INTRODUCTION

One in three people will experience chronic pain in their lifetime. Living with pain can prevent participation in enjoyable and everyday activities, and reduce overall well-being. In 2018, chronic pain was estimated to cost $A80b, affecting 3.24 million people. In some Western countries, chronic pain surpasses heart disease, cancer and diabetes in terms of total costs. International guidelines for chronic pain management consider education, physical activity and psychological therapies as first line intervention. Systematic reviews suggest that cognitive–behavioural therapy (CBT) and acceptance and commitment therapy (ACT), are effective for the treatment of chronic pain and depression. Currently, these are the only psychological treatments recommended in the National Institute for Health and Care Excellence guidelines for chronic pain. However, CBT and ACT are complex psychological treatments, requiring extensive and expensive training. This represents a barrier for communities where accessing specialist workers is challenging which, in part, compels us to identify alternative treatments for pain.

Behavioural activation (BA) is an alternative to CBT and ACT, as a treatment for depression. It is based on the idea that when people plan and set aside time for pleasurable activities, their mood is enhanced. Recent trials indicate that BA may be as effective as CBT for the treatment of depression. In an equivalence trial, CBT was compared with BA with 440 trial participants, (adults with moderate to severe depression). BA was delivered by junior mental health workers (no formal psychological qualifications or training) who received 5 days of training, whereas CBT was delivered by qualified psychotherapists (post-graduate CBT qualification). BA was shown to be equally effective in reducing depressive symptoms. If BA can deliver similar outcomes for depression as CBT, it could also be an alternative treatment for chronic pain. If so, we provide a comprehensive summary of the published literature on the application of behavioural activation (BA) to manage pain.

We aimed for optimal transparency by publishing our a priori protocol and rigour by adhering to Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews guidelines.

We excluded research involving children, conducted in hospital settings, and where BA was not the primary focus.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- We provide a comprehensive summary of the published literature on the application of behavioural activation (BA) to manage pain.
- We aimed for optimal transparency by publishing our a priori protocol and rigour by adhering to Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews guidelines.
- We excluded research involving children, conducted in hospital settings, and where BA was not the primary focus.

ABSTRACT

Background Behavioural activation (BA) is an effective treatment for depression; however, it is unclear if it can be used to manage pain.

Objectives To conduct a scoping review of primary research that reported using BA to support people living with chronic pain to understand how BA had been used in relation to pain. In addition, we wanted to understand whether there were any reported changes in that pain, and how and who delivered BA.

Eligibility criteria Primary research published in English.

Sources of evidence We searched seven databases MEDLINE, Ovid Embase, Ovid Emcare, PsycINFO, CINAHL, Scopus and Web of Science, for primary research. No initial date limit was used with the date the searches were conducted used as the end date limit (1 July 2021).

Charting methods A customised data extraction table was developed, piloted and used.

Results 551 papers were screened for inclusion, with 15 papers included in our review. Studies were conducted in North America and in Canada. These included three case studies, nine uncontrolled trials and three randomised controlled trials. Only two studies reported pain as the primary outcome. BA was applied across a range of pain related conditions. The dose of BA ranged from 3 to 16 sessions. Duration of treatment was 3 weeks to 12 months. Most studies reported reductions in pain following exposure to BA.

Conclusion BA has the potential to reduce pain. Caution needs to be exercised in the interpretation of these findings as a high risk of bias was observed in most studies. High-quality research is required to test if BA is an effective intervention for chronic pain.
it may increase access to interventions for people living with pain.

There are several reasons why BA might be beneficial in chronic pain management. People with chronic pain often perceive activity as being unsafe or inducing increased pain, although activity may gradually decrease pain.10 There is significant evidence that exercise interventions are an effective treatment for pain11 12; authors and peak bodies recommend primary care physicians prescribe exercise, noting its effectiveness at reducing pain without the side effects of opioid medications.11 13 In this sense, we consider exercise to be activity rather than a strenuous endeavour. For people living with chronic pain, it is important to consider activity that is both within the means of the person and that which may challenge someone to extend a little further. There is a complex, yet poorly understood, relationship between chronic pain and depression. Their coexistence can exacerbate each other, and people with chronic pain are more likely to develop depression and people living with depression may be more likely to develop chronic pain.14 15 The existence of one in the presence of the other also leads to poorer prognosis and outcomes.14 15 In this sense, it is possible that if BA can reduce depression for someone with chronic pain, it may reduce the chronic pain itself. Additionally, it may improve well-being and the potential to cope with chronic pain. Developing a sense of mastery (a core component of BA) and the reward that comes from undertaking activities and achieving goals may be pivotal in this. Despite the inference and theoretical argument that BA may be an effective intervention for people with chronic pain,16 the extent to which this has been tested is not clear.

This scoping review considers primary research into BA for chronic pain in people with or without a comorbid psychological condition. We were interested in understanding how BA has been used in relation to pain management, potential changes in pain, and how and by whom BA was delivered.

METHODS AND ANALYSIS
A scoping review is appropriate when the intent is to scan the body of literature and explore the research conducted.17 Consistent with this approach, evidence relating to BA and chronic pain, study types, measures, and samples, were mapped.

Design
The methodological approach proposed by Arksey and O’Malley18 and Peters et al19 was used. The protocol was published in the BMJ Open.20

Review questions
The following questions were used to frame the review: 1. What studies have been published on the use of BA to support patients living with chronic pain?

2. How has BA been applied to support patients with chronic pain?

3. How has BA been integrated with other models of care/treatments for people living with chronic pain?

4. What was the reported effect of BA on pain and pain outcomes?

The fourth question was added to those originally identified in the protocol. It was believed the effect of BA on pain outcomes was an important aspect when considering whether it is a worthwhile treatment.

Selection criteria
Population
The population of interest was people over 18 years with chronic pain, such as back or musculoskeletal pain, arthritis and cancer.

