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REVIEW

Effectiveness of Workplace Interventions in Return-to-Work for Musculoskeletal, Pain-Related and Mental Health Conditions: An Update of the Evidence and Messages for Practitioners

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Abstract *Purpose* The objective of this systematic review was to synthesize evidence on the effectiveness of workplace-based return-to-work (RTW) interventions and work disability management (DM) interventions that assist workers with musculoskeletal (MSK) and pain-related conditions and mental health (MH) conditions with RTW. *Methods* We followed a systematic review process developed by the Institute for Work & Health and an adapted best evidence synthesis that ranked evidence as strong, moderate, limited, or insufficient. *Results* Seven electronic databases were searched from January 1990 until April 2015, yielding 8898 non-duplicate references. Evidence from 36 medium and high quality studies were synthesized on 12 different intervention categories across three broad domains: health-focused, service coordination, and work modification interventions. There was strong evidence that duration away from work from both MSK or pain-related conditions and MH conditions were significantly reduced by multi-domain interventions encompassing at least two of the three domains. There was moderate evidence that these multi-domain interventions had a positive impact on cost outcomes. There was strong evidence that cognitive behavioural therapy interventions that do not also include workplace modifications or service coordination components are not effective in helping workers with MH conditions in RTW. Evidence for the effectiveness of other single-domain interventions was mixed, with some studies reporting positive effects and others reporting no effects on lost time and work functioning. *Conclusions* While there is substantial research literature focused on RTW, there are only a small number of quality workplace-based RTW intervention studies that involve workers with MSK or pain-related conditions and MH conditions. We recommend implementing multi-domain interventions (i.e. with healthcare provision, service coordination, and work accommodation components) to help reduce lost time for MSK or pain-related conditions and MH conditions. Practitioners should also

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consider implementing these programs to help improve work functioning and reduce costs associated with work disability.

Keywords Return to work · Workplace · Program effectiveness · Musculoskeletal pain · Mental health · Systematic review

Introduction

Despite overall work injury rates declining in most high-income countries [1, 2], equivalent improvements in return-to-work (RTW) rates (i.e. percentage returning to work within certain disability duration windows) have not been observed. In Australia and New Zealand, the latest data indicate RTW rates have remained static for 15 years [3]. Canadian-wide statistics comparing the percentage of wage loss claims at specific durations (e.g., 30 or 180 days after injury) indicate that disability duration has remained constant or increased between 2000 and 2008 [4]. Societal changes are making improvements in RTW more difficult to achieve. The ageing workforce poses particular challenges given findings that older workers take longer to RTW than younger workers and are more likely to 'relapse' into a period away from work following an initial return to work [5]. Similarly, there is a growing trend in precarious employment relationships (e.g., workers with short-term contract arrangements). Workers with precarious job arrangements also take longer to RTW than those with secure employment relationships [6].

There is now a substantial research literature on RTW interventions delivered in the workplace. This diverse literature contains relatively few high quality intervention studies. One systematic review of workplace based interventions published in 2004, for workers with musculoskeletal (MSK)- and pain-related conditions, identified ten good quality intervention studies after completing a search that retrieved 35 relevant studies [7]. The review found strong evidence that time away from work (work disability duration) is reduced by work accommodation offers and contact between healthcare providers and the workplace, and moderate evidence that other disability management interventions were effective. There was limited or mixed evidence of the impact of these interventions on health related quality of life.

The complex nature of interventions in this field poses a direct challenge for researchers. Conducting high-quality work disability research, and in particular, evaluating return-to-work interventions which have many socio-legal aspects and often requires the endorsement and cooperation of stakeholders with competing interests (e.g., employers, insurers, labour unions, provider networks, compensation authorities, etc) is difficult [8]. Still, in the decade since the review's publication, and other studies by the same research team [9], there has been steady growth in the volume and scope of RTW intervention studies published. RTW or work disability research has emerged as a stand-alone field of endeavour encompassing multiple disciplines, with a rapidly growing evidence base [10].

This is true for both MSK and pain-related conditions; and more recently mental health (MH) conditions. The growth in literature focused on interventions to manage depression in the workplace has grown substantially over the last 5 years. In 2010, several authors from this research team published a systematic review [11] on interventions to manage depression in the workplace, finding 12 high quality studies. Recently, this team has sought to update findings on this question and have found the body of relevant literature to have more than doubled in the last 5 years (unpublished data).

Consistent with the best practice of updating systematic reviews as new evidence emerges [12], we sought to update and extend the previous review of workplace based RTW interventions that was limited to MSK and pain-related conditions. The primary objective of this review was to synthesize evidence on the effectiveness of workplace-based RTW interventions that assist workers with MSK, mental health (MH), and pain-related conditions to return to work after a period of work absence. The focus of this update was expanded to include MH conditions, based largely on input from our occupational health and safety (OHS) stakeholders given that the burden associated with managing the effects of mental health conditions in the workplace is extensive [13–16]. A particular strength of the Institute for Work & Health (IWH) systematic review program is the unique process of stakeholder engagement adopted throughout the review process [17]. Our stakeholders provide guidance to ensure the review question is relevant, the search terms are comprehensive and the targeted literature identified is up-to-date. But more importantly, stakeholders helped us examine the findings from this review to determine the best wording for our key messages to facilitate uptake and dissemination of these evidence-based approaches for OHS practitioners and other workplace parties This paper focuses on the evidence on RTW outcomes. A future paper will address the evidence from this review on recovery outcomes.

Methods

The systematic review followed the six review steps developed by the Institute for Work & Health (IWH) for OHS prevention reviews [18]: (1) question development, (2) literature search, (3) relevance screen, (4) quality appraisal,

(5) data extraction, and (6) evidence synthesis. The review team consisted of 17 researchers from Australia, Canada, Europe and the United States. Reviewers were identified based on their expertise in conducting epidemiologic or intervention studies related to work-related conditions, their experience in conducting systematic reviews or their clinical expertise. Review team members had backgrounds in epidemiology, ergonomics, kinesiology, physical therapy, psychology, social sciences, and information science. All 17 team members participated in all review steps.

The IWH Systematic Review program follows an integrated stakeholder engagement model during reviews [17]. Stakeholder meetings were held on multiple occasions through the review process in Toronto, Canada and Melbourne, Australia. Stakeholders were selected from injured worker advocacy groups, unions, workplaces, and health and safety associations and provided valuable input on search terms, inclusion/exclusion criteria, operational definitions, terminology, other search considerations, how findings of the review might be used, potential audiences, how the finalized review could be presented, how the review findings could be disseminated, and stakeholder information and communication needs throughout the review process.

Question Development

The review team and stakeholders participated in a meeting to discuss the review update research question, and proposed search terms. The review question and search terms from the original review were used as a starting point and were updated through this process of question development. The inclusion of MH conditions to the final research question was an addition driven largely in response to stakeholder feedback through this process.

Literature Search

Search terms were developed iteratively by the research team in consultation with a librarian, content area experts and stakeholders. Search terms were identified for three broad areas; population terms for workers and for injury/conditions, intervention terms, and outcome terms. Both database-specific controlled vocabulary terms and keywords were included. The terms within each category were combined using a Boolean OR operator and then terms across the three main categories were combined using a Boolean AND operator. The complete list of terms used in our search is reported in Supplementary Table 1.

The following electronic databases were searched; Medline, EMBASE, CINAHL, PsycINFO, Sociological Abstracts, Applied Social Sciences Index and Abstracts (ASSIA), and ABI Inform (American Business Index) from 1990 to April 2015. Research prior to 1990 was considered informative from a historical perspective but less relevant to current personal injury-illness compensation and other health care system and therefore excluded from this review. As the controlled vocabulary and the ability to handle complicated multi-term searches differ across the databases searched, search terms were customized for each database as required. All peer-reviewed literature was included, including non-English citations.

In addition to the database searches, the review team identified, from their own holdings and via contact with international content area experts, a list of studies that were in press or otherwise forthcoming in the published peer review literature.

References were loaded into commercially available review software (DistillerSR®) [19], which was also used for all remaining review steps. DistillerSR® is an online application designed specifically for the screening, quality appraisal and data extraction phases of a systematic review.

Relevance Screen

The review team devised five screening criteria to exclude articles not relevant to our review question: (a) commentary/editorial, (b) study was not about RTW or disability management/support, (c) non-intervention studies or interventions that did not occur as part of a system, program, policy or work practice change, (d) interventions that were not workplace-based, and (e) study population included greater than 50% of any of the following excluded conditions: severe traumatic brain injury, spinal cord injury, severe lower limb traumatic injuries including amputations; MSK disorders secondary to cancer, cancer-related pain or osteoporosis; and severe mental disorders (i.e. bipolar disorder, chronic severe depression or schizophrenia).

First, titles and abstracts of references were screened by a single reviewer. To limit the possibility of bias, a quality control (QC) step was implemented. A QC reviewer independently assessed a randomly chosen set of 329 titles and abstracts (approximately 5% of references from the search). Comparing the QC reviewer responses directly to review team responses, 27 conflicts (8%) (i.e. where the QC reviewer disagreed with the assessment of the original reviewer) were found. However, only four (1.2%) were conflicts in which the review team excluded references and the QC reviewer included them. The small (1.2%) number of consequential discrepancies suggests that reviewers had a similar understanding and application of the screening criteria.

Second, the full text of articles that advanced through the title and abstract screening process were screened using the same criteria, with two reviewers independently

reviewing and coming to consensus. When consensus could not be reached, a third reviewer was consulted.

Quality Appraisal

Relevant articles were appraised for methodological quality. The team grouped multiple articles associated with a single study, designating one article as the primary article. Study quality was assessed using 25 methodological criteria within the following broad headings: Design and Objectives, Level of Recruitment, Intervention Characteristics, Intervention Intensity, Outcomes, and Analysis (see Supplementary Table 2).

Methodological quality scores for each study were based on a weighted sum score of the quality criteria (with a maximum score of 96). The weighting values assigned to the 25 criteria ranged from "somewhat important" (1) to "very important" (3). Each study received a quality ranking score by dividing the weighted score by 96 and then multiplying by 100. The quality ranking was used to group studies into three categories: high (>85%), medium (50–85%) and low (<50%) quality [20].

Each study was independently assessed by two reviewers, who were required to reach consensus. Where consensus could not be achieved, a third reviewer was consulted. Team members did not review articles they had consulted on, authored or co-authored.

