The impact of non-pharmacological cancer-related fatigue interventions on activity performance and participation outcomes in adult cancer survivors: A systematic review.

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Executive summary

**Introduction:** Increased cancer survivorship means more people are living with cancer-related fatigue (CRF). CRF is the most distressing symptom survivors experience and is associated with activity performance limitations, restricted participation in meaningful life roles and reduced quality of life. Occupational therapists have skills relevant to fatigue management, however, the role of occupational therapy in CRF management is unclear. Synergies between the focus of occupational therapy on enabling participation in everyday life and challenges experienced by survivors living with CRF suggests opportunity for considerable occupational therapy involvement in CRF management.

**Thesis overview:** This thesis contains two sections, a literature review and a systematic review study. The literature review examined and critiqued existing research exploring the experience of survivors living with CRF, current occupational therapy involvement within CRF management and identified an evidence gap pertaining to participation within CRF research. Subsequently, the systematic review study presented in section two of this thesis aimed to identify whether existing non-pharmacological interventions effective in minimising CRF also had an impact on everyday activity performance and participation outcomes for adult cancer survivors.

**Study methods:** The study was a systematic review with narrative synthesis. Eight databases were searched (Medline, CINAHL, PsychINFO, EMBASE, Scopus, OT Seeker, CENTRAL, Cochrane SR database), from 1998-2018 and limited to randomised controlled trials (RCTs) published in English.

**Study results:** A total of 29 studies met selection criteria and were included in the review. Four intervention categories were identified: physical activity, psychosocial, multi-modal and ‘hands on’ therapies. In 28 studies (97%) quality of life, not participation or activity performance, was investigated as a primary or secondary outcome. Correspondingly, instruments measuring quality of life were used in 28 studies (97%). Three studies (10%) used additional instruments to measure participation, however, outcomes were not always reported. No obvious pattern of impact was identified between intervention type and survivors’ quality of life subscale data.

**Conclusion:** Findings of this review indicate there is insufficient evidence to determine whether survivors’ activity performance and participation is impacted by CRF interventions. Consideration of the sensitivity and precision of quality of life instruments to measure activity performance and participation should be incorporated into future CRF research designs.
# Table of contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE PAGE</td>
<td>1</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>2</td>
</tr>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td>3</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>4</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>6</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>7</td>
</tr>
<tr>
<td>SECTION I: LITERATURE REVIEW</td>
<td></td>
</tr>
<tr>
<td>1. Introduction</td>
<td>9</td>
</tr>
<tr>
<td>2. Cancer survivorship</td>
<td>9</td>
</tr>
<tr>
<td>2.1. Cancer survivorship prevalence</td>
<td>9</td>
</tr>
<tr>
<td>2.2. Current support for cancer survivors in Australia</td>
<td>10</td>
</tr>
<tr>
<td>2.3. Implications for cancer survivors and occupational therapists</td>
<td>11</td>
</tr>
<tr>
<td>3. Cancer-related-fatigue (CRF)</td>
<td>11</td>
</tr>
<tr>
<td>3.1. CRF definition and prevalence among survivors</td>
<td>11</td>
</tr>
<tr>
<td>3.2. Current understanding of CRF</td>
<td>12</td>
</tr>
<tr>
<td>3.3. Implications for cancer survivors and occupational therapists</td>
<td>12</td>
</tr>
<tr>
<td>4. Connecting CRF with activity performance and participation</td>
<td>13</td>
</tr>
<tr>
<td>occupational therapy</td>
<td></td>
</tr>
<tr>
<td>4.2. Framework for occupational therapy practice in CRF</td>
<td>14</td>
</tr>
<tr>
<td>4.3. Implications for occupational therapists</td>
<td>14</td>
</tr>
<tr>
<td>5. Living with CRF</td>
<td>15</td>
</tr>
<tr>
<td>5.1. CRF adversely impacts activity performance, participation and</td>
<td>15</td>
</tr>
<tr>
<td>quality of life</td>
<td></td>
</tr>
<tr>
<td>5.2. Implications for cancer survivors and occupational therapists</td>
<td>16</td>
</tr>
<tr>
<td>6. An opportunity for occupational therapy in CRF – closing the</td>
<td>17</td>
</tr>
<tr>
<td>participation evidence gap?</td>
<td></td>
</tr>
<tr>
<td>6.1. Information about current occupational therapy practice in CRF</td>
<td>17</td>
</tr>
<tr>
<td>management is limited</td>
<td></td>
</tr>
<tr>
<td>6.2. Evidence for participation focused occupational therapy in</td>
<td>18</td>
</tr>
<tr>
<td>survivor care is emerging</td>
<td></td>
</tr>
</tbody>
</table>
6.3. Limited occupational therapy CRF intervention studies exist......... 19
6.4. Proliferation of CRF intervention literature - limited attention
    on participation ................................................................. 20
7. Quality of life measures evaluate participation to a limited degree... 23
  7.1. Common quality of life measures used in oncology research ....... 23
  7.2. Connecting quality of life measures to activity and participation
       using the ICF framework ................................................... 23
  7.3. Implications for cancer survivors and occupational therapists..... 23
8. Conclusion............................................................................. 25
9. References............................................................................. 26