Concept
We were interested in how BA has been used to support people living with chronic pain, with a focus on activity scheduling. BA aims to increase activity, which introduces routine, feelings of reward and mastery of daily activities. We excluded studies where BA was not the primary focus of the intervention.

Context
Our focus was on the application of BA for the longer-term management of pain in community settings. Patients needed to be living in their own or residential homes. As hospitals are primarily focused on acute care, we excluded studies where BA was delivered in inpatient settings.

Types of studies
We included primary research including observational studies, experimental studies, case studies and clinical audits. Opinion papers and systematic/scoping reviews were excluded on the basis they were not primary research, this reflects a refinement of our protocol.

Search strategy
The following three steps were followed:

Step 1: As recommended by Arksey and O’Malley,18 we searched one relevant online database (MEDLINE) to inform the search strategy, which is detailed in the protocol.20

Step 2: Keywords, Medical Subject Headings (MeSH), and index terms, were identified across the included databases.

Step 3: A search strategy was developed for each database (see online supplemental file 1). Studies were restricted to English. A preliminary search of MEDLINE, Cochrane Central Register of Controlled Trials, Scopus, and Web of Science was conducted with no start date applied, and an end limit of 22 July 2020 (date searches conducted). This was completed to gain an understanding of the studies that may be yielded and ensure an empty review would not ensue. All databases (MEDLINE, Cochrane Central Register of Controlled Trials, Scopus, Web of Science,
PsycINFO, Ovid EMCARE, Ovid EMBASE and CINAHL) were then searched with no start date and an end date of 1 July 2021 (date searches conducted).

**Study selection**

Citations were imported to Endnote (Clarivate Analytics, Boston, Massachusetts, USA), duplicates removed, then uploaded to Covidence (www.covidence.org). Title and abstracts were screened by SW/MJ/TE/KT and full-text screening was conducted by MJ and SW, with disagreements resolved by RG. Reasons for exclusion were noted. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews Checklist.21

**Data extraction, charting and presentation**

The data extraction form was tested with three studies from the initial search to ensure relevant results (interventions, populations, study methods and outcomes of significance to the review) were extracted. It informed the final data extraction form design. Included studies were entered into the data extraction tool which provided a transparent summary of studies, addressing specific subquestions and thereby the overarching review question.

**Patient and public involvement**

A person with a lived experience of chronic pain (TC) was involved in developing/preparing the protocol and manuscript.

**RESULTS**

Of the 967 identified papers, 551 were screened by title and abstract, and 36 by full text. Reasons for exclusion at full text included: wrong intervention (12), wrong study design (2), duplication (1), not in English (1), wrong outcomes (3) or conference paper (2). Fifteen publications were included in the review (see figure 1).

**Characteristics of included studies**

Thirteen studies were conducted in the USA, and two22 23 in Canada. Three studies,24–26 were randomised controlled trials (RCTs), nine22 23 27–33 uncontrolled trials and three34–36 case studies (table 1).

**Study settings**

Studies were conducted across a range of settings including outpatient services at university hospitals/medical centres,24 26 30–32 veteran medical centre,29 psychology clinic,34 primary care practices,25 and four studies occurred in rehabilitation services.22 25 27 36 One study28 delivered BA via non-government organisations; while another35 reported BA delivered in a community-based ageing centre and a community-based mental health site. In the final study,35 it was evident that delivery occurred in the community, however, we were unable to determine the setting.

**Pain as primary outcome and secondary outcome**

In two studies,34 35 pain was the primary outcome; in the remaining studies, it was a secondary outcome. Pain and post-traumatic stress disorder (PTSD) were reported as the primary outcomes in two studies,23 29 while depression and PTSD were the primary outcomes in two studies.26 36 In five studies,24 27 28 30 31 the primary outcome was depression. Three studies25 32 33 considered feasibility as the primary outcome. In the remaining study,22 the primary outcome was return to work.

**Pain-related conditions**

BA was applied to a variety of pain related conditions, including lower back pain,34 physical injuries,26 36 work-related musculoskeletal disorders or work-related disability,22 23 27 cancer,24 30 31 HIV25 35 and chronic pain.29 32 33 One study28 included people with a range of chronic health conditions.

**Comorbid psychological conditions**

In seven studies, patients had comorbid psychological conditions including depression,24 25 27 28 30 31 35 and PTSD.23 26 29 34 36 In one study,33 enrolled participants were experiencing a variety of mental health disorders. Two studies22 32 did not focus on patients with comorbid psychological conditions.