The quality appraisal represents an assessment on: internal validity, external validity, and statistical validity [21]. A higher quality score increases the team's confidence that an effect was an intervention consequence rather than the effect(s) of other workplace or external environment factors. Therefore, data extraction and evidence synthesis were only completed on high and medium quality studies.

Data Extraction

Standardized forms based upon previous reviews were used for data extraction [7, 11]. Extracted data were used to create summary tables sorted by intervention category and used for evidence synthesis. Data were extracted independently by pairs of reviewers. As in the relevance and quality appraisal stages, reviewer pairs were rotated to reduce bias. Team members did not review articles they consulted on, authored or coauthored. Any conflicts between reviewers were resolved by discussion. Stakeholders were consulted to determine relevant workplace-based RTW intervention categories.

Evidence Synthesis

The evidence synthesis approach [18, 22] considers the quality, quantity and consistency in the body of evidence (see Table 1). First, the intervention categories created in the data summary tables were examined by the entire team. Once consensus was reached on the categories, the team moved to summarizing the evidence for each intervention category. Due to the heterogeneity of outcome measures, study designs and reported data, we chose not to calculate a pooled effect estimate. To determine individual study intervention effects, the following rules were applied: an intervention with a positive and no negative results was classified as a positive effect, an intervention with both positive and no effects was also classified as a positive effect intervention, an intervention with only no effects was classified as no effect, an intervention with any negative effect was classified as negative effect. Intervention effects were combined with the quality rating and number of studies to determine the level of evidence for each intervention category.

To generate practical messages, an algorithm developed by IWH along with OHS stakeholders was followed [23]. A strong level of evidence leads to "recommendations". A moderate level of evidence leads to "practice considerations". For all evidence levels below moderate, the consistent message is: "Not enough evidence from the scientific literature to guide current policies/practices". This does not mean that the interventions with limited, mixed, or insufficient evidence may not be effective; only that there is not enough scientific evidence to draw conclusions.

Table 1 Best evidence synthesis algorithm/algorithm for messages

Level of evidence	Minimum quality[a]	Minimum quantity	Consistency	Strength of message
Strong	High (H)	3	3H agree; if 3+ studies, ≥3/4 of the M and H agree	Recommendations
Moderate	Medium (M)	2H or 2H and 1M	2H agree or 2M and 1H agree; if 3+, ≥2/3 of the M and H agree	Practice considerations
Limited		1H or 2M or 1M and 1H	2 (M and/or H) agree; if 2+, >1/2 of the M and H agree	Not enough evidence to make recommendations or practice considerations
Mixed		2	Findings are contradictory	
Insufficient	Medium quality studies that do not meet the above criteria			

[a]High = >85% in quality assessment; medium = 50–85% in quality assessment

Results

Literature Search

The search (covering 1990 to April 2015) identified 8880 references once results from the different electronic databases were combined and duplicates removed (Fig. 1). Eighteen additional papers not captured by the search were identified by the research team resulting in a total of 8898 references (Fig. 1).

Relevance Screen

Overall, 7786 references and 1076 full articles were excluded for not meeting relevance criteria (reference list is available from corresponding author upon request). There were 36 unique studies (described in 65 articles) identified as relevant workplace-based interventions (Fig. 1), 26 of these examined interventions for MSK and pain-related conditions and 10 were focused on MH conditions.

Quality Appraisal

Eighteen studies were classified as high quality (>85% of criteria met) [24–60] and 18 studies were medium quality (50–85% of criteria met) [61–92]. No studies were rated as low quality (<50% of criteria met) (Supplementary Table 2). The quality criteria that differentiated medium and high quality studies were non-randomisation and lack of allocation concealment (N = 16), substantial loss to follow up (N = 15), uneven attrition between groups (N = 22), lack of evidence of intervention compliance (N = 21), failure to blind participants and/or personnel (N = 27) and use of non-optimal statistical analyses (N = 13). Fifteen studies also failed to state clearly the primary study hypothesis (N = 15).

Data Extraction

Study Characteristics

The study designs included randomized controlled trials (n = 19), non-randomized controlled trials (n = 7) and cohort studies with either concurrent (n = 4), historical (n = 4) or both concurrent and historical comparison groups (n = 2).

The studies came from the Netherlands (n = 11), USA (n = 6), Sweden (n = 6), Canada (n = 4), Finland (n = 2), Germany (n = 2), Australia (n = 1), Denmark (n = 1), Hong Kong (n = 1), UK (n = 1) and one multi-jurisdictional study which included participants in Denmark, Germany, Israel, the Netherlands, Sweden and USA.

The sectors included public administration (n = 2), professional, scientific or technical services (n = 3), mining (n = 1), construction (n = 2), agriculture (n = 2), manufacturing (n = 10), transportation (n = 3), health care and social assistance (n = 17), educational services (n = 3), hospitality and other services (n = 5), other (n = 5), and unknown

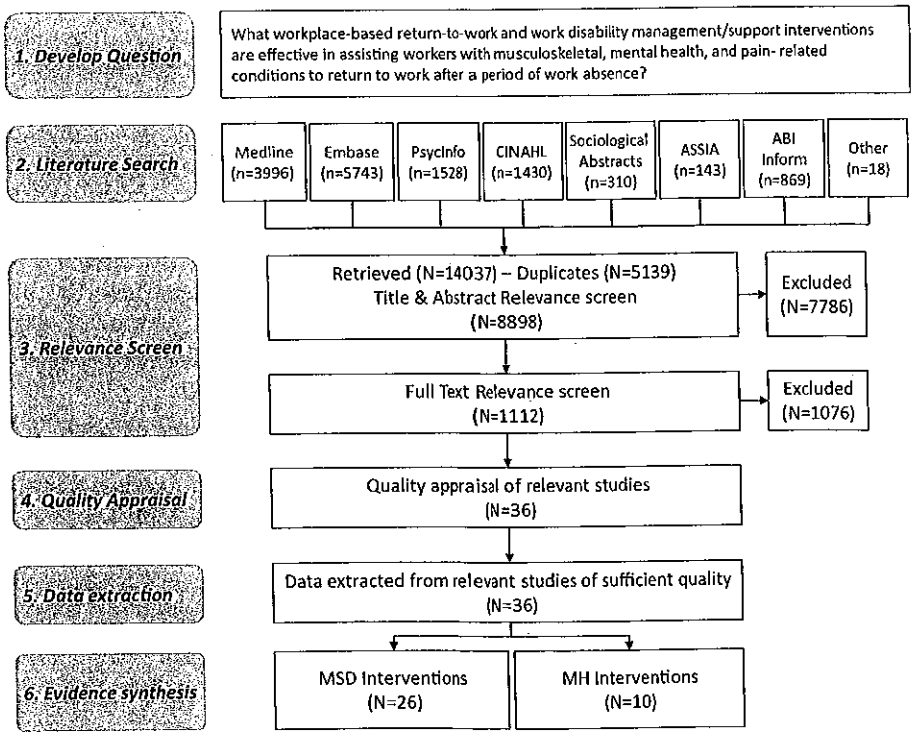

Fig. 1 Flowchart of study identification, selection and synthesis

(n = 13). Some studies included populations from multiple sectors.

The length of follow-up in these studies ranged from 4 weeks to 10 years, with the majority (N = 17) having a 12-month follow-up. Other lengths of follow-up observed in these studies included 4 weeks (N = 1), 8 weeks (N = 1), 6 months (N = 2), 14 months (N = 1), 18 months (N = 3), 2 years (N = 5), 3 years (N = 3), 6 years (N = 2), and 10 years (N = 1).

Study characteristics can be found in Table 2.

Intervention Categorization

A diverse range of interventions were included. An intervention components inventory was created so medium to high quality studies could be aggregated into mutually exclusive categories; 12 unique intervention categories were developed (see Table 3) across four broad domains. Studies were allocated based on investigator consensus on the primary intervention objective. The four domains are:

1. Health-focused interventions. These interventions facilitate the delivery of health services to the injured worker either in the workplace or in settings linked to the workplace (e.g., visits to healthcare providers initiated by the employer/workplace). Specific health services intervention subcategories for which evidence synthesis was conducted include; graded activity/exercise, cognitive behavioural therapy, work hardening and multi-component health-focused interventions (which often included the above elements as well as: medical assessment, physical therapy, psychological therapy, occupational therapy).
2. Service coordination interventions. These interventions were designed to better coordinate the delivery of, and access to, services to assist RTW within and involving the workplace. Coordination involves attempts to improve communication within the workplace or between the workplace and the healthcare providers. Examples are development of RTW plans, case management and education and training.
3. Work modification interventions. These interventions alter the organization of work or introduce modified working conditions. Examples are: workplace accommodations such as provision of modified duties, modified working hours, supernumerary replacements, ergonomic adjustments or other worksite adjustments.
4. Multi-domain interventions. These interventions had multiple intervention components and included at least two of the three above intervention domains [e.g., interventions that involved graded activity in the workplace (health-focused domain) in addition to modified working conditions (work modification domain)].

Across the 36 studies, seven studies investigated health-focused interventions [24–32, 61–63], four studies examined service coordination interventions [33–35, 64–66], and four studies focused on work modification interventions [36–38, 67–69]. In addition, there were 21studies the review team felt were multi-domain interventions. The vast majority of these (n = 15) included components from all three domains [41, 42, 44–50, 54–60, 70–78, 80–85, 91, 92]. Two studies were focused on the health-focused and service coordination domains [43, 51–53], three studies included components from the health-focused and work modification domains [39, 40, 79, 87–90] and one study focused on intervention components from the service coordination and work modification domains [86]. Some multi-intervention studies (n = 5) compared interventions across more than one of these domains [56–60, 87–92].

RTW Outcome Categorization

Three RTW outcomes categories were derived from an inventory of outcome components:

1. Lost time: measures approximating the amount of time spent away from the workplace, or the rate of RTW amongst a group over a given time period. These include outcomes such as days from injury until first return to work, total duration of sick leave over a given time period, work status (working/not working) at a point in time, and recurrences of sick leave/work absence. These measures may be self-reported or collected from organisational or system records.
2. Work functioning: measures assessing the workers function in the workplace and health-related lost productivity. These include outcomes such as the self-rated work limitations questionnaire and estimates of productive working hours.
3. Costs: measures of work disability cost and time loss including costs of income replacement as well as the total cost of compensation paid (where such costs included income replacement costs).

