this sizeable change was observed during the 3-week course which would suggest that the non-physical factors such as beliefs, knowledge, and so on had a role in pain perception; reflective of the multidimensional nature of LBP. Caution should be taken when interpreting these findings given the extent of the missing data for pain.

**Disability**

Based on the reported requirements for the general population neither group achieved a meaningful change in disability scores. However, where both groups were largely of minimal disability based on ODI and the absence of a population-specific measure of disability, where a sensitive and specific has not yet been established, groups did meet the values required at the lower end of the range for the reported MCID from other populations, ranging 2.92 to 15.36 to a 10-point change combined with a 30% improvement from baseline.

**Implications for practice and policy**

It has been documented that prompt recovery (in non-specific LBP) is most likely to occur during 3 months post onset, with only gradual improvements thereafter. Moreover, studies have found that 62% of all patients continued to complain of pain at 12 months. This raises the question as to what we can realistically expect given patients commenced the course, on average, 8+ months from initial presentation. Only 69% of patients saw an Exercise Therapist at PCRF pre course; one of their primary functions is group exercise. There may be greater potential for improvements if rehabilitation courses are offered earlier in the care pathway, and which may in turn ameliorate some of the cost burden of managing more established chronic pain presentations.

With a lack of comparable data for those individuals who did not attend an RRU course, this study raises the question of whether the right patients are being selected for course participation as part of the DMRP tier approach. Despite DMRP referral guidelines and timescales, referral patterns to the RRU are patient-dependent and therapist-dependent, informed by therapist expertise, patient operational demands and clinical presentation. This may also explain the variability in waiting times seen in this SE. With a review citing 1501 potential prognostic factors associated with poor recovery from LBP decision-making for patient referral is complex. With the recent introduction of the
StArTBack tool into the DMRP, this may now better differentiate between patients with LBP and inform targeted management.44 45

Maher46 summaries the challenges clinicians face where no single treatment cures CLBP, and the abundant unregulated, non-evidence-based management options that bombard patients confuse the issue further. While there is no specific evidence for the 3-week model, elements found within the course are well evidenced. This SE goes someway to justify the need for more research into the modes of rehabilitation delivery in the UK military setting to assist with clinical decision-making.

Strengths and limitations
One of the main limitations is that pain, ODI and Mod-MSFT data were not available at the 3-month or 12-month follow-up points. The habitual use of outcome measures in clinical practice has challenges and is widely reported in the literature.47 The lack of routine outcome measures recorded across the DMRP limits the impact of the findings of this SE and warrants further investigation. Moreover, population-specific measures with established measurement properties are required to further inform practice decisions.48 This SE has highlighted the inconsistent recording of the numerical pain rating scale49 pre course and post course, despite being an outcome measure documented in DDR policy. Finally evaluation of the impact of a GGE course on patients with LL was beyond the scope of this SE, although it could be useful to strengthen proposed service changes.

CONCLUSION
Patients with CLBP who completed a 3-week rehabilitation programme had comparable outcomes when grouped with patients with LL injuries, although only improvements in pain in the GGE group achieved more than the MCID on completion of the course. At 12-month follow-up, both groups were largely comparable with respect to achieving medical fitness with no or minor employment restrictions. This service evaluation supports the need to further consider timing for rehabilitation in the care pathway, comprehensive use of patient-reported outcomes and further evaluation of potential costs and savings to service costs.