**Assessments of pain**

The studies used different pain assessment approaches, including the Pain Interference Short Form Scale (PROMIS)37 32 the bodily pain component of the Medical Outcomes Study Short Form (SF36-BP)38 24 28 30 31 and the
| Table 1 Characteristics of included studies |
|------------------------------------------------|
| **Study** | **Study design/methodology** | **Aim/research question/s** | **Population** | **n** | **Pain and pain measures** | **Setting** | **Intervention** | **Outcome/findings** |
| Brooks *et al.* 2021 USA | Mixed-methods - pre- and post-intervention and semi-structured interview | To examine acceptability, feasibility, and preliminary effectiveness of BA-PR | 50 years+comorbid chronic pain and mental health conditions Age: 55–62 years (M=57.1, SD 2.12) | 8 | Comorbid chronic pain. NRS 0–10; Chronic Pain Coping Inventory | Community-based ageing centre and Community-based mental health site. | BA-PR 6 weeks, 2 hours, group-based, weekly, older peer and clinician co-facilitated pain rehab intervention | Non-significant reductions in pain intensity. Improvements in active and passive pain coping strategies. |
| Hooker *et al.* 2020 USA | Single-arm, mixed methods—preintervention and postintervention and interview at follow-up | To evaluate feasibility and acceptability of BA in urban family medicine clinic. | 18+living with chronic pain Age: 24–72 years (M=47.8, SD11.6) | 30 | Chronic pain. PROMIS | Primary care clinic (urban family medicine clinic). | 10 min or less values-based BA. Two parts: (a) values card sort (b) values-based BA (goal setting). | Statistically significant reduction in mean pain interference (p=0.001) baseline (26.3 SD 4.1) to follow-up (24.8 SD 5.0). |
| Hopko *et al.* 2005 USA | Uncontrolled preliminary clinical trial—pre, post, 3 months follow-up. | To assess effectiveness of BATD among depressed cancer patients in primary care. | 18+, cancer, diagnosis MDD moderate severity Age: 28–66 years (M=46.4, SD 14.1) | 6 | Chronic pain. SF-36BP | Primary care. | BATD: 9×1 hour including psychoeducation, treatment rationale, activity and goal selection, and BA. | Significant improvement SF-36BP means pre- (40.0 SD 16.0) to post-treatment (52.3 SD 29.4) moderate effect size (d 0.5). 3 months follow-up (68.3 SD 28.6) treatment gains maintained (nonsignificant) |
| Hopko *et al.* 2011 USA | RCT | To conduct a randomised trial using BATD, comparing it to PST for depressed breast cancer patients. | 18+years women diagnosed with breast cancer and moderate -severe MDD Age: range not reported (M=55.4, SD 11.9) | 80 | Bodily pain. SF-36 BP | University medical care setting. | BATD and PST. BATD 8 sessions x 1 hour. | SF-36 BP - BATD showed significantly more post-treatment improvement than PST. BATD showed continued post-treatment improvement on 7/14 outcomes, compared with PST (2/14). |
| Hopko *et al.* 2009 USA | Pre-post study Measures pretreatment and post-treatment, 3 months follow-up. | To examine frequency and significance of sudden gains experienced by depressed cancer patients undergoing brief BA | 18+years, cancer patients with moderate to severe MDD. Age: range not reported (M=52.8, SD 11.1) | n=37 pre-treatment phase, n=26 completed BA protocol. n=13 sudden gains; n=13 no sudden gains | Chronic pain. SF-36 measured bodily pain. | University medical centre. | 9-sessions. - Contemporary BA (CB intervention with BA core component) and ‘pure’ BA. | Individuals with sudden gain had less severe depression, less somatic anxiety, greater physical functioning, less bodily pain. |
| Study | Study design/methodology | Aim/research question/s | Population | n = | Pain and pain measures | Setting | Intervention | Outcome/ findings |
|-------|--------------------------|-------------------------|------------|-----|------------------------|---------|-------------|------------------|
| Kim et al 2017 USA | Case study | To detail the assessment and use of BA to treat a patient with low back and bilateral foot pain. | Veteran 30-year-old, single, African American female, 3-year history low back pain, 10 years bilateral foot pain | 1 | Low back pain and bilateral foot pain. NRS average pain (10-point scale-10 reflecting greater pain) NRS post- treatment range 5–8 | Home | Nine sessions, BA proposed to Veteran as intervention to help re-establish purpose-driven activities. | NRS avg pain level pre-7, range 5–8 previous week; post-treatment 8, range 7 to 8. Four-week follow-up avg pain 7, range 5 to 7 previous week. PCS pre-=32 post-treatment=7. PDI pre-=42/70; post-treatment=32/70. |
| Moitra et al 2019 USA | Case study | To reduce pain-related interference in physical and psychosocial functioning | PLWH Age not reported | 1 | Comorbid chronic pain depression. No reported outcome measures | Community – therapist office and telephone-based | 7-sessions, 4 core strategies to improve domains of health and well-being. | No outcomes reported |
| Pimentel et al 2020 Canada | Uncontrolled study, pre, mid and post measures | To examine sequential relation between symptom catastrophising and PTSD severity | Work-disabled adults with PTSD referred to an occupational rehabilitation service, Age: range not reported (M=47.0, SD 9.7) | 73 (n=39 women, n=34 men) | Chronic pain. MPQ-SF | Occupational rehabilitation service. | PGAP—10 week standardised risk targeted BA to facilitate return to work. | Significant reductions in scores on MPQ-SF, t(72) = 4.9, p<0.001, d=0.59. |
| Plagge et al 2013 USA | Uncontrolled trial, premeasures and postmeasures | To explore preliminary clinical effectiveness and feasibility of BA to treat comorbid chronic pain and PTSD | Iraqi veterans self-reported pain (3+months), significant PTSD symptoms. Age: range not reported (full sample M=33.0 SD 9.2; completers M=38.8 SD 10.5) | n=58 (full sample) 30 (completers) | Chronic pain. Chronic Pain Grade (Pain severity and Pain interference), PCS | Veterans Affairs Medical Centre. | Adapted BA for Treatment of PTSD manual. 8×75–90 mins individual sessions | Pain severity: pre- 6.8 (1.4); mid- 6.1 (2.0); post-5.8 (2.2). Pain interference: pre- 6.9 (2.1); mid- 5.1 (2.4); post-4.9 (2.5); Pain catastrophising pre- 32.9 (13.0); post-intervention 23.9 (10.5). |
| Quijano et al 2007 USA | Uncontrolled study, pre and post measures. | To evaluate BA for depression delivered to high-risk, diverse older adults by case managers. | All new and existing clients 60+ years in community, receive services at community-based service. Age: range not reported (all clients M=75.9 SD 9.5; eligible M=72.5 SD 9.4) | n=49 measured on QoL (pain); 42 people participated in BA—unknown if they were the same people | Chronic pain. SF–36 used to measure pain | Two non-profit community-based agencies and one county social service agency. | Contemporary BA identifying behavioural goals important to individual patients. | Pain reduced to no-mild pain 16.5% (baseline) 44.9% (6 months). % participants reporting change in pain significant (p=0.003). |
| Sullivan et al 2020 Canada | Uncontrolled study, pre, mid and post measures—crossed-lagged panel design | To examine the role of perceived injustice as a determinant of symptom severity in individuals with MDD. | Work-disabled adults with MDD at occupational rehabilitation service. Age range not reported (males M=45.8 SD 9.8 females M=45.2 SD 9.8) | 253 | Chronic pain. NRS (10-point scale-10 reflecting greater pain) | Occupational rehabilitation service. | PGAP—10 week standardised risk targeted BA to facilitate return to work. | Significant reductions in pain pretreatment 4.5(SD 2.5) mid-treatment 4.1 (SD 2.4) post-treatment 3.5 (SD 2.3) (p<0.001 Cohen's d 0.42). |
| Study                  | Study design/methodology          | Aim/research question/s                                                                 | Population                                                                 | n   | Pain and pain measures                  | Setting                                                                 | Intervention                                                                 | Outcome/findings                                                                 |
|-----------------------|----------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------|------|----------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Turner and Jakupcak 2010 USA | Single case study                | To describe BA for PTSD and depressive symptoms in veteran with physical injuries      | 22 years male soldier PTSD—multiple severe fractures, pain left leg        | 1    | Weight bearing pain NRS (10-point scale—10 reflecting greater pain) | Veterans Administration inpatient rehab unit (initial admission) and two primary care practices | Weekly treatment over 4 months; based on BA protocol by Jacobson et al     | Recovered from physical injuries and surgeries, weight bearing pain reduced from 8 to 0, improved ambulation. |
| Uebelacker et al 2016 USA | RCT. Assessments at baseline, 1 2 3 months (endpoint), 4 months (1 month follow-up). | To assess feasibility and acceptability of BA for pain and depressive symptoms in PLWH. | 18+PLWH; 6 months chronic pain; pain interference BPI-I ≥5; pain severity ≥4 on 0 to 10 NRS. Age: range not reported (HIV-PASS M=52.0 SD 7.2 HE M=49.7 SD 9.4) | 23   | Chronic pain. Average pain in past week - NRS (10-point scale - 10 reflecting greater pain). | Two primary care practices                                                                                           | HIV-PASS-modified manualised BA for primary care.                             | Effect size for avg pain in HE direction. BPI medium effect favouring HIV-PASS. Means decreased at 1 2 3 4 months for BPI and avg pain. |
| Wagner et al 2007 USA | Small, randomised effectiveness trial | To examine the impact of BA on PTSD (and range of factors that contribute to avoidance including pain) | Adults recently injured with PTSD 1-month post-injury, recruited from surgical ward. Age: range not reported (BA M=28.0 SD 15.4 TAU M=39.0 SD 16.2) | Total n=8 TAU n=4, BA n=4 | Chronic pain (some injury related). SF-12 (PCS-12) | Community - Harborview Medical Centre Seattle                                                                                   | BA over 6 sessions 60–90 min each.                                             | PCS-12 pre-treatment BA 34.2 (5.0) TAU 30.6 (8.7); post-treatment BA 35.7 (8.3) TAU 25.4 (8.1). BA reported higher physical function. |
| Yamada et al 2020 Canada | Uncontrolled study, pre and post measures | To examine role of fatigue as determinant of work-disability in individuals with WRMDs | Individual with WRMDs Age: range not reported (Male M=46.3 SD 8.5 Female M=45.7 SD 9.3) | 117 (n=64 women, n=53 men) | Chronic pain. NRS pain measure (10-point scale - 10 reflecting greater pain). PDI | Occupational rehabilitation service                                                                                           | PGAP—10-week standardised risk targeted BA to facilitate return to work.      | PDI reduced pre (34.9, SD 8.7) to post assessment (27.5, SD 11.7) p value<0.001. NRS reduced pre (6.4, SD 1.8) to post assessment (5.2, SD 2.6) p value<0.001 |