There was one study with negative effects reported for both the lost time and disability costs outcomes [91, 92] in this review (Supplementary Table 3). The most common RTW outcome reported was lost time, which was included in 34 studies. There were 8 studies that examined work functioning outcomes and 15 studies that evaluated cost outcomes. Overall, positive effects were reported for at least one outcome in 29 of the 36 studies.

Table 2 Characteristics of studies

Study author (year) QA rating	Intervention domain	Country	Study design	Population	Sample size	Loss to follow-up	Length of observation
Cheng (2007) High	Health focused	Hong Kong	Randomized trial	MSK/pain	i1 = 46 c1 = 48	Not provided	4 weeks
Linton (1992) Moderate	Health focused	Sweden	Randomized trial	MSK/pain	i1 = 36 c1 = 30	Not provided	6 months (all subjects) 18 months (i1)
Norrefalk (2005) Moderate	Health focused	Sweden	Non-randomized trial	MSK/pain	i1 = 72 c1 = 14	i1 = 5 c1 = Not provided	1 year
Lidstrom (1992) High	Health focused	Sweden	Randomized trial	MSK/pain	i1 = 51 c1 = 52	Not provided	2 years
Hlobil 2005 High	Health focused	The Netherlands	Randomized trial	MSK/pain	i1 = 67 c1 = 67	i1 = 0 c1 = 0	1 year (RTW) 3 years (costs)
Verbeek (2002) High	Health focused	The Netherlands	Randomized trial	MSK/pain	i1 = 61 c1 = 59	Not provided	1 year
Whitfill (2010) High	Health focused	USA	Randomized trial	MSK/Pain	i1 = 58 c1 = 44	Not provided	1 year
Haig (1990) Moderate	Service coordination	USA	Cohort with historical comparison	MSK/pain	i1 = 61 c1 = 52	Not provided	1 year
McCluskey (2006) Moderate	Service coordination	United Kingdom	Non-randomized trial	MSK/pain	i1 = 81 i2 = 223 c1 = 214	Not provided	1 year
Ryan (1995) Moderate	Service coordination	Australia	Cohort with concurrent comparison	MSK/pain	Not provided	Not provided	6 years
van Oostrom (2010) High	Service coordination	The Netherlands	Randomized trial	Mental health	i1 = 73 c1 = 72	i1 = 0 c1 = 2	1 year
Anema (2004) Moderate	Work modification	Denmark, Germany, Israel, the Netherlands, Sweden & USA	Cohort with concurrent comparison	MSK/pain	i1 = 206, i2 = 299, i3 = 270 c1 = 311, c2 = 244, c3 = 291	Not provided	2 years
Hanson (2001) Moderate	Work modification	USA	Cohort with concurrent comparison	MSK/pain	i1 = 14, i2 = 29 c1 = 14	Not provided	1 year
Viikari-Juntura (2012) High	Work modification	Finland	Randomized trial	MSK/pain	i1 = 32 c1 = 31	i1 = 1 c1 = 5	1 year
Shaw (2006) Moderate	Work modification	USA	Randomized trial	MSK/pain	i1 = 11 c1 = 12	Not provided	14 months
Bernacki (2003) Moderate	Multi-domain	USA	Cohort with historical comparison	MSK/pain	i1 = 17k to 28k per annum (1993 to 1999) c1 = 16k to 17k per annum (1989 to 1992)	Not provided	10 years
Beutel (2005) Moderate	Multi-domain	Germany	Randomized trial	Mental health	i1 = 179 c1 = 87	i1 = 83 c1 = 2	2 years

Table 2 (continued)

Study author (year) QA rating	Intervention domain	Country	Study design	Population	Sample size	Loss to follow-up	Length of observation
Davis (2004) Moderate	Multi-domain	Canada	Cohort with historical and concurrent comparison	MSK/pain	i1 = 90 c1(hist.) = 345 c2(con.) = 53	Not provided	6 months
Jensen (1998) High	Multi-domain	Sweden	Cohort with concurrent comparison	MSK/pain	i1 = 67 c1 = 29	i1 = 9 c1 = 4	18 months
Lambeek (2010) High	Multi-domain	The Netherlands	Randomized trial	MSK/pain	i1 = 66 c1 = 68	i1 = 3 c1 = 7	1 year
Larson (2011) Moderate	Multi-domain	USA	Cohort with historical comparison	MSK/pain	i1 = 661 c1 = 713	Not provided	8 weeks
Nordstrom-Bjorverud (1998) Moderate	Multi-domain	Sweden	Cohort with historical comparison	MSK/pain	i1 = 34 c1 = 72	i1 = 0 c1 = 15	2–4 years (median: 2.8 years)
Yassi (1995) Moderate	Multi-domain	Canada	Non-randomized trial	MSK/pain	i1 = 60 c1 = 158	Not provided	2 years
Jensen (2013) High	Multi-domain	Denmark	Non-randomized trial	MSK/pain, mental health	i1 = 114 c1 = 86	i1 = 27 c1 = Not provided	2 years
Karlson (2010) Moderate	Multi-domain	Sweden	Non-randomized trial	Mental health	i1 = 74 c1 = 74	i1 = 0 c1 = 0	18 months
Anema (2007) Moderate	Health focused (i2), Work modification (i1), Multi-domain (i3)	The Netherlands	Randomized trial	MSK/pain	i1 = 96, i2 = 55, i3 = 27 c1 = 100, c2 = 57, c3 = 85	i1 = 10, i2 = 19, i3 = Not provided c1 = 0, c2 = 0, c3 = 0	1 year
Blonk (2006) Moderate	Health focused (i1), Multi-domain (i2)	The Netherlands	Randomized trial	Mental health	i1 = 40, i2 = 40 c1 = 42	i1 = 10, i2 = 10 c1 = 13	1 year
Hees (2013) High	Health focused (c1), Multi-domain (i1)	The Netherlands	Randomized trial	Mental health	i1 = 78 c1 = 39	i1 = 10 c1 = 6	18 months
Vlasveld (2013) High	Health focused (c1), Multi-domain (i1)	The Netherlands	Randomized trial	Mental health	i1 = 65 c1 = 61	i1 = 21* c1 = 31*	1 year
Arends (2013) High	Health focused (c1), Multi-domain (i1)	The Netherlands	Randomized trial	Mental health	i1 = 80 c1 = 78	i1 = 23* c1 = 28*	1 year
Kroger (2015) High	Health focused (c1), Multi-domain	Germany	Non-randomized trial	Mental health	i1 = 13 c1 = 13	i1 = 0 c1 = 0	1 year
Lagerveld (2012) High	Health focused (c1), Multi-domain (i1)	The Netherlands	Non-randomized trial	Mental health	i1 = 105 c1 = 103	i1 = 30 c1 = 23	1 year
Schene (2007) High	Health focused (c1), Multi-domain (i1)	The Netherlands	Randomized trial	Mental health	i1 = 32 c1 = 30	i1 = 8 c1 = 5	3.5 years
Karjalainen (2003) High	Health focused (i1), Multi-domain (i2)	Finland	Randomized trial	MSK/pain	i1 = 58 i2 = 55 c1 = 57	i1 = 0 i2 = 2 c1 = 3	2 years

Table 2 (continued)

Study author (year) QA rating	Intervention domain	Country	Study design	Population	Sample size	Loss to follow-up	Length of observation
Lemstra (2004) Moderate	Health focused (i2), Multi-domain (i1)	Canada	Cohort with historical and concurrent comparison	MSK/pain	i1 = 232, i2 = 232 c1 = 185, c2 = 285	Not provided	3 years
Loisel (1997) High	Health focused (i1), Work modification (i2), Multi-domain (i3)	Canada	Randomized trial with cross-over	MSK/pain	i1 = 31, i2 = 22, i3 = 25 c1 = 26	Not provided	6.4 years

i intervention group, *c* comparison group, *hist* historical, *con* concurrent

*Loss to follow-up only affected self-report measures. RTW data was available for all participants

Evidence Synthesis

Where appropriate, the interventions across the 36 studies were grouped into 12 different intervention categories within the four domains described above. Evidence synthesis for each category was determined and paired with practical messages (see Table 3 for a complete list of categories). The message content was determined through iterative stakeholder consultations to improve practicality. The messages were worded to help clarify the strength of the evidence, limit misinterpretation and increase user uptake.

Multi-domain interventions had a strong level of evidence showing a positive effect on the primary outcome of lost time associated with work disability. Fourteen studies [39–42, 44, 56–60, 70–89, 91, 92] targeted MSK or pain-related conditions. These four high and 10 medium quality studies presented a strong positive effect for comprehensive multi-domain interventions to reduce lost time (see Supplementary Table 3 for a more complete description of the intervention programs; see Table 3 for the evidence synthesis and practical messages for stakeholders). This strong level of evidence resulted in the following message for stakeholders: implementing a multi-domain intervention (i.e. with multiple health-focused, service coordination, and work modification components) can help reduce lost time for MSK and pain-related conditions.

In addition, seven multi-domain interventions for MH conditions [43, 45–55, 90] had a strong level of evidence. These six high and one medium quality studies offered cognitive behavioural therapy (CBT) focused on identifying work relevant solutions. Together, they presented a strong positive effect on reducing lost time for individuals with MH conditions. Four of these high quality studies [43, 47–53, 55] also found a strong positive effect for improving costs associated with work disability for these conditions (see Supplementary Table 3 and Tables 2, 3 for details). Together, these strong levels of evidence resulted in the following message: implementing a work-focused CBT intervention can help reduce lost time and costs associated with work disability for MH conditions.

One intervention category found a strong level of evidence of no effect on lost time for MH conditions. Seven studies (six high and one medium quality) [43, 45–55, 90] found that cognitive behavioural therapy alone offered no effect on lost time for MH conditions, leading to the following stakeholder message: implementing a traditional CBT intervention has no effect on reducing lost time for MH conditions (see Supplementary Table 3 and Tables 2, 3 for more details).

There was a moderate level of evidence for a positive effect on the primary outcomes for the following intervention domains: (see Supplementary Table 3, and Tables 2, 3 for details).