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REFERENCES
1 Knox J, Orchowski J, Scher DL, et al. The incidence of low back pain in active duty United States military service members. Spine 2011;36:1492–500.
2 Strowbridge NF, Burgess KR. Sports and training injuries in British soldiers: the colchester garrison sports injury and rehabilitation centre. J R Army Med Corps 2002;148:236–43.
3 Defence Analytical Services Agency. Secondary defence analytical services agency. http://webarchive.nationalarchives.gov.uk/20130430160018/http://www.dasa.mod.uk/monintrate/UKDS/UKDS2010/ukds.php
4 National Institute for Health and Care Excellence (NICE) guidelines. Neck pain - non-specific secondary neck pain - non-specific, 2015. https://cks.nice.org.uk/neck-pain-guidance/neck-pain-guidance/neck-pain-guidance-2015
5 Department AR. Emerging themes and research questions academic department of military research. RCG Research Workshop DMRC. Headley Court, 2014.
6 National Institute for Health and Care Excellence (NICE) guidelines. Low back pain and sciatica in over 16s: assessment and management. Secondary low back pain and sciatica in over 16s: assessment and management. 2016. https://www.nice.org.uk/guidance/ng59
7 O’Keeffe M, Hayes A, McCrecich K, et al. Are group-based and individual physiotherapy exercise programmes equally effective for musculoskeletal conditions? A systematic review and meta-analysis. Br J Sports Med 2017;51:126–32.
8 Toomey E, Currie-Murphy L, Matthews J, et al. The effectiveness of physiotherapists delivered group education and exercise interventions to promote self-management for people with osteoarthritis and chronic low back pain: a rapid review part I. Man Ther 2015;20:265–86.
9 Saragiotto BT, Maher CG, Yamato TP, et al. Motor control exercise for chronic non-specific low-back pain. Cochrane Database Syst Rev 2016;21.
10 Searle A, Spink M, Ho A, et al. Exercise interventions for the treatment of chronic low back pain: a systematic review and meta-analysis of randomised controlled trials. Clin Rehabil 2015;29:1155–67.
11 Defence Mo. JSP 950: chapter 22: rheumatology and rehabilitation. Leaflet 2-22-1 Defence Medical Rehabilitation Programme (DMRP), 2010.
12 Roberts AJ, Dew A, Bridger R, et al. Predicting low back pain outcome following rehabilitation for low back pain. J Back Musculoskeletal Rehabil 2015;28:119–28.
13 Comparison of 3 exercise therapies for recreational runners with chronic low back pain. Tsukuba, Japan: 34 International Conference of Biomechanics in Sport, 2016.
14 Altman DG, Simera I, Hoey J, et al. EQUATOR: reporting guidelines for health research. Lancet 2008;371:1149–50.
15 Pincock H, Barwick M, Carpenter CR, et al. Standards for Reporting Implementation Studies (StaRI): explanation and elaboration document. BMJ Open 2017;7:e007955.
16 Charlton JE. Core curriculum for professional education in pain. 3rd edn. Seattle, USA, 2005.
17 Lawson E. Regional rehabilitation unit - spine exercises course standardisation. Tidworth Garrison, 2017.
18 Chilidis ID, Piva SR, Fritz JM. Responsiveness of the numeric pain rating scale in patients with low back pain. Spine 2005;30:1331–4.
19 Fairbank JC, Pyntest PB. The Oswestry disability index. Spine 2000;25:2940–53.
20 Grotle M, Garratt AM, Krogstad Jenssen H, et al. Reliability and construct validity of the numeric pain rating scale in patients with low back pain. Spine 2005;30:1331–4.
21 Dawson AP, Steele E, Hodges PW, et al. Utility of the oswestry disability index for studies of back pain disability in nurses: evaluation of psychometric and measurement properties. Int J Nurs Stud 2010;47:604–7.
22 Defence Mo. JSP 950: Chapter 6: Joint service manual of medical fitness Leaflet 6-7 MOD Intranet, 2016.
23 Lamb KL, Rogers LA. Re-appraisal of the reliability of the 20 m multi-stage shuttle run test. Eur J Appl Physiol 2007;100:281–92.
24 Vitale AE, Jankowski LW, Sullivan SJ. Reliability for a walk/run test to estimate aerobic capacity in a brain-injured population. Brain Inj 1997;11:67–76.
25 Hassett LM, Harmer AR, Moseley AM, et al. Validity of the modified 20-metre shuttle test: assessment of cardiorespiratory fitness in people who have sustained a traumatic brain injury. Brain Inj 2007;21:1069–77.
26 Roberts AJ, Seab R, Dickens IC, et al. A comparison of pain levels after the biering-sorensen and the modified 20-metre shuttle test in patients with chronic low back pain. J Back Musculoskeletal Rehabil 2014;27:173–9.
27 Ministry of Defence. Defence Mo. AP3342: RAF fitness test, section 4 MOD Intranet, 2015.
28 Department for International Development FCO. National security strategy and strategic defence and security review, 2015.
29 Field A. Discovering statistics with IBM SPSS. Newbury Park, CA: Sage, 2013.
30 Koes BW, van Tulder MW, Thomas S. Diagnosis and treatment of low back pain. BMJ 2006;332:1430–4.
31 Authority HR. Defining research. 2016 Secondary defining research, 2016. http://www.hra.nhs.uk/research-community/before-you-apply/determine-whether-your-study-is-research/ 32 Dione E, Mitton C, Macdonald T, et al. The challenge of obtaining information necessary for multi-criteria decision analysis implementation: the case of physiotherapy services in Canada. Cost Eff Resour Alloc 2013;11:11.
33 Walton DM, Making WDM. Making (common) sense of outcome measures. Man Ther 2015;20:723–6.
34 Bombardier C. Outcome assessments in the evaluation of treatment of spinal disorders: summary and general recommendations. Spine 2000;25:1300–3.
35 Foster NE, Anema JR, Cherkin D, et al. Prevention and treatment of low back pain: evidence, challenges, and promising directions. Lancet 2018;391:2368–83.
36 Johnson LH, Helum C, Nygaard OP, et al. Comparison of the SF6D, the EQ5D, and the oswestry disability index in patients with chronic low back pain and degenerative disc disease. BMC Musculoskeletal Disord 2013;14:148–57.
37 Ostelo RW, Deyo RA, Stratford P, et al. Interpreting change scores for pain and functional status in low back pain: towards international consensus regarding minimal important change. Spine 2008;33:90–4.
38 Pratt RK, Fairbank JC, Vitt A. The reliability of the shuttle walking test, the Oswestry spinal stenosis questionnaire, the Oxford spinal stenosis score, and the Oswestry
disability index in the assessment of patients with lumbar spinal stenosis. *Spine* 2002;27:84–91.