BA-PR, behavioural activation for pain rehabilitation; BATD, behavioural activation treatment for depression; BPI-I, Brief Pain Inventory-Interference scale; CB, cognitive behavioural; MDD, major depressive disorder; MPQ-SF, McGill Pain Questionnaire-Short-Form; NRS, Numerical Rating Scale; PCS, Physical Component Score; PDI, Pain Disability Index; PLWH, person’s living with HIV/AIDS; PROMIS, Pain Interference-Short Form scale; PST, problem solving therapy; PTSD, post-traumatic stress disorder; RCT, randomised controlled trial; SF, Short Form; SF-36 BP, Medical Outcomes Study Short Form, Bodily Pain component; TAU, treatment as usual; WRMD, work-related musculoskeletal disorders.
Table 2 Overview of how BA was delivered

| Study                          | No of sessions | Duration of sessions | Frequency of sessions | Duration of treatment |
|-------------------------------|----------------|----------------------|-----------------------|-----------------------|
| Brooks et al 23               | 6              | 2 hours              | Weekly                | 6 weeks               |
| Hooker et al 32               | 3 (including initial visit and follow-up) | 10 min             | Once                  | 3–5 weeks            |
| Hopko et al 2005 30           | 9              | 1 hour               | Weekly                | 9 weeks               |
| Hopko et al 2009 31           | 9              | 1 hour               | Weekly                | 9 weeks               |
| Hopko et al 2011 24           | 8              | 1 hour               | Weekly                | 8 weeks               |
| Kim et al 24                  | 10             | Not reported         | Not reported          | Not reported          |
| Moitra et al 25               | 7              | Not reported         | Not reported          | Not reported          |
| Pimentel et al 23             | 10             | Not reported         | Weekly                | 10 weeks              |
| Plagge et al 29               | 8              | 75–90 min            | Not reported          | Mean no of days between initial in-person contact and intervention completion 110 days, median of 106, range 24–224 |
| Quijano et al 28              | 10             | Not reported         | Not reported          | 6 months              |
| Sullivan et al 27             | 10             | Not reported         | Weekly                | 10 weeks              |
| Turner and Jakupcak 36        | 16             | Not reported         | Weekly                | 4 months (tapering up to 12 months) |
| Uebelacker et al 25           | 7              | 30–50 min            | 2 weeks on average    | 3 months              |
| Wagner et al 26               | 4–6            | 60–90 min            | Weekly (not always consecutive) | 9.8 weeks avg |
| Yamada et al 22               | 10             | Not reported         | Weekly                | 10 weeks              |

BA, behavioural activation.