Table 3 Level of evidence for workplace-based RTW interventions and accompanying messages

Levels of evidence (direction of effect)	Intervention (No. of H and M studies)	Outcome	Message
Strong (positive)	Multi-domain MSK interventions (4H, 10M)	Lost time	Implementing a multi-domain intervention (with components in at least 2 of the following domains: health-focused, service coordination, or work modification) can help reduce lost time for MSK and pain-related conditions
	Work-focused CBT for MH conditions (6H, 1M)	Lost time	Implementing a work-focused CBT intervention can help reduce lost time and costs associated with work disability for mental health conditions
	Work-focused CBT for MH conditions (4H)	Cost	
Strong (no effect)	CBT for MH conditions (6H, 1M)	Lost time	Implementing a traditional CBT intervention has no effect on reducing lost time for mental health conditions
Moderate (positive)	Graded activity (2H, 1M)	Lost time	Consider implementing these interventions in practices if applicable to the work context
	Work accommodations (2H, 3M)	Lost time	
	Multi-domain MSK interventions (1H, 2M)	Work functioning	
	Work-focused CBT for MH conditions (2H)	Work functioning	
	Multi-domain MSK interventions (2H, 4M)	Cost	
Limited (positive)	Work accommodations (1H, 1M)	Cost	Not enough evidence from the scientific literature to guide current policies/practices
	Health-focused multi-component (1H)	Work functioning	
Limited (no effect)	Work hardening (1H)	Work functioning	Not enough evidence from the scientific literature to guide current policies/practices
	Physician training (1H)	Lost time	
	RTW plan (1H, 1M)	Lost time	
	RTW plan (1H)	Cost	
Mixed	Work hardening (1H, 1M)	Lost time	Not enough evidence from the scientific literature to guide current policies/practices
	Health-focused multi-component (3H, 2M)	Lost time	
	Graded activity (1H, 1M)	Cost	
	Health-focused multi-component (2H)	Cost	
Insufficient	Case management (1M)	Lost time	Not enough evidence from the scientific literature to guide current policies/practices
	Work accommodations (1M)	Work functioning	
	Worker education/training (1M)	Cost	
	Supervisor education/training (1M)	Cost	
	Work hardening (1M)	Cost	

H high quality, *M* medium quality, *MSK* musculoskeletal or pain-related conditions, *CBT* cognitive behavioural therapy, *MH* mental health conditions, *RTW* return-to-work

1. Health-focused interventions: graded activity programs (3 studies: 2 high and 1 moderate quality) [25–30, 87–89] were found to have a positive effect on reducing lost time.
2. Work modification interventions: work accommodations (5 studies: 2 high and 3 medium quality) [36–38, 58–60, 67, 68, 87–89] were found to have a positive effect on reducing lost time.
3. Multi-domain interventions for MSK or pain-related conditions were found to improve work functioning after RTW (3 studies: 1 high, 2 medium quality) [39, 40, 44, 70–75]; and were also shown to improve costs associated with work disability (2 high, 4 medium quality) [56–60, 70–75, 77, 80–85, 91, 92].
4. Multi-domain interventions for MH conditions (2 high quality studies) [45–50] were found to improve work functioning after RTW.

The key message for stakeholders arising from these moderate levels of evidence of a positive effect is: consider implementing these interventions if applicable to the work context.

The evidence for the primary outcomes across the remaining intervention categories (Health-focused multi-component (3H, 2M) [32, 56–63], work hardening (1H, 1M) [24, 91, 92], physician training (1H) [31], RTW plan (1H, 1M) [33–35, 64], case management (1M) [65], worker education/training (1M) [66], supervisor education/training (1M) [69]) resulted in limited, mixed or insufficient evidence as a result of either too few high quality studies available or from conflicting evidence across studies (Table 3). This resulted in the message: there is not enough evidence from the scientific literature to guide current policies or practices for several of these intervention categories. For a message to be provided for these interventions, more high quality consistent evidence is needed (Table 3).

Discussion

The current review and evidence update gathers and synthesizes the scientific literature and presents practical messages for workplace parties and occupational health and safety practitioners. The review team consulted with these stakeholders to help ensure the messages were useful and applicable in practice.

The review identified 36 medium and high quality intervention studies that examined workplace-based RTW and disability management/support initiatives. The primary finding is strong evidence that multiple domain interventions are effective in improving RTW outcomes in workers with MSK, pain-related or MH conditions. In contrast, most single domain focused interventions have mixed or limited evidence to support their effectiveness. This result is aligned with one of the dominant theoretical paradigms in the work disability and return to work literature, the Sherbrooke model [93]. This model proposes that multidisciplinary and multi-factorial interventions that seek to address an array of individual and societal factors that influence RTW are likely to be effective.

Combining newer studies with those from the original review [7] resulted in stronger evidence levels across a greater number of intervention categories. In addition, we were able to synthesize new evidence on intervention strategies to manage MH conditions in the workplace, which has emerged as an important area of concern for employers since the original review was published.

Our review identified that in most cases interventions were multi-faceted and included multiple intervention components, often operating across multiple domains (health focus, service coordination and work modification). This approach is different to the previous review [7], which sought to evaluate the effectiveness of discrete intervention components; leading to a different interpretation of the literature.

For example, the original review, Franche et al. [7], found a strong level of evidence for a positive effect of work accommodations, while in the current update only a moderate level of evidence was found. Of note, one of the interventions included in the original review examining work accommodation offers was reclassified in this review as a multi-domain intervention (of which work accommodations was only one of many components investigated) [80–85]. Among the five studies in this review looking at the effect of work accommodation on its own, two were rated as high quality [36–38, 58–60] and three were rated as medium quality [67, 68, 87–89]. According to our evidence synthesis algorithm (shown in Table 1), a minimum of three high quality studies was necessary to assign a strong level of evidence, which contributed to the change in level of evidence.

Although the types of interventions evaluated were diverse across the 36 studies, they could be grouped into one of four major domains, and 12 intervention categories, based on a consensus view of the primary intervention objective (i.e. health-focused, service coordination, work accommodation or multi-domain). Nearly 60% of these studies (n = 21) included multi-domain interventions, indicating that they included at least two of the three intervention domains mentioned above. Ninety-four percent of the included studies (n = 34) used an estimate of lost time from work as their primary RTW outcome variable. This is consistent with the broader RTW research literature in which lost time is often the outcome used to assess return to work status, despite the inherent limitations of this approach [94]. Other outcomes included work functioning and costs of work disability, but these were less commonly reported.

Our findings are consistent with other reviews that included workplace-based interventions [7, 95–97]; although reviews that focused on RCTs only and conducted meta-analyses found only moderate levels of evidence for workplace interventions [95–97]. While the current findings are consistent, our synthesis of workplace-based interventions for RTW in workers experiencing lost time from work due to MSK, pain-related and MH conditions includes practical messages for, and developed with, practitioners [17, 23].

This review highlighted a number of features of the RTW literature, and of workplace-based intervention studies in particular, worthy of comment. Fourteen of the 18 high quality studies were randomized trials, while only five of the 18 moderate quality studies were randomized trials. The majority of moderate quality studies were cohort studies with comparison groups. Due largely to their design, these studies were unable to ensure the presence of important quality standards such as blinding of participants and personnel, and allocation concealment. These moderate quality studies also suffered from quality limitations in that they were subject to attrition bias (uneven attrition and substantial loss to follow-up) and did not routinely assess compliance with the intervention. The review identified a group of 19 published randomized trials, which demonstrates that it is feasible to conduct such trials in the field. We also identified three non-randomized trials and one cohort study that were rated as high quality, and five randomized trials that were rated as moderate quality. Moving forward, a strong focus on study quality in addition to trial design is warranted.

It is now accepted that the system of compensating work-related injury can exert powerful influences on injured worker RTW [98]. Despite this, a recent systematic review identified that only a small proportion of studies including persons with compensable injury report on aspects of the compensation process [99]. The authors

proposed that research involving persons with compensable conditions should include a description of system level factors such as compensation system structure and administration (e.g., source of funding); scheme eligibility (e.g., workforce coverage, claim coverage, waiting periods); scheme benefits and entitlements (e.g., level and duration of wage-replacement benefits); and case management (e.g., work capacity review, role of physician). Descriptions of system factors were often absent in the studies included in the present review, despite the study samples being predominantly workers with compensable injuries.

Due to the substantial heterogeneity across studies regarding intervention components, workplace contexts and study designs, a meta-analysis was not conducted. Instead, a best evidence synthesis (BES) approach [22] consistent with the original review [7] was used. While this approach has been criticized for being at risk of producing biased results [100], it is a transparent approach with clearly defined criteria to determine the level of evidence. This provides practitioners with useful information in addition to accessing the messages from the synthesis of studies. Practitioners can also more readily identify and consider relevant evidence from individual studies using this approach. This is especially practical when there are few studies available for a given intervention, as practitioners still need to act even when there is limited scientific evidence available to help guide their practice.

A particular strength of this review is the unique process of stakeholder engagement adopted throughout the review process. Our stakeholders provided guidance to ensure the review question was relevant, the search terms were comprehensive and the targeted literature identified was up-to-date. But more importantly, stakeholders helped us examine the findings from this review to determine the best wording for our key messages to facilitate uptake and dissemination of these evidence-based approaches for OHS practitioners and other workplace parties.

Conclusions

Our synthesis update of the scientific literature identified 12 different types of interventions from 36 studies examining three broad RTW outcomes (i.e. lost time, work functioning and costs associated with work disability). There were several intervention types that did not meet the criteria for high or moderate levels of evidence across these different outcomes. However, we note that this does not mean that these interventions are not effective, only that there is insufficient evidence to support recommending these interventions to address RTW outcomes based on the scientific evidence.

Graded activity programs and work accommodations had a moderate level of evidence for a positive effect in reducing lost time associated with work disability. Practitioners should *consider* implementing graded activity programs and work accommodations in practices if applicable to the work context.

Cognitive behavioural therapy (CBT) programs focused on work relevant solutions for MH conditions had a strong level of evidence for a positive effect on both reducing lost time and costs associated with work disability. Additionally, there was a moderate level of evidence that these work-focused CBT programs had a positive effect on work functioning after RTW. We *recommend* implementing work-focused CBT interventions to help reduce lost time and costs associated with work disability for MH conditions. Practitioners should also *consider* implementing these programs to help improve work functioning after RTW for individuals with MH conditions.

Alternatively, there was a strong level of evidence indicating that traditional cognitive behavioural therapy programs for MH conditions have no effect on reducing lost time from work. We *recommend* practitioners should seek alternative interventions (such as work-focused CBT programs) to improve RTW after illness for MH conditions.

There was a strong level of evidence to support multi-domain interventions that include multiple components aimed at service coordination, work modification and improving worker health for reducing lost time associated with musculoskeletal injuries and pain-related conditions. Additionally, there was a moderate level of evidence that these multi-domain interventions had a positive effect on improving work functioning after RTW and reducing costs associated with work disability. We *recommend* implementing a multi-domain intervention (i.e. with health-focused, service coordination, and work modification components) to help reduce lost time for MSK and pain-related conditions. Practitioners should also *consider* implementing these programs to help improve work functioning and reduce costs associated with work disability for people with MSK or pain-related conditions.