SECTION II: JOURNAL MANUSCRIPT

  Title page................................................................. 38
  Abstract............................................................. 39
  Introduction.......................................................... 41
  Methods.............................................................. 43
  Results................................................................. 47
  Discussion.......................................................... 62
  Conclusion.......................................................... 66
  Key points for occupational therapy................................. 66
  References.................................................................... 68

APPENDICES.................................................................. 75

Appendix I: Australian Occupational Therapy Journal - Author Guidelines...... 75
Appendix II: Sample search results.......................................... 88
Appendix III: PEDro scale for randomised clinical trials.................... 92
List of tables

Section I: Literature Review

Table 1: CRF systematic reviews and meta-analyses (Sept. 2014 to Dec. 2018) 22
Table 2: Illustrative example of quality of life outcome measures mapped to ICF 24

Section II: Journal Manuscript

Table 1: Characteristics of included studies 57
Table 2: PEDRO scores of included studies 59
Table 3: Summary of outcomes on quality of life domains 60
List of figures

Section I: Literature Review

Figure 1: Framework of factors associated with CRF (for occupational therapists) 14

Section II: Journal Manuscript

Figure 1: PRISMA flow diagram 56
1. Introduction

As cancer survivorship increases more people are expected to live with cancer-related fatigue (CRF). CRF is the most distressing symptom reported by survivors (National Comprehensive Cancer Network [NCCN], 2018) and can contribute to decreased performance of daily activities and reduced participation in meaningful life situations and roles. Occupational therapists have skills relevant to fatigue management, however, the role of occupational therapy in CRF management is unclear. Synergies between the focus of occupational therapy on enabling participation and the challenges experienced by cancer survivors living with CRF suggests opportunity for greater occupational therapy involvement in CRF management. Therefore, this review aims to examine and critique existing literature pertaining to the experience of survivors living with CRF, the current occupational therapy role in CRF management and seeks to identify future opportunities for occupational therapists within CRF management. Articles relevant to this literature review were identified through a Boolean search of eight databases including Medline and CINAHL. Search terms used to identify relevant articles included, “cancer” OR “neoplasm” AND “fatigue” OR “cancer-related-fatigue”. Additional searches were conducted to identify literature relevant to occupational therapy, combining “occupation*” with the above search terms. Reference lists of relevant articles were hand-searched to identify additional publications.

2. Cancer survivorship

2.1. Cancer survivorship prevalence

It is estimated that one in two Australians will be diagnosed with cancer in their lifetime (Australian Institute of Health and Welfare [AIHW], 2017). Cancer is a cellular disease that can occur anywhere in the body when abnormal cells divide uncontrollably and invade or damage surrounding tissue potentially causing malignant tumour growth (National Cancer Institute [NCI], 2015). Historically, ‘cancer’ was synonymous with mortality however today more people ‘survive’ cancer. A cancer survivor is any person living with cancer post diagnosis until the end of their life (Brearley et al., 2011; NCI, n.d). In 2012, 4.3% of Australians (994, 605 people) were living beyond a cancer diagnosis (AIHW, 2017). Australia has one of the highest survival rates globally for most cancer types based on a study involving data from 37.5 million people spanning seventy-one countries (Allemani et al., 2018). Locally and globally in developed countries, survival rates are increasing with a greater percentage of the population expected to live beyond cancer in the future. Wider adoption of screening practices; advancements in risk factor identification, diagnosis and
treatment; and impacts of an aging population (Hewitt et al. 2006; Phillips & Currow, 2010) are key contributors to sustained increased survival projections.