Physical Component Summary of the SF-12 Health Survey (PCS-12). Five studies, asked the patient to rate their pain on a 10-point Numerical Rating Scale (NRS) anchored with 0 (no pain) and 10 (the most pain one could experience). The application of the NRS was varied in these studies measuring current pain, pain on weight bearing, and average pain intensity during the past week. Two studies assessed pain-specific thoughts and beliefs via the Pain Catastrophising Scale (PCS). One case study was concerned with pain-related interference but did not employ a measure. Sullivan et al 27 and Pimentel et al 23 assessed pain catastrophising using the Symptom Catastrophising Scale (SCS). The latter also measured pain severity using the McGill Pain Questionnaire–Short-Form (MPQ-SF). In addition to an NRS for pain during the past week, Uebelacker et al 25 considered pain interference using the Brief Pain Inventory–Interference scale. Other pain-related measures included the Chronic Pain Grade (CPG) 41 Chronic Pain Coping Inventory 42 43 Chronic Pain Acceptance Questionnaire 46 25 and the Pain Disability Index. 47 22 34

BA programmes

All studies reported employing fundamental principles of BA; scheduling activity informed by patient values and gradually increasing patient activity through scheduling. In some instances, the purpose of the activity scheduling was to either break avoidance patterns or help the person return to their ‘normal’ activities. Two studies focused on activity scheduling aimed to break avoidance patterns. In both studies, patients experienced PTSD after a traumatic event. In other studies, activity scheduling was aimed at supporting people to reintroduce themselves to their previous role, such as returning to the workplace. Several studies reported using a particular BA programme. BA for the treatment of depression (BATD) 51 was used in three studies. However, in one of these studies, this was not explicitly stated, instead referring to BA or enhanced BA referencing previous studies using BATD.

Risk-targeted BA interventions were employed in three studies. Yamada et al 23 referred to Progressive Goal Attainment Programme (PGAP) and, while not explicitly stated, Pimentel et al 23 and Sullivan et al 27 mentioned a similar programme, with wording consistent to other papers referring to PGAP. Sullivan et al 22 explain that PGAP is a risk targeted BA intervention as it ‘specifically targets disability-relevant psychosocial risk factors’ (p.291). Sullivan et al 22 included additional techniques related to perceptions of injustice. PGAP is a manual-based intervention, with a workbook the basis for intervention techniques. An educational video is used in the first session to orient the client to PGAP and provide an overview of relevant conditions, such as depression or PTSD. The initial sessions seek to establish a strong working relationship between clinician and patient, subsequent sessions focus on structured activity scheduling and reviewing progress towards these goals, with the ultimate goal to decrease barriers to rehabilitation, encourage engagement in daily activities and return-to-work.

Brooks et al 23 used BA for Pain Rehabilitation (BA-PR), noting it is ‘the first pain rehabilitation intervention for middle-aged and older adults with varying types of mental health conditions’. (p.363) Wagner et al 26 used a modified
## Table 3 Overview of effect of BA on pain

| Study                  | Pain measure          | Baseline mean (SD) | Mid mean (SD) | Post mean (SD) | Follow-up mean (SD) | P value | D       | T       |
|-----------------------|-----------------------|--------------------|---------------|----------------|---------------------|---------|---------|---------|
| Brooks et al<sup>33</sup> | 0–10 NRS              | 7.00 (1.60)        | n/a           | 6.67 (1.02)    | n/a                 | 0.594   | n/a     | 0.558   |
| Hooker et al<sup>32</sup> | PROMIS               | 26.3 (4.1)         | n/a           | 24.8 (5.0)     | n/a                 | 0.001   | – 0.72  |         |
| Hopko et al 2005<sup>30</sup> | SF36 (Bodily Pain)    | 40.0 (16.0)        | n/a           | 52.3 (29.4)    | 68.3 (28.6) (3 month) | <0.05   | 0.5     |         |
| Hopko et al 2009<sup>31</sup> | SF36 (Bodily Pain)    | 44.5 (21.4) (sudden gains) | n/a           | n/a           | n/a                 | n/a     | n/a     |         |
| Hopko et al 2011<sup>34</sup> | SF36                 | 46.4 (26.6)        | n/a           | 55.5 (22.7)    | 65.0 (15.3) (12 month) | <0.05   | 0.33    |         |
| Kim et al<sup>34</sup> | 0–10 NRS              | 7 (range 5–8)      | n/a           | 8 (range 7–8)  | n/a                 | n/a     | n/a     |         |
| PCS                   | 32, 80th percentile  | n/a                | n/a           | 7, 17th percentile | n/a             | n/a     | n/a     |         |
| PDI-recreation        | 42/70                 | n/a                | n/a           | 32/70          | n/a                 | n/a     | n/a     |         |
| Moitra et al<sup>35</sup> | Pain-related interference | Descriptive        | n/a           | Descriptive    | n/a                 | n/a     | n/a     |         |
| Pimentel et al<sup>23</sup> | MPQ-SF               | 13.7 (8.0)         | 11.5 (7.9)    | 9.0 (7.9)      | n/a                 | <0.001  | 0.59    |         |
| Plagge et al<sup>29</sup> | Pain severity (NRS)   | 6.8 (1.4)          | 6.1 (2.0)     | 5.8 (2.2)      | n/a                 | 0.050   | 0.47    |         |
| Pain interference (NRS) | 6.9 (2.1)            | 5.1 (2.4)          | 4.9 (2.5)     | n/a            | <0.001  | 0.88    |         |
| PCS                   | 32.9 (13.0)           | n/a                | 23.9 (10.5)   | n/a            | <0.001  | 0.79    |         |
| Quijano et al<sup>28</sup> | SF36                 | 16.3% (no pain or mild pain at 6 months) | n/a           | 44.9% (no pain or mild pain at 6 months) | n/a | 0.003 | n/a |
| Sullivan et al<sup>27</sup> | 11-point NRS         | 4.6 (2.5)          | 4.1 (2.4)     | 3.5 (2.3)      | n/a                 | <0.001  | 0.42    |         |
| Turner and Jakupcak<sup>36</sup> | Weight bearing pain (NRS) | 8                  | n/a           | 5 (2 month)    | 0 (12 month)        | n/a     | n/a     |         |
| Uebelacker et al<sup>25</sup> | NRS (pain in the past week) | 6.9 (1.6)          | n/a           | 5.8 (1.3) (4 month) | n/a | 0.332 | 0.67 (-0.30; 1.64) compared with health education control |
| BPI-I                 | 7.3 (1.6)             | n/a                | 5.5 (1.9)     | n/a            | 0.566   | −0.39 (-1.36; 0.58) |         |
| Wagner et al<sup>26</sup> | SF-12 - PCS-12       | 34.2 (5.0)         | n/a           | 35.7 (8.3)     | n/a                 | 0.05    | n/a     | 1.89    |
| Yamada et al<sup>22</sup> | 11-point NRS         | 6.4 (1.8)          | n/a           | 5.2 (2.6)      | n/a                 | <0.001  | 0.59    |         |
| PDI                   | 34.9 (8.7)            | n/a                | 27.5 (11.7)   | n/a            | <0.001  | 0.75    |         |