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Compliance with Ethical Standards

All authors declare that (1) no financial or other support was received for the submitted work; (2) they have no relationships with companies that might have an interest in the submitted work in the previous 3 years; (3) their spouses, partners, or children have no financial relationships that may be relevant to the submitted work; and (4) they have no

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Implementation of Early Intervention Protocol in Australia for 'High Risk' Injured Workers is Associated with Fewer Lost Work Days Over 2 Years Than Usual (Stepped) Care

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Abstract

Purpose To evaluate whether a protocol for early intervention addressing the psychosocial risk factors for delayed return to work in workers with soft tissue injuries would achieve better long-term outcomes than usual (stepped) care. *Methods* The study used a controlled, non-randomised prospective design to compare two case management approaches. For the intervention condition, workers screened within 1–3 weeks of injury as being at high risk of delayed returned to work by the Örebro Musculoskeletal Pain Screening Questionnaire—short version (ÖMPSQ-SF) were offered psychological assessment and a comprehensive protocol to address the identified obstacles for return to work. Similarly identified injured workers in the control condition were managed under usual (stepped) care arrangements. *Results* At 2-year follow-up, the mean lost work days for the Intervention group was less than half that of the usual care group, their claim costs were 30% lower, as was the growth trajectory of their costs after 11 months. *Conclusions* The findings supported the hypothesis that brief psychological risk factor screening, combined with a protocol for active collaboration between key stakeholders to address identified psychological and workplace factors for delayed return to work, can achieve better return on investment than usual (stepped) care.

Keywords Screening · Psychosocial factors · Workers' compensation · Work injury · Early intervention

Introduction

Soft tissue (musculoskeletal) injuries are the most common work-related injuries and while little time is lost from work for most cases, a small proportion have delayed recovery and delayed return to work (RTW) [1, 2]. For this group, length of absence is associated with an increased risk of never returning to work; longer term ill-health and financial insecurity; and costs to the community [2–4]. Prospective studies indicate that psychological and social/environmental factors are strong predictors of delayed recovery and disability associated with chronic pain [5–7]. As many of these psychosocial risk factors (e.g. anxiety, depression,

We would like to dedicate this paper to the memory of Dr Garry Pearce who played a critical role in the establishment and conduct of the study but died before the paper was completed.

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catastrophizing, poor workplace support) are modifiable, interventions targeting them could prevent long-term disability [8].

We know that psychologically-informed treatments provided for injured workers without psychological risk factors, are no better than usual treatment [9]. However, superior benefits have been found when they are employed only for patients with psychological risk factors [9–11].

When RTW is the goal, an additional focus on the workplace appears essential [12, 13] For example, an RCT of the effectiveness of a guideline-based intervention within one company, found implementation of the experimental intervention was impeded by unforeseen organizational obstacles at one of two sites, thereby undermining the results [14]. Recently, Cullen et al. [15] confirmed that better RTW results are obtained when treatment for injured workers is integrated with workplace support, but implementation is a major challenge. In a compensable environment, integrating the treatment protocol within the normal practice of the insurance company, as well as the workplace, has also been recognized as important [13].

At the conceptual level, the relatively new field of Implementation Science provides useful frameworks for addressing these challenges. The Exploration, Preparation, Implementation, Sustainment (EPIS) framework for implementation research [16] has been recommended for the conceptualization and planning of RTW interventions for injured workers [17] as it takes into account interacting and multi-level factors. Specifically, the EPIS framework identifies five domains to be considered: intervention characteristics, outer setting (regulators, treatment providers), inner setting (workplace), characteristics of the individuals involved, and the actual process of implementation. This perspective was used in the present study to guide the sustained implementation of the intervention protocol with an insurer and a large, multi-site workplace. The primary goal was to test whether early screening for psychological risk factors, coupled with an intervention that incorporated the EPIS perspective could achieve reduced lost time from work.

Methods

The work injury screen early (WISE) study intervention protocol was initially tested in a small pilot study in Sydney [18]. The protocol entailed a coordinated approach to injured hospital workers identified by a brief psychological screening instrument as high risk for delayed recovery. The intervention targeted both psychological and workplace risk factors. The usual-care approach, as recommended by the existing state-wide guidelines for injured workers [19], follows a stepped-care model [20] whereby considering psychological and social risk factors is indicated only after a poor response to initial treatment (6–8 weeks after the injury). In the WISE protocol, those injured workers (IWs) who had taken medically-sanctioned time off work were screened for psychological risk factors within the first 1–3 weeks after their injury, regardless of progress in initial treatment, and an intervention plan was to be implemented immediately.

Participants and Pain Sites

Study participants were recruited from consecutive injured (public) hospital workers with work-related soft tissue injury. Initial consent for screening (by telephone) was obtained by the insurance case manager 1–3 weeks after injury and those consenting were administered the 10-item Örebro Musculoskeletal Pain Screening Questionnaire—Short Form (ÖMPSQ-SF) [21, 22]. Additional consent from those offered the intervention arm of the trial was obtained later at the workplace.

The Case managers (CMs) of the insurance company (known as a 'Scheme Agent' in the New South Wales (NSW) Workers' Compensation system) were divided into two independent teams by the senior management: one for the designated Intervention hospitals and the other for the designated Control (Usual Care) hospitals.

The completed screening instruments were scored separately by the Research Manager, who advised only the CMs for the Intervention hospitals and the hospital's return-to-work (RTW) Coordinators of the outcome. The insurance claims team, the workplace, and the treatment providers for the Control hospitals were not given this advice and were therefore blind to the risk status for their IWs. The workers from the Intervention hospitals met with their RTW Coordinator within a week to discuss what the study entailed. Those who consented were enrolled for the intervention arm of the study. Those who declined to participate received usual care (as for the Control condition, but were out of the study as their classification as high risk was no longer blinded). The identified high-risk workers from the Control hospitals received usual care under the NSW Workers' Compensation system. Prospective participants were recruited between September 2013 and June 2015. This resulted in fewer participants being recruited than originally intended, but the funding bodies, including the employer, wanted recruitment to stop in order to enable the Control hospitals and others across the state to implement the intervention protocol. As a result, the Research Manager's role was changed to Implementation Manager to facilitate the general implementation across the state during the follow-up period.

Specific Hypotheses Tested

The Intervention condition would have significantly fewer lost work days over the ensuing 2 years period.

The mean costs of claims (for lost time and treatments) would be less for the Intervention condition.

Inclusion/Exclusion Criteria

Health care workers reporting work-related soft tissue injuries that were accepted by the insurer, and had taken (medically-sanctioned) time off work due to their injury. All participants had to be able to read and speak English well enough to not require an interpreter. All participants provided verbal informed consent to participate in the screening phase prior to the telephone screening.

Exclusion Criteria

Prospective participants were excluded if they had made a stress (or psychological injury) claim, had no time off work, had been assessed by their treating doctor as requiring surgical intervention, or declined to participate.

Study Design

A controlled, non-randomised, prospective design was used (Fig. 1). The outcomes of high-risk workers from Intervention hospitals were compared with the outcomes of similar high-risk workers from other (public) hospitals (controls). Assignment of workers to Intervention or Control groups was based on which hospital employed them.

Public hospitals with the largest staffing levels were selected by the employer (the NSW Ministry of Health) to participate. The representative (MM) of the Ministry of Health (not the researchers) independently assigned the hospitals to Intervention (n = 11) or Control groups (n = 6) and attempted to balance those in inner city areas versus suburban and peripheral regions, as well as the injury rates for the previous 2 years. This was intended to maximise the chances of equivalent numbers in each condition.

Since both RTW coordinators and supervisors at each workplace were integral contributors to the intervention protocol and usual care, random assignment to treatment/control was not possible. Instead, blinding of the claims team, RTW coordinators, supervisors and treatment providers regarding the risk status of controls was employed.

Data on work status, lost days, and costs were maintained by the insurer as normal for a minimum of 2 years from the date of injury. At 1 year from the date of injury all participants were telephoned by an independent research assistant, blind to the group status of each worker, to answer questions on their current work and pain status, treatment and RTW experiences. Originally, it was intended to include a 5 year follow-up, but as mentioned earlier the funding bodies, including the employer, decided to stop the trial after 2-years of follow-up as they felt the outcomes were clear and they wanted to implement the protocol to the Control

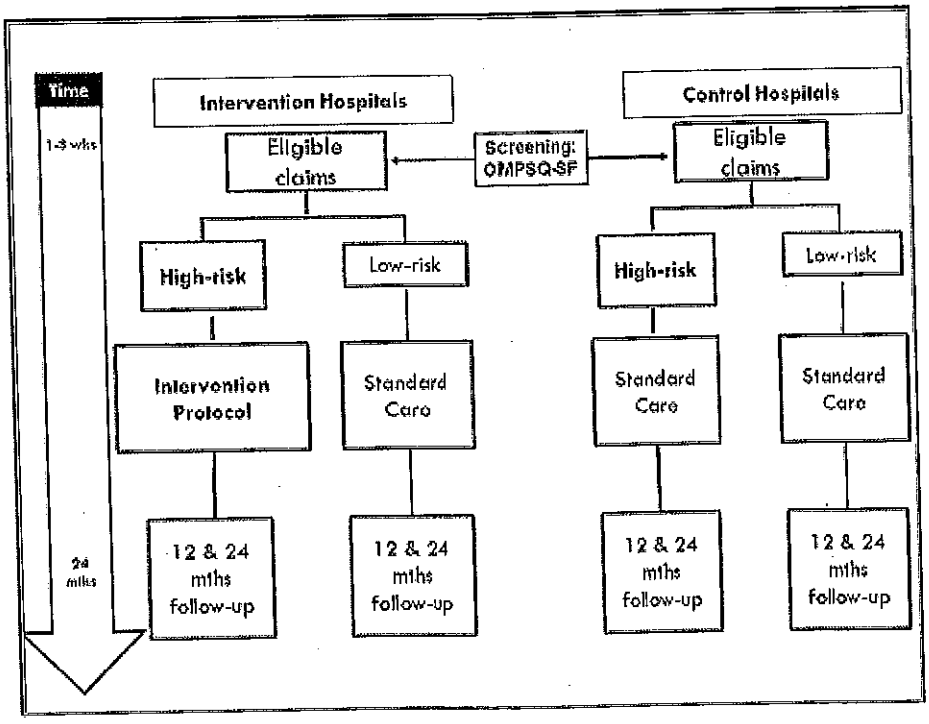

Fig. 1 Study design

(usual care) sites and all public hospitals across the state. Follow-up data collection continued until the last participant reached the 2-year follow-up.