39 Chown M, Whittamore L, Rush M, et al. A prospective study of patients with chronic back pain randomised to group exercise, physiotherapy or osteopathy. *Physiotherapy* 2008;94:21–8.

40 Roberts AJ, Franklyn-Miller AD, Etherington J. A new functional outcome assessment tool for military musculoskeletal rehabilitation: a pilot validation study. *Pm R* 2011;3:527–32.

41 Roberts AJ, Etherington J. The functional activity assessment: a validated PROM, unreliable in the hands of clinicians. *J R Army Med Corps* 2013;159:287–90.

42 Pengel LH, Herbert RD, Maher CG, et al. Acute low back pain: systematic review of its prognosis. *BMJ* 2003;327:323–5.

43 Kent PM, Keating JL. Can we predict poor recovery from recent-onset nonspecific low back pain? A systematic review. *Man Ther* 2008;13:12–28.

44 Hestbaek L, Leboeuf-Yde C, Manniche C. Low back pain: what is the long-term course? A review of studies of general patient populations. *Eur Spine J* 2003;12:149–65.

45 Kongsted A, Andersen CH, Hansen MM, et al. Prediction of outcome in patients with low back pain—a prospective cohort study comparing clinicians’ predictions with those of the start back tool. *Man Ther* 2016;21:120–7.

46 Maher C, Underwood M, Buchbinder R. Non-specific low back pain. *Lancet* 2017;389:736–47.

47 Colquhoun HL, Lamontagne ME, Duncan EA, et al. A systematic review of interventions to increase the use of standardized outcome measures by rehabilitation professionals. *Clin Rehabil* 2017;31:299–309.

48 Kyte DG, Calvert M, van der Wees PJ, et al. An introduction to patient-reported outcome measures (PROMs) in physiotherapy. *Physiotherapy* 2015;101:119–25.