2.2. Current support for cancer survivors in Australia

Surviving cancer is life-changing and many people experience impaired function subsequent to cancer and cancer treatments leading to reduced quality of life (QoL) (Hewitt et al., 2006). Adjusting to life with a chronic and complex condition is the reality for many survivors, subsequently, lifelong rehabilitation may be required (Phillips & Currow, 2010). Although, in 2008-09 almost 80% of Australia’s AUD$4.5 billion public health budget for cancer management was allocated to inpatient hospital services (AIHW, 2013). Concentrating the majority of healthcare expenditure on the acute survivorship phase, defined as the period from diagnosis to completion of active cancer treatment (e.g. chemotherapy, radiotherapy) (Miller, Pandey, Jain & Mehta, 2015) preserves life. However, what resources remain to support QoL for the almost one million Australian survivors living in the community?

Cancer recurrence surveillance is the most common post-acute care activity, whereas health promotion, cancer prevention and symptom management for common long-term and late effects, including fatigue, are inconsistently managed (McCabe et al., 2013) despite being identified as essential components of survivorship care (Hewitt et al., 2006). Survivorship care plans (SCPs) support survivors during post-treatment transition by providing information pertaining to follow-up care requirements, potential late or long-term effects, and strategies to remain well (Kinnane, Moore, Jefford, Piper & Nolte, 2016). SCPs are positively perceived in Australia, however, barriers related to cost, time and uncertainty about effectiveness mean SCPs are not standard clinical practice (Kinnane et al., 2016). Subsequently survivors may transition from specialist oncology care to primary care with inadequate support. Further, in contrast with several Nordic and European countries with established multi-modal oncology rehabilitation programs (Hellbom et al., 2011) oncology rehabilitation is not considered standard care in Australia. There are an estimated 31 oncology rehabilitation programs across private and public settings in Australia that provide support for only 0.5% of Australia’s cancer survivors (Dennett, Peiris, Shields, Morgan & Taylor, 2017). Exercise, education and self-management interventions are core components of Australia's identified rehabilitation programs and occupational therapists are currently involved in delivery of 52% of the programs (Dennett et al., 2017).
2.3. Implications for cancer survivors and occupational therapists

Currently Australia’s public healthcare system is fiscally constrained contributing to limited support for cancer survivors beyond the acute survivorship phase. Consequently, limited funding may underpin the infancy of Australia’s oncology rehabilitation provision. In response, survivors are anticipated to increasingly seek private healthcare to meet their rehabilitation needs or live with reduced QoL and additional functional challenges. To close the gap between demand for rehabilitation and service availability radical reform is required. At this macro-level occupational therapists can contribute to the solution by advocating for the incorporation of oncology rehabilitation into standard survivor care and through establishment of private oncology rehabilitation programs. Further, addressing problematic long-term symptoms that disproportionately impact QoL, such as cancer-related fatigue, is of value.

3. Cancer-related fatigue (CRF)

3.1. CRF definition and prevalence among survivors

Increased cancer survivorship means more people are living with CRF. CRF is the most distressing symptom cancer survivors report, causing greater distress than pain or nausea which is often managed with medication (NCCN, 2018; Stone et al., 2000). CRF is associated with the cancer disease itself or cancer treatment with 60-96% of people experiencing fatigue as a side effect of common cancer treatments such as chemotherapy and radiation therapy (Wagner & Cella, 2004). Long-term fatigue, persisting for up to a decade post treatment completion, is experienced as problematic by approximately 30% of survivors (Brearley et al., 2011; Minton et al., 2013). No universal definition or assessment measure(s) exist for CRF which contributes to inconsistencies in reported prevalence rates (Barsevick et al., 2010; Donovan, McGinty & Jacobsen, 2013; Minton et al., 2013). Reliance on self-report measures and differences in how CRF is measured between outcome measure instruments may additionally contribute to prevalence rate inconsistencies. The NCCN’s CRF definition is most widely cited in the literature (Minton et al., 2013) and defines CRF as a “distressing, persistent, subjective sense of physical, emotional, and/or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning” (NCCN, 2018, pg.MS-3). The key distinction between fatigue experienced by healthy people and CRF is that CRF is disproportionate to exertion and not relieved by rest (Ryan et al., 2007).
3.2. Current understanding of CRF