Sample Size

Based on differences in time lost for the high-risk patients in the pilot study (standardised mean difference approximately 0.3) and our expectation that our study would have a stronger effect, we used a standardised mean difference of 0.4, with alpha = 0.05 and power = 0.8 to calculate the sample for the main study [18]. This yielded a requirement of 100 cases per group, but to allow for possible drop-outs we added 10% per group (i.e. 110 high risk workers per group, 220 in total). This figure is similar to the estimated sample size for a similar study in Norway [23].

Protocol for Intervention Condition

As this study involved several stakeholders working in a coordinated way, the (abbreviated) roles of each are specified here. A fuller account is currently in preparation for separate publication. The implementation of the protocol by all stakeholders was monitored closely by the Research Manager throughout the project to ensure adherence, as much as possible.

Workplaces and RTW Coordinators

Workplace interventions depended upon what workplace RTW obstacles were identified by the psychologist or RTW coordinator for each worker. The RTW coordinator met (face to face) with all high risk workers within a week of the telephone screening to recruit them for the study and, if successful, to arrange for them to see the selected psychologist within the next week for an assessment and possible treatment.

The RTW coordinator was expected to be in regular contact with the workers, as well as their General Practitioner (GP), CM, and the treating psychologists throughout their treatment. They were also expected to work closely with each worker's workplace supervisor to assist the RTW processes, including managing any identified workplace RTW obstacles.

Psychologists

To participate in the project the psychologists had to work near the Intervention hospitals, to be experienced in managing injured workers, and to agree to follow the intervention protocol. This required them to assess the workers within a week of referral and to address any identified psychological obstacles to RTW within six sessions. They were also expected to maintain regular contact with both the workplace (RTW coordinator) and other treatment providers, as appropriate (GP, physiotherapist).

Nominated Treating Doctor (GP)—Primary Care General Medical Practitioners

The GPs were chosen by the injured workers, as per normal for injured workers in NSW. The CM at the insurance company contacted each GP in the initial stages of establishing the claim (their '3-point contact' with the injured worker, GP, and RTW coordinator). The GPs were informed their patient was in an approved trial and details of the trial were provided by the RTW coordinator.

The (Insurance) Case Manager (CM)

The CM referred the participating workers to a selected independent medical consultant (usually an occupational or rehabilitation physician) for an early specialist review (between 6 and 8 weeks after the injury).

If required, the CM arranged a case conference involving the worker, their GP, RTW coordinator, and CM. The case conference was intended to review the obstacles to RTW and to reach agreement on a plan for overcoming them.

Independent Medical Consultants (IMCs)

The IMCs agreed to review all referred workers within 6–8 weeks and then to liaise with the GP, RTW Coordinator and CM. If appropriate, the IMC was asked to reassure the worker that s/he had a soft-tissue injury that would resolve fairly quickly and they should be able to RTW without risk.

Physiotherapists

As usual in NSW, the physiotherapists providing care were selected by the workers' GPs and reported to the CM and GP on their progress. The physiotherapists treating Intervention workers were advised by the CM that the worker was participating in a study aimed at facilitating early RTW. The physiotherapists were expected to have a good understanding of the importance of an activity-based approach to treatment. The approved basic physiotherapy treatment plan was eight sessions.

Independent Physiotherapy Consultant (IPC)

An independent physiotherapist (RB) conducted a file review of any case if the treating physiotherapist requested more than eight sessions, and then recommended to the case manager if the request should be accepted or denied. When necessary, the IPC reminded the treating physiotherapists

under review of the importance of using an activity-based approach.

Protocol for Control Condition

High risk workers at the Control hospitals received treatment as usual under the Work Cover NSW Soft Tissue Injury Guidelines [19].

Measures

Screening Measure

The ÖMPSQ-SF contains ten items, each scored on a 0–10 scale, to yield a possible score between 0 and 100. Workers scoring ≥ 50 (out of 100) were considered at high-risk of delayed recovery [21]. This criterion was validated in Sydney. [22]

Outcome Measures

Days to Pre-injury Duties (PID)

Operationalised as lost time from work (number of days reimbursed for missing work) over 2 years. The data on lost work time were obtained from the insurance company. Time to return to PID is not a binary variable and is complex (because after returning to work a worker may take more time off later). Accordingly, lost work days is the best available proxy for return to PID.

Total Claim Costs

These data were also obtained from the insurance company records. These include costs for both wage replacement and treatments, including the costs of the psychologists for the intervention group.

Supplementary Data

i. *Participants' evaluation* (*answers to blinded follow-up interviews at* 1 *year*). These were based on telephone follow-up by a research assistant blind to group membership. Included were the ÖMPSQ-SF, questions about the participants' satisfaction (on a 0–10 scale) with how their work injury had been handled by the workplace, the insurer and the treatment providers, plus questions about any pain they might still be experiencing (copies available from the first author).
ii. Acceptability of the intervention protocol for employer and insurer.

To evaluate the acceptability of the WISE protocol for the management of workers with recent musculoskeletal injuries by the insurer and employer their response was sought from representatives of both the employer (MM) and insurer (KM) at the end of recruitment.

Psychological Treatment Outcome Measures

The changes in psychological risk factors following the psychological treatments (only) were evaluated by the treating psychologists before and after their treatments using these measures:

i. ÖMPSQ-SF [21].
ii. The 21-item version of the Depression Anxiety Stress Scales (DASS) [24], assessed severity of distress. The three subscales were combined to produce a single score. Total scores could range between 0 and 63.
iii. The Brief Pain Inventory (BPI) (Interference scale) [25] provided a general measure of interference in daily activities due to pain. Possible scores can range from 0 to 10.
iv. The Pain Self-Efficacy Questionnaire (PSEQ) [26] measures the strength and generality of a patient's beliefs about their ability to accomplish various activities despite their pain. Scores range from 0 to 60. Higher scores indicate stronger self-efficacy beliefs.
v. The Pain Catastrophising Scale (PCS) [27] provides a measure of distressing thoughts about pain. Total scores range between 0 and 52.

Statistical Analyses

The demographic and medical characteristics of the sample were described using means, standard deviation and response frequencies. The pre-post changes in scores on the psychometric instruments from pre- to post-(psychological) treatment were appraised using paired t-tests and linear mixed models (the latter to account for clustering by health district and to handle missing data by using all available data), and measures of effect size were examined by appraisal of standardised mean differences (Cohen's d).

For the return to work outcomes—lost work days—the primary analysis was based on the data at 24 months post-injury, for which all participants had data. The data available for this variable are a proxy for days to PID, but are not technically a time-to-event variable (as described above), and were complete (i.e., no censored observations) so differences between the Intervention and Control groups on this variable were examined in several ways.

First, an independent-samples t test with 1000 bootstrapped samples (because of anticipated skew) was conducted and 95% bias-corrected and accelerated confidence

intervals (95% BCa CI), with equal variances not assumed, were calculated. Second, a Cox regression analysis, which avoids the assumption of normality by treating lost work days as a time-to-event variable (i.e., a proxy for days to PID), was conducted and predictors (in this case, Intervention vs. Control condition) of lost work days were identified. Third, treating lost work days as a binary variable, participants were classified as either having returned to work or not after 3 months (the time after which pain is classified as chronic [28], and the groups were compared using the Fisher test. The equality of variances between the two groups was also examined.

For the cost data, the equality of variances between the two groups was examined. Change in cumulative costs over time was calculated using a linear mixed model with repeated measures (with autoregressive variance–covariance matrix), accounting for clustering by health district. Because bootstrapping was not available for this analysis, the positive skew of the cost data was accounted for by taking the natural logarithm of cost, whose distribution closely approximated normal.

Responses to the blinded telephone interviews at 1-year were compared between groups using χ^2 tests of independence for categorical variables and independent-samples *t*-tests for continuous variables using the Hochberg Type I error correction method [29].

Results

Number of Claims

A total of 1655 claims were received in the study period. Exclusions included severe injuries (n = 299), no lost time (n = 416), ineligible claims (n = 111). This left 829 eligible claims for screening. Of these, 580 (70%) were screened, 77 (9%) refused screening, and 172 (21%) were missed due to contact difficulties (see Fig. 2).

In total, 133/366 (36%) from the Intervention hospitals and 75/213 (35%) from the Control hospitals were identified as high risk. This suggests the two samples were comparable in terms of psychological risk characteristics.

Mean lost work days for high risk cases in the Control condition was 66.5 (SD = 116.2) versus 20 days (SD = 30, median = 10.1) for the low-risk cases (Cox regression hazard ratio = 0.5, $p < .001$). This finding supports the validity of the ÖMPSQ-SF as a screening measure in discriminating between those likely to be delayed in RTW and those who are not [22].

Final Sample

Intervention Condition

Of the 133 high-risk Intervention claims, 67 (50%) refused the psychological assessment. Of the 66 who agreed to a psychological assessment, 10 (15%) refused to have psychological treatment, 6 (8%) withdrew from treatment, 4 (6%) were assessed by the psychologist as not requiring their treatment, and 2 (3%) required additional (beyond 5 sessions) psychological treatment. Of the 46 (70%) who attended some Psychological treatment, 1 was later found to have had no initial time loss and 11 required surgery (both of which were exclusion criteria, but were missed when the data were recorded by the CM at the time). These 12 (16%) were excluded, leaving a total of 54/66 (82%) for analyses by intention-to-treat principles. There was no significant difference in ÖMPSQ-SF scores between those who refused psychological assessment (mean = 57.5, SD = 6.8) and those who agreed (mean = 59.6, SD = 7.1), 95% BCa CI (−4.54, 0.13).

Control Condition

Of the 75/213 (68%) high-risk Control claims, 5 had no initial time loss, and 11 required surgery. After these 16 were excluded the total for the Control condition was reduced to 59.

Loss to Follow-Up

As the data on time lost from work and costs were maintained by the insurer, none of the 113 (54 Intervention + 59 Control) participants were lost to follow-up over the 24 months.