BA, behavioural activation; BATD, Behavioural Activation Treatment for Depression; BPI-I, Brief Pain Inventory interference scale; MDD, major depressive disorder; MPQ-SF, McGill Pain Questionnaire-Short-Form; n/a, not applicable; NRS, Numerical Rating Scale; PCS, Pain Catastrophising Scale; PCS, Physical Component Score; PDI, Pain Disability Index; PROMIS, Pain Interference-Short Form scale; SF, Short Form.
BA manual53 to allow for delivery in a reduced number of sessions. Turner and Jakupcak36 adopted a modified BA intervention54 tailored to suit patients with PTSD and symptoms reflecting patterns of avoidance. Plagge et al59 described being part of a larger programme which used BA for the treatment of PTSD.55 56 The BA approach was not reported in four studies.28 32 34 35 We do note, however, one study35 referred to a larger study and it is assumed the intervention used was the same, HIV-Pain and Sadness Study (HIV-PASS).25

**Frequency and duration of sessions**

Table 2 provides an overview of how BA was delivered in terms of the number, duration, frequency of sessions and treatment duration.

There was variation in session elements across studies. For example, Hooker et al32 used a novel one-off BA session with a follow-up 2–3 weeks later. BA was condensed into 10 min, with the follow-up lasting 10–20 min, and incorporated into routine pain management care. In one case study,36 16 sessions were delivered over 4 months, with an additional session after 12 months.

**Delivery of BA**

There was variation in who delivered BA. In three studies by Hopko et al24 30 31 the principal investigator trained graduate students to deliver BA. In four studies,22 29 32 33 a psychologist delivered BA, whereas Kim et al24 described the person as a ‘therapist’. Two studies26 36 did not report who delivered BA. In the study by Brooks et al33 a PhD trained psychotherapist cofacilitated delivery with older peers to people over the age of 50.

In the remaining studies, non-mental health professionals were trained to deliver BA. Quijano et al28 reported case managers delivered BA and provided a brief description of the training: 15 case managers and three supervisors were prepared by specialist mental health workers in social work and psychology. Training included group sessions, assignment of a coach and semiannual follow-up training sessions to address issues. During the intervention, the coach met the case manager twice monthly. Two studies22 27 used occupational therapists (OTs) to deliver BA. Sullivan et al27 trained 24 OTs, who had experience with mental health clients. Training was a 2-day intensive workshop with ongoing access to videos for support. The OTs received weekly supervision, which the authors state ensured ‘fidelity to the protocol’ (p. 291). Similarly, Yamada et al32 trained OTs ‘to competency’ and weekly supervision ensured ‘fidelity to the standardised treatment protocol’ (p. 137). We assume that three other studies22 25 27 were drawing on a similar clinician sample, as the description of training OTs was identical.

**Delivery modalities**

BA was delivered face to face in three studies27 32 34 and one study delivered BA by telephone.35 and four studies25 26 28 29 used a combination of face to face and telephone. Seven studies22–24 30 31 33 35 did not report how BA was delivered, but face to face was implied. Wagner et al26 noted a flexible approach was used to determine where BA was delivered, due to physical limitations of patients.

**Effect on pain**

Eight uncontrolled trials reported improvements in pain for BA participants (see table 3); while the remaining study31 did not comment on improvement in pain, they noted less bodily pain at baseline was associated with improvements. Sullivan et al27 using an NRS with 253 work-disabled individuals with Major Depressive Disorder, reported a modest decrease in mean current pain scores from pretreatment (4.6 SD 2.5) to mid-treatment (4.1 SD 2.4) to post-treatment (3.5 SD 2.3) (p<0.001 pretreatment to post-treatment). Yamada et al27 using an NRS with 117 people with work-related musculoskeletal disorders,

### Table 5 Randomised controlled trials—Risk of Bias Assessment 2

| Study       | Randomisation process | Deviations from intended intervention | Missing outcome data | Measurement of outcome | Selection of reported result | Overall |
|-------------|-----------------------|---------------------------------------|----------------------|------------------------|-------------------------------|---------|
| Hopko et al24 | High                  | Some concerns                         | High                 | Some concerns          | Some concerns                 | High    |
| Uebelacker et al25 | High                  | Major concerns                        | High                 | Major concerns         | High                          | High    |
| Wagner et al26     | High                  | High                                  | Low                  | Some concerns          | Some concerns                 | High    |
reported a decrease in average current pain from pretreatment (6.4 SD 1.8) to post-treatment (5.2 SD 2.6). They reported decreases on PDI means from pretreatment (34.9 SD 8.7) to post-treatment (27.5 SD 11.7). Brooks et al reported a nonsignificant reduction (t-test 0.558, p=0.594) in average pain intensity during the past week (NRS)—pretreatment (7.00 SD 1.60) to post-treatment (6.67 SD 1.02).