CRF is poorly understood, however, its aetiology and influencing mechanisms are considered multifactorial (Horneber, Fischer, Dimeo, Rüffer, & Weis, 2012; Ryan et al., 2007; Wagner & Cell, 2004). Serotonin dysregulation, hypothalamic–pituitary–adrenal axis dysfunction, circadian rhythm disruption and increased proinflammatory cytokines are several possible pathophysiological factors causing CRF (Ryan et al., 2007). Dysregulation of proinflammatory cytokines is one of the most researched causes of CRF. It is hypothesised that cancer tumours and cancer treatments activate the proinflammatory cytokine network, sending signals via the central nervous system that trigger fatigue responses (Bower, 2014). Additionally, CRF may be influenced by: comorbid conditions including anaemia, nutritional disorders, infections; comorbid symptoms including pain, sleep disturbances, physical deconditioning due to lack of activity; and psychosocial factors including depression, anxiety and stress reaction (Horneber et al., 2012; Wagner & Cell, 2004). Emerging understanding of CRFs underlying mechanisms contributes to CRF being frequently underdiagnosed and undertreated by health professionals (Minton et al., 2013). Diversity of CRF presentation in individuals further contributes to underdiagnosis. Research has commenced into the existence of CRF phenotypes aligned to different phases including: active treatment, survivorship and palliative care (Olson, Saligan & Piper, 2018). For example, CRF symptoms such as weakness more commonly occur in palliative patients versus women undergoing chemotherapy for breast cancer (Olson et al., 2018). Therefore, phenotypes may support increased CRF diagnosis as health professionals would have greater clarity on CRFs presentation throughout the survivorship journey. Phenotypes could also be valuable for developing more precise CRF interventions aligned to the characteristics of each phenotype.

3.3. Implications for cancer survivors and occupational therapists

Lack of clarity about which individual, or cluster of, underlying mechanisms are causing CRF for an individual complicates intervention prescription to alleviate each survivors’ CRF. Despite the challenges, occupational therapists are trained in strategies to support symptom management. For example, an occupational therapist may collaborate with a survivor to implement sleep hygiene strategies, such as sleep environment and behaviour modifications, to minimise sleep disturbance subsequent to circadian rhythm disruption. However, given the emphasis on usual functioning interference in the CRF definition, this is the more pertinent focus for occupational therapists.
4. Connecting CRF with activity performance and participation

4.1. Connecting ‘functioning’, activity performance, participation and occupational therapy

CRF’s interference with usual functioning is distressing for cancer survivors (NCCN, 2018). Minton et al. (2013) connected usual functioning to the World Health Organisation’s (WHO) International Classification of Functioning, Disability and Health (ICF); as the ICF provides a universally available, common language between health professionals and cancer survivors this framework has been used to conceptualise the impact of CRF on usual functioning. Akin to occupational therapy, the ICF adopts a biopsychosocial perspective by integrating medical and social models of disability, this perspective also supports understanding of CRF’s biopsychosocial mechanisms. Further, comparability of different outcome measures is supported through connection to the ICF framework (Cieza, Fayed, Bickenbach & Proding, 2016).