Characteristics of the Injured Workers in Both Groups

The average age of the sample was 45 years (range 23–75), and 80% were women (reflecting the nature of the workforce in hospitals). Occupational categories were broad, and included registered nurses, security staff, orderlies, technicians, managers, administrative staff, and paramedics. Mean baseline OMPSQ-SF scores did not differ significantly between Intervention (mean = 58.94, SD = 6.73) and Control groups (mean = 59.46, SD = 8.56), $t(111) = 0.35$, $p = .725$.

Main Injury Sites and Medical Diagnoses

Based on the medical reports, 'Backs' represented about a third of cases, the upper limbs and lower limbs next most frequent. The most common diagnoses were: Trauma to Muscles (41); Soft Tissue Injuries due to Trauma or unknown

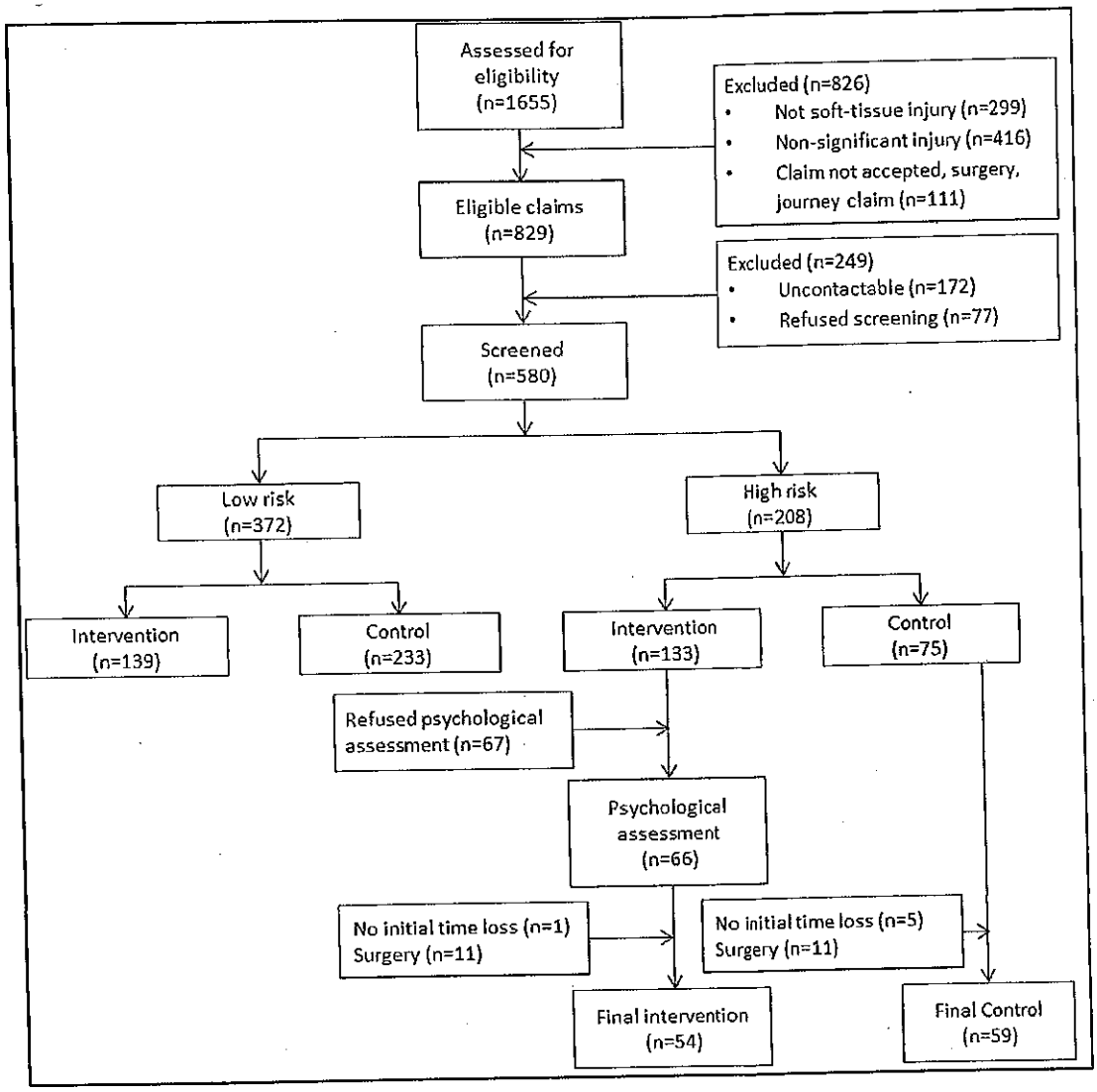

Fig. 2 CONSORT diagram

mechanisms (22); Trauma to Joints and Ligaments, unspecified (17); Contusion, Bruising and Superficial Crushing (7); Disc Displacement, Prolapse, Degeneration or Hernia (5).

Psychology Treatment Outcomes

The psychologists, on average, provided five treatment sessions and exceeded this in only two cases. The results indicate the identified psychological risk factors were significantly reduced following treatment (see Fig. 3). It should be noted that these measures were collected for the Intervention group only in order to test if changes occurred on these variables as expected.

Mean ÖMPSQ-SF score reduced from high-risk to low risk range (58.9; SD = 7.6 vs. 35.4; SD = 14.8, respectively), standardised mean difference, d = 1.99. The improvements on all measures were clinically and statistically ($p < .0005$) significant, when analysed using both paired t-tests and linear mixed models to account for clustering by health district. The standardised mean difference (d) for each was in the large range (> 0.8). For distress (DASS total score) d = 0.81; for disability (BPI) d = 1.15; for pain self-efficacy (PSEQ) mean score improved from 33.1 (SD = 13.6) to 45.8 (SD = 12.8), d = −0.97. Although not high initially, the mean score on catastrophising (PCS), the SMD for improvement in pain catastrophising was still 0.91.

Return to Work Outcomes (lost work days)

At 24 months post injury, the mean lost work days was 66.5 (SD = 116.2) for the Control condition and 31.7 (SD = 36.7) for the Intervention condition (Fig. 4). Using

the *t*-test approach, the confidence interval (8.8, 65.1) did not include 0, indicating a group difference.

Secondly, using Cox regression, the proportional hazards assumption was satisfied, and the group difference was not significant (hazard ratio = 1.39, $p = .088$). Thirdly, using the Fisher test approach, the proportion with lost work days > 3 months was significantly greater in the Control group vs the Intervention group (see Table 1).

It was also found that the variability in days lost over the first 24 months was significantly higher in the Control condition than in the Intervention condition ($F = 14.37$, $p < .001$).

Cost Outcomes

Costs comprise a combination of payment for lost time at work and treatment-related costs.

Mean (Total) Costs

At 24 months, the group mean total costs for the Intervention condition were $16,443 and for the Control condition were $23,405, a difference of $6962. Although this represents a 30% difference, and is of importance to the insurer and employer, an independent samples t-test with 1000

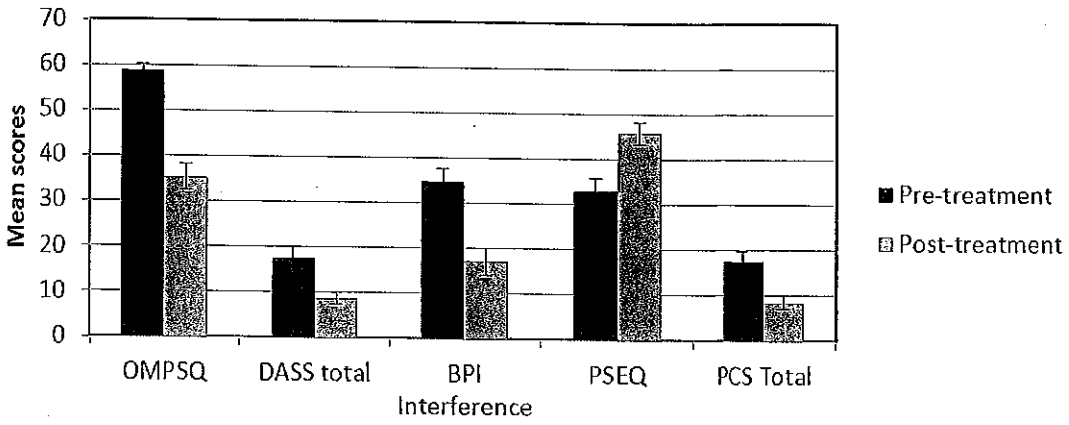

Fig. 3 Pre- and Post-treatment mean scores on psychological instruments (Error bars indicate ± 1 standard error) (N = 32)

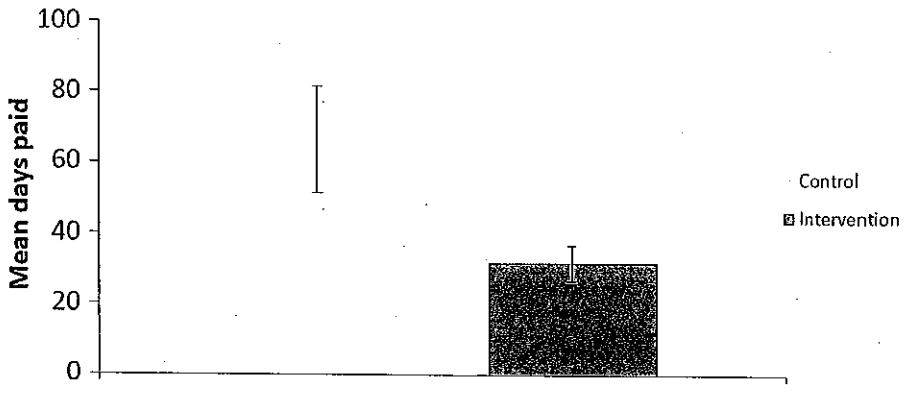

Fig. 4 Mean lost work days for high-risk workers in both conditions. Error bars indicate ± 1 standard error

Table 1 Cross-tabulation of return to work within 3 months by group

Conditions	RTW < 3 months	RTW > 3 months	Totals
Intervention	51 (94.4%)	3 (5.6%)	54
Control	48 (81.4%)	11 (18.6%)	59
Total	99 (87.6%)	14 (12.4%)	113
			Odds ratio = 0.26, 95% confidence interval = 0.07–0.98, $p = .046$

bootstrapped samples revealed this difference was not statistically significant (95% CI – 1369.76, 15,634.60). However, the difference in variability for costs between the groups was statistically significant ($F = 13.32$, $p < .001$), with smaller variability in the Intervention condition than the control condition, consistent with the pattern of variability found in the days lost results.