Two studies used the SF-36-BP to assess pain. Quijano et al reported a significant increase (p=0.003) in the percentage of participants reporting no or mild pain from preintervention (16.3%) to 6 months later (44.9%). Hopko et al reported bodily pain symptoms, at 3-month follow-up, had improved to a clinically significant margin, suggesting the positive effects of BATD may continue after therapy termination. Although it was noted that pre–post treatment improvement was nonsignificant; SF36-BP mean scores improved from pretreatment (40.0 SD 16.0) to post-treatment (52.3 SD 29.4) to 3 months follow-up (68.3 SD 28.6).

Pimentel et al using MPQ-SF, reported significant reductions in pain severity from pretreatment (mean 54.8 SD 15.5) to post-treatment (mean 40.8 SD 14.0), (t(72)=4.9, p<0.001, d=0.59) for 73 work-disabled individuals. Hooker et al used PROMIS and reported a small (not clinically significant) decrease in mean pain interference scores from baseline (26.3 SD 4.1) to post-treatment (24.8 SD 5.0). Plagge et al used three pain-related assessments: pain severity, pain interference and pain catastrophising. For pain severity, there was a decrease pretreatment (mean 6.8 SD 1.4), mid-treatment (mean 6.1 SD 2.0) to post-treatment (mean 5.8 SD 2.2). For 20% of participants who completed the study, there was a clinically significant reduction in pain severity. For pain interference, scores decreased from pretreatment (mean 6.9 SD 2.1), mid-treatment (mean 5.1 SD 2.4), to post-treatment (mean 4.9 SD 2.5). For 40% of participants, there was clinically significant reductions in pain interference. PCS scores decreased from pretreatment (mean 32.9 SD 13.0) to post-treatment (mean 23.9 SD 10.5).

The three RCTs reported varied results. In the study by Hopko et al patients with breast cancer received either BATD or problem-solving therapy. Using the SF-36-BP, patients in the BATD group showed more improvement (pretreatment mean 46.4 SD 26.6, post-treatment mean 55.5 SD 22.7) than the PST group (pretreatment 51.4 SD 26.7, post-treatment 62.6 SD 22.1). They noted the BATD group had significantly more post-treatment improvement than the PST group. Wagner et al employed BA with patients experiencing PTSD and physical injuries. Assessing pain with the PCS-12, the BA group showed modest improvement from pretreatment (34.2 SD 5.0) to post-treatment (35.7 SD 8.3) while the treatment as usual (TAU—as ‘accessed by trauma patients from this type of trauma care facility’ p.344) group declined pretreatment (30.6 SD 8.7) to post-treatment (25.4 SD 8.1). Notably, this was a small sample with four participants in each group. Uebelacker et al compared two groups who
received either BA (HIV-PASS) or health education (HE). For both groups, average pain on an NRS decreased, relative to baseline, in the post-treatment months. However, the effect size for change in average pain score favoured the HE group.

Three case studies reported mixed results. Kim et al.34 noted no change in the patient’s pain but reported increase in activity. Moitra et al.35 made no claim whether there was an effect on pain. Turner and Jakupcak36 reported the patient recovered from physical injuries and surgeries, and weightbearing pain reduced from 8 (baseline) to 0 (end of intervention) on the NRS.

**Critical appraisal of studies**

Table 4 summarises the tools used to critically appraise the included studies.

The three RCTs24–26 were rated as high risk of bias (Table 5). The RCTs did not describe the allocation process, such as steps they took to conceal allocation of participants to BA. In addition, none of the papers reported steps taken to prevent awareness that participants were being allocated to BA. We could not confirm if the trials followed their protocols as we could not locate their protocols. All22 27–32 uncontrolled studies were rated as fair (Table 6). Two case studies34 36 were rated good and one35 poor (Table 7).

**DISCUSSION**

The purpose of this scoping review was to investigate if and how BA had been used in relation to people with chronic pain. We were interested in reported changes in pain, and how and by whom BA was delivered. We used a broad search strategy, with a theoretical rationale for the potential benefit of BA in reducing pain.

**Effect of BA on pain**

The low number of studies and mixed methodological quality makes it difficult to make clear conclusions about the effectiveness of BA to manage pain. However, there is some positive evidence to warrant further exploration. In general, participants were in less pain or less impacted by their pain after BA than they were beforehand. Where a comparison intervention existed, the effect of BA on pain was mostly superior to that observed in the comparison group. That studies involved people with chronic pain, not recurrent or acute pain, reduced the likelihood (but importantly does not exclude it completely) that the passing of time, or regression to the mean, explains the effects. None of the studies reported adverse events or identified potential risks, which may suggest that BA is safe for people with chronic pain. However, it may be due to authors failing to collect or report harms. We found no mediation analyses to explore whether reductions in pain were mediated by reductions in comorbid conditions (such as depression, PTSD) or vice versa.

**Could BA be an accessible psychological treatment for chronic pain?**

Several different approaches to BA have been trialled with people with pain. The number of sessions varied from 2 to 16; duration of sessions varied from 10 min to 90 min; and length of intervention period varied from 3 weeks to 12 months. There was insufficient data to postulate optimal number, duration or frequency of sessions.