According to the ICF, functioning is influenced by environmental and personal factors and is defined and conceptualised as the interaction between an individual’s physiological and psychological function, their anatomical structures, and performance of daily activities and participation in life roles (WHO, 2013). The ICF contains nine activity and participation domains including: self-care; domestic life; relationships; community, social and civic life (WHO, 2017). ‘Activities’ are actions and tasks executed by individuals and ‘participation’ is involvement in life situations (WHO, 2013). Activity and participation components can describe either a person’s highest probable level of function at a point in time (‘capacity qualifier’) or what the person ‘does’ in the context they live in (‘performance qualifier’) (WHO, 2017). Concern with the individual’s lived experience would be prioritised when applying an occupational therapy lens. Therefore, by understanding how CRF impacts on everyday activity performance and participation, occupational therapists can support strategies to reduce CRF’s interference with usual functioning. Given synergies between the founding purpose of the occupational therapy profession – “to enable people to participate in the activities of everyday life” (World Federation of Occupational Therapists [WFOT], 2012, para.1) and the challenges experienced by survivors living with CRF it would be expected that occupational therapists are intrinsically involved in CRF management. However, limited literature connects occupational therapy and CRF as will be examined later in this review.
4.2. Framework for occupational therapy practice in CRF

Nevertheless, a conceptual framework has been developed to guide occupational therapy CRF practice and future research (Purcell, Fleming, Haines & Bennett, 2009) (see Figure 1). A key framework strength is presentation of the complex CRF construct in an easy to comprehend diagram that directly connects the fatigue symptom experience with occupational performance and QoL impacts. Further, the framework encourages occupational therapists to understand and address symptom correlates and functional impacts of CRF. Opportunity exists to develop the framework further by including ‘participation’ within the ‘functional impact’ component of the framework. Explicitly connecting occupational or activity performance, participation and QoL would acknowledge the effect functional difficulties may have on participation restrictions (Deimling, Sterns, Bowman & Kahana, 2007), better align with the ICF model and the foundational purpose of the occupational therapy profession.

![Framework of factors associated with CRF (for occupational therapists)](image)

4.3. Implications for occupational therapists

Conceptualising activity performance and participation in everyday life as the outcome of ‘usual functioning’ that CRF interferes with provides occupational therapists with a niche focus area within CRF management that embraces the profession’s founding purpose. Updating occupational therapy CRF frameworks to incorporate participation will support therapists to holistically respond to the needs of survivors living with CRF.
5. Living with CRF

5.1. CRF adversely impacts activity performance, participation and quality of life

A US population-based study reported cancer survivors were approximately 1.5 times more likely to experience restricted participation in life situations and physical performance limitations than people without a cancer diagnosis (Ness, Wall, Oakes, Robison & Gurney, 2006). However, while conducting this review, as has been observed previously (Behringer et al., 2016; Holley, 2000; Purcell et al., 2009), the majority of CRF literature adopts a biomedical focus, concerned with prevalence, CRF mechanisms or modulating factors – less is known about the lived experience of survivors with CRF. Several studies have investigated the specific impact of CRF on the lives of survivors and have identified reduced daily activity performance and restricted participation in employment and life situations. One frequently referenced (Barsevick et al., 2013; Cramp & Byron-Daniel, 2012; Pergolotti, Williams, Campbell, Munoz & Muss, 2016; Purcell et al, 2009) American phone survey study by Curt et al. (2000) found 91% of survivors experienced fatigue (275 participants) and CRF prevented them living a normal life. Difficulties reported included: cognitive and emotional function, daily activity performance and reduced employment participation. Despite a relatively small sample size and being conducted almost two decades ago, when CRF understanding was less developed than it is today, this study is perpetually the only reference provided in the literature in support of the adverse impact of CRF on a survivor’s daily life. The frequency with which this study is used to support the connection between CRF and decreased daily activity performance and participation implies establishing this connection is important. However, raises questions about why additional, more recent studies have not been referenced or conducted.

Recent studies supporting the connection between CRF and decreased participation have been published. One large European study reported significant adverse impacts of CRF on employment participation (Behringer et al., 2016). The study involving 3,759 adult Hodgkin lymphoma survivors reported people experiencing severe fatigue had significantly less employment/formal education participation at five-years post-therapy compared with survivors without fatigue (57% versus 84% participation respectively, P<.001) (Behringer et al., 2016). Further, CRF was associated with increased financial difficulties. Small qualitative studies have identified CRF as the most problematic factor limiting participation in meaningful leisure activities for Australian colorectal survivors (Shipp, McKinstry & Pearson, 2015); employment for survivors of childhood cancer (Berg & Hayashi, 2013).
and social activities for breast cancer survivors (Fleischer & Howell, 2017). An in-depth interview study involving 17 survivors with mixed diagnosis, provides an illustrative example of how CRF impacted one 66-year-old male who described how he stopped answering the phone “because it was work to talk” (Holley, 2000, p. 93). For older cancer survivors reduced social participation increases the risk of social isolation (Deimling et al., 2007).