Costs Over Time

In the first 10–11 months, there was little difference in the growth in average costs between the Intervention group and the Control group, but thereafter the Control group costs continued to rise while the Intervention group costs appeared to plateau, indicating effective return to PID. As expected, using the 24-month data, cumulative costs significantly increased over time, $F(23, 2538.19) = 163.37$, $p < .001$. The difference in change over time between groups was statistically significant ($F(23, 2538.19) = 4.611$, $p < .001$), indicating that the costs were rising more rapidly over time for the Controls compared to the Intervention condition.

Another way of describing the evolution of costs over time is presented in Fig. 5. This includes the outcomes in claims costs up to and beyond the formal analyses conducted on 24-month follow-up data by showing the claim costs over 46 months (primarily, lost time from work as this was the major cost driver). This figure reveals a gradual decline towards zero (apart from the odd spike) for the Intervention group, whereas payments for the Control group continue to peak increasingly over time.

Participants' Evaluation (Blinded Follow-Up Interviews at 1 Year)

One year after entering the study 75 (66.4% of the total) participants were available for the blinded telephone interviews. Of the 75, 35 (47%) were from the Intervention condition and 40 (53%) were Controls. For this subset, baseline ÖMPSQ scores did not differ significantly between the Intervention (mean = 58.6, SD = 6.1) and Control (mean = 58.3, SD = 6.8) groups, 95% BCa CI (−3.26, 2.63), indicating no initial risk status differences.

Of the questions asked about satisfaction with the RTWC, workplace manager, and case manager, there were no differences between groups on satisfaction with the RTWC or workplace manager, but there was a difference in satisfaction with the case manager, with the Intervention group reporting higher satisfaction (7.4 vs. 5.8, $p < 0.03$; for Intervention vs. Control, respectively). The only other difference found related to the presence of ongoing pain, which also favoured the Intervention group. Ongoing (chronic) pain was assessed by two statements ["Always present (intensity varies)" and "Often present (pain free periods < 6 h)"] 14 (43.7%) and 4 (14.3%) of the Control and Intervention condition participants, respectively, confirmed one of these statements ($\chi^2 = 16.23$ ($p = .001$). However, using the Hochberg Type I error correction method, the differences in satisfaction and presence of chronic pain were not statistically significant due to the number of variables tested and the small number of cases. Accordingly, these findings should be treated as preliminary and requires further study.

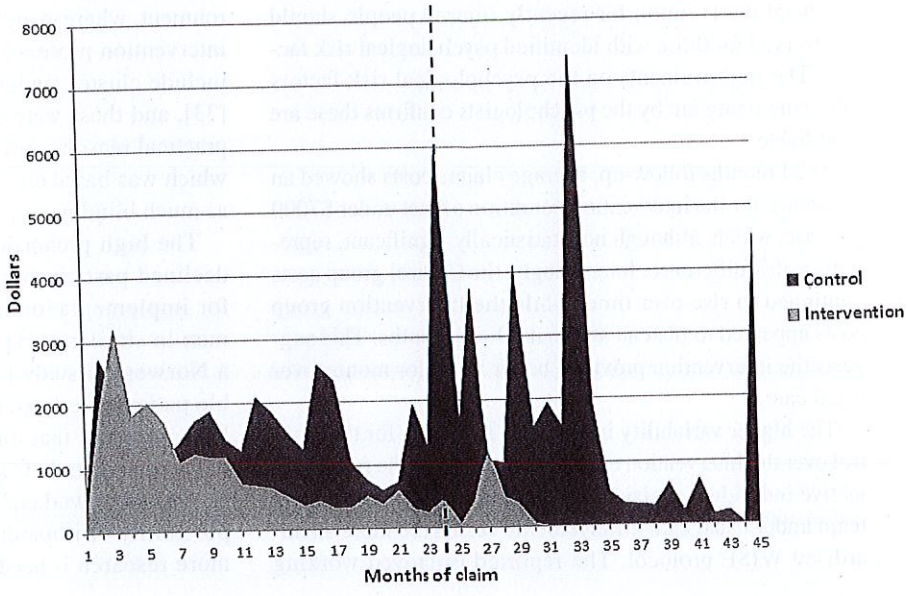

Fig. 5 Group mean costs incurred each month, by Intervention and Control with the end of the formal study indicated by dash line at 24 months

The Validity of Results: Acceptability of the Protocol to the "Stakeholders"

At the completion of recruitment, all participating hospitals were offered the opportunity to either employ the WISE protocol or resume usual care for managing injured workers, as per the Control condition. All the hospitals (Intervention and Control) elected to employ the WISE protocol.

In addition, the feedback from the claims teams indicated their relationships and communications with the RTW coordinators at the Intervention hospitals had noticeably improved during the study.

Also, the employer, the NSW Ministry of Health, based on their experience with the WISE protocol, elected to adopt the protocol for all public hospitals across the state, including the Control hospitals, and this was implemented over the following year (2016) with the help of the Research Manager.

Discussion

Combined with our earlier paper on the validity of the OMPSQ-SF [22], this trial provides evidence that psychological screening can identify injured workers at high risk of delayed RTW, and that a comprehensive protocol to address the identified needs of these workers was associated with less lost work time than usual (stepped) care. Importantly, the pattern of results was evaluated over a 2-year follow-up period.

These findings are strengthened by their consistency with those of Cullen et al. [15] that indicated better RTW outcomes are more likely when the psychological treatment is linked closely to the workplace. The findings are also consistent with recommendations [9, 10] that early psychosocial intervention for recently injured people should be reserved for those with identified psychological risk factors. The improvements on the psychological risk factors following treatment by the psychologists confirms these are modifiable.

At 24 months follow-up, average claims costs showed an advantage for the intervention condition of just under $7000 per case, which, although not statistically significant, represents a 30% difference. Interestingly, the Control group costs continued to rise over time, while the Intervention group costs appeared to plateau at about 10–11 months. This suggests the intervention provided better value for money over usual care.

The higher variability in lost time and costs for the Control over the Intervention condition may reflect the more subjective individual decision-making approach by the claims team under usual care arrangements versus the more standardised WISE protocol. The reported improved working relationships between the workplace and claims teams for the intervention hospitals should also be noted in this context. The decision-making processes for the usual care condition are consistent with a stepped-care approach (whereby intervention decisions are based on failure of initial treatments). In contrast, the WISE protocol was consistent with a matched-care approach [30] with early risk screening followed closely by treatment based on individual psychological assessment, rather than a stepped-care paradigm with its inherent delays in obtaining such help."

Åsenlöf et al. [31] demonstrated similar benefits for early matching of patients with low back pain (in primary care) to treatment based on individual behavioural assessments versus guideline-informed exercise-based treatment.

A key goal in occupational injury research is implementation of the findings into normal practice [14] The fact that all participating hospitals chose to maintain the WISE protocol for managing their injured workers, and that the employer adopted the protocol for all public hospitals across the state indicates the acceptability of the protocol. This outcome also provides support for the theoretical framework (EPIS) [17] concerning the implementation of an intervention within a complex organisation. In this case, the research team engaged with the insurer and the employer at multiple levels of management, including senior management and those most directly involved (the Case Managers and RTW Coordinators), as well as the workers' compensation scheme regulator, and the clinicians involved in service delivery to facilitate the implementation of the protocol.

In evaluating the study's strengths and limitations, the lack of random assignment to either condition is a limitation, but as indicated in the Methods section, it would have risked compromising the protocol at the different workplaces and at the claims office. This is a recognised problem for the evaluation of complex interventions in a multi-stakeholder environment, where many interacting elements contribute to the intervention process [32]. Possible options in this situation include cluster randomisation and stepped-wedge designs [33], and these were considered but had to be rejected for practical reasons. Instead, we manualized the intervention, which was based on a previous pilot study, and maintained as much blinding as possible for the control condition.

The high proportion (50%) of high-risk workers who declined participation in the study is a serious challenge for implementation into usual practice, but not uncommon in similar workplace research studies. For example, a Norwegian study [23] reported that 310 of 723 eligible patients declined to participate, and in a Dutch study [34] reported that only 145 of 686 suitable employees participated in their study. These high refusal rates may be related to workers' understandable concerns about the possibility of jeopardising their chances of RTW. Clearly, more research is needed on ways of encouraging injured

workers to participate in intervention trials. Finally, as only one large employer was involved it cannot be assumed the same outcomes would be found with smaller employers, where there may be less flexibility to provide job accommodations. Future studies should test similar protocols with small and mid-size employers.

Strengths of the study include its systematic use of screening and a protocol-driven complex intervention for workers within 1–3 weeks of injury, along with the 2 year follow-up. The early identification process administered to all injured workers with lost time claims by a busy claims office not only provides a measure of ecological validity for the study, but may have yielded a more generalizable sample relative to studies recruiting from clinic attenders, where there may be delays in seeking care. The long-term follow-up was also a strength, especially given that most studies in this area have a 12 month, or less, follow-up period (e.g., [24, 35]. That differences between groups continued to strengthen over time, even after 10–11 months post-injury, suggest that future studies in this area should consider longer timeframes for their evaluations.

The heterogeneous nature of the participants' injuries, although considered 'soft tissue' was also a strength. In contrast to those studies limited to one site of injury, this study expanded the practice of psychosocial screening to work injuries in general. Another strength was the use of a contemporaneous control condition of similarly injured workers. This controlled for the possible effects of changes in legislation, insurance claims practice, and workplace policies that could affect the management of injured workers (see [36, 37]. Finally, the use of actual, and not estimated, claims costs enables readers to evaluate the return on investment for the use of the protocol. Even so, we did not assess costs to the injured workers and that is a limitation that must be addressed in future as they can be substantial [38].

In summary, this study evaluated a multi-level, protocol-driven intervention by multiple stakeholders for injured workers screened as at-risk of delayed recovery due to psychosocial factors. The findings supported the hypothesis that brief psychological risk factor screening, combined with a protocol for active collaboration between key stakeholders to address identified psychological and workplace factors for delayed return to work, can achieve better return on investment than usual (stepped) care.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval The study was approved by the Sydney Local Health District Human Research Ethics Committee at Concord Hospital (17/06/2013), and the Human Research Ethics Committees of each participating hospital. The study was registered prospectively with the Australian and New Zealand Clinical Trials Registry (# ACTRN12613000847718). The system regulator, WorkCover(NSW), also gave its written approval for the protocol employed in the study.

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