Different healthcare workers used BA to manage pain with their clients. Some were specialist mental health workers, such as psychologists or therapists; others were non-specialist healthcare workers. Hooker et al.32 embedded psychologists in primary care to provide a 10 min BA session and as part of a physician appointment. Patients reported ‘a significant decrease in pain interference’. (p.8) In the approach employed by Plagge et al.39 psychologists delivered BA and acted as case managers. Pain severity and pain interference decreased from preintervention to postintervention. As noted by Plagge et al.39 using psychologists to work as case managers is expensive and a pragmatic limitation. This could be also be said of the study by Hooker et al.32 Alternatively, Quijano et al.39 trained case managers to deliver BA to older adults. That more participants reported no pain or mild pain at 6 months than at baseline is encouraging. Studies by Sullivan et al.27 and Yamada et al.22 trained OTs, some with previous experience in mental health,27 to deliver BA. This may be a viable approach in areas where access to psychologists is limited but allied health professionals less so. There seems to be no obvious barrier to training non-psychologists. Perhaps allied health professionals, nurses including mental health nurses, or case managers are well positioned to effectively deliver BA for pain. One issue that may require further consideration is whether previous mental health experience is important to prepare workers to deliver BA. It was difficult to determine the quality of training provided or assess the competency of the workforce who delivered BA. Quality research is required to address concerns of training and competency and determine whether BA can safely and effectively be delivered by non-specialist workers.
Recommendations
The risk and effectiveness data are encouraging. However, larger, more robust trials are required. We did identify one study protocol57 for an RCT that may contribute to a growing body of knowledge. Comparing three treatment groups (TAU, TAU with ACT, TAU with BA), with pain as a primary outcome measure, patients with chronic low back pain and moderate to severe depression will participate in the study with measures taken pretreatment, post-treatment and 1 year later. This will hopefully improve our understanding of the effectiveness of BA in relation to pain.

Further research should consider the range of settings and professions that are able to deliver BA to people living with chronic pain. From an implementation perspective, it would be important to consider the appropriateness and understand the experience of the workers and patients if delivery occurs in novel settings with non-mental health professionals. For example, are OTs well positioned to deliver BA in a community health setting, do they consider this within their scope of practice and are they competent/confident to do so, and is this considered appropriate by patients. If this approach is taken, feasibility should consider the number of non-mental health professionals who commence and complete training in BA and the number of patients who are willing, in comparison to the number of patients asked, to participate.

LIMITATIONS
As this scoping review was restricted to peer-reviewed studies, publication bias is a potential limitation. Furthermore, research involving children was excluded, in part, as the therapeutic intervention may vary due to the cognitive and emotional stages of children participants. It would be pertinent to undertake another review that explores the use of BA with children experiencing pain.

CONCLUSION
BA has the potential to reduce pain. There is a need for further research to better understand any mechanism of action which may explain an association between BA and pain relief. The studies have potentially affirmed a complex relationship between pain and depression. It is possible the therapeutic effect of BA on pain is mediated through depression. It may also be that the therapeutic effect is achieved by directly working on pain, drawing on the evidence that supports exercise as a treatment for pain. Caution needs to be exercised in the interpretation of these findings as a high risk of bias was observed in most studies. There is a need for well-designed studies to test the association between BA and pain.

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Contributors MJ, SW, RJG, MG, KMG, TB, TE and GLM conceptualised the project, drafted the manuscript, contributed to the development of the research questions, study design and reviewed and edited the manuscript for important intellectual content. MJ, SW, RJG, MG, KMG, TB, TE and GLM authors approved the final manuscript and accepted to be accountable for all aspects of the work. All authors conceptualised the project, drafted the manuscript, contributed to the development of the research questions, study design and reviewed and edited the manuscript for important intellectual content. All authors approved the final manuscript. SW is the authors acting as guarantor.

Funding This study was supported by infrastructure provided by the Department of Rural Health, University of South Australia. GLM is supported by a Leadership Investigator Grant from the National Health & Medical Research Council of Australia ID1178444.

Competing interests GLM has received support from: Reality Health, ConnectHealth UK, Sequira, Kaiser Permanente, Workers’ Compensation Boards in Australia, Europe and North America, AIA Australia, the International Olympic Committee, Port Adelaide Football Club, Arsenal Football Club, all for work related to pain and performance management. Professional and scientific bodies have reimbursed him for travel costs related to presentation of research on pain at scientific conferences and symposia. He has received speaker fees for lectures on pain and rehabilitation. He receives book royalties from NO1group publications, Dancing Giraffe Press & OPTP, for books on pain science, education and rehabilitation.

Patient and public involvement Patients and/or the public were involved in the design, conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as online supplemental information.

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REFERENCES
1 Tsang A, Von Korff M, Lee S, et al. Common chronic pain conditions in developed and developing countries: gender and age differences and comorbidity with depression-anxiety disorders. J Pain 2008;9:883–91.
2 Deloitte Access Economics. The cost of pain in Australia. Painaustralia, 2019.
3 National Institute for Health and Care Excellence. Chronic pain (primary and secondary) in over 16s: assessment of all chronic pain and management of chronic primary pain, 2020.
4 Richmond H, Hall AM, Copsey B, et al. The effectiveness of cognitive behavioural treatment for non-specific low back pain: a systematic review and meta-analysis. PLoS One 2015;10:e0134192.
5 Veehof MM, Oskam M-J, Schreurs KMG, et al. Acceptance-based interventions for the treatment of chronic pain: a systematic review and meta-analysis. Pain 2011;152:533–42.
6 Bai Z, Luo S, Zhang L, et al. Acceptance and commitment therapy (ACT) to reduce depression: a systematic review and meta-analysis. J Affect Disord 2020;260:728–37.

Walsh S, et al. BMJ Open 2022;12:e056404. doi:10.1136/bmjopen-2021-056404