Further, CRF has been connected to reduced QoL. Two large survey-based studies, each involving more than 1,900 breast cancer participants, investigated the relationship between CRF and QoL and reported an inverse relationship between higher CRF and lower physical functioning and social functioning aspects of QoL (Bower et al., 2000; Schmidt et al., 2012). However, understanding why CRF adversely impacts QoL may be uncovered through deeper understanding of the participation experience of survivors. Participation in meaningful activity has been reported as the strongest predictor of QoL (p < 0.0001) in a study involving 567 long-term rectal cancer survivors (McMullen et al., 2017). Moreover, the occupational therapy literature explicitly connects increased participation with improved QoL and has stated occupational therapy maximises QoL “through effective solutions that facilitate participation in everyday living” (American Occupational Therapy Association [AOTA], 2018, para.1). Therefore, QoL may be considered an outcome of meaningful participation. Consequently, increased participation in meaningful activity may lead to improved QoL (Pergolotti, Cutchin & Muss, 2015) for survivors living with CRF.

5.2. Implications for cancer survivors and occupational therapists

Participation limitations subsequent to CRF are problematic for cancer survivors. Given participation is a core component of ‘usual functioning’ and a key contributor to QoL increased focus on survivors’ participation experience is important and may provide greater insight into effective interventions for improving CRF. Yet, given the frequent use of QoL outcome measures in oncology and CRF research, obtaining granular data on survivor’s participation experience is challenging. Therefore, occupational therapists have an opportunity to apply their expertise in ‘enabling participation’ to conduct participation-focused research as a foundation for future CRF intervention development. However, currently occupational therapists appear to have minimal involvement in CRF management.
6. Opportunity for occupational therapy in CRF – closing the participation evidence gap?

6.1 Information about current occupational therapy practice in CRF management is limited

Occupational therapy services are underutilised in cancer survivorship care (Hwang, Lokietz, Lozano & Parke, 2015; Pergolotti, Cutchin, Weinberger & Meyer, 2014) and numerous authors have argued for increased occupational therapy involvement (Baxter, Newman, Longpré & Polo, 2017; Hunter, Gibson, Arbesman and D’Amico, 2017a; Pergolotti et al., 2016; Rijpkema, Van Hartingsveldt & Stuiver, 2018; Sleight & Duker, 2016). Pergolotti et al. (2016) justify the need for greater occupational therapy involvement by highlighting unmet cancer survivor needs occupational therapists can support, for example activity limitations. Within CRF management, the unmet need this review has identified is supporting survivors’ meaningful participation. Despite stating occupational therapists have the skills to effectively support CRF management, literature from over a decade ago (Lowrie, 2006; Purcell et al., 2009) highlighted the paucity of published evidence supporting the occupational therapy role in CRF management.

Limited yet conflicting information still exists to explain the role of occupational therapists in CRF management. A small UK study exploring typical involvement of occupational therapists with breast cancer survivors showed 1% of therapists’ time was spent on fatigue management (Vockins, 2004). In the same study, another 1% of therapists’ time was spent on self-care - not enabling participation in leisure or productivity activities. In contrast, among a small sample of Australian occupational therapists, 90.7% (185 respondents) identified fatigue and energy conservation as the second most common issue they addressed, behind equipment provision (94.1%) (Buckland & Mackenzie, 2017). Further, 66.2% of respondents supported return to participation in meaningful activities, including leisure, however, only 39.2% of respondents supported return to work (Buckland & Mackenzie, 2017). It is unclear whether participation in self-care was included in ‘meaningful’ activity participation data, however, it is probable given the study discusses concerns regarding neglecting to focus on leisure and productivity subsequent to a primary focus on self-care. Therefore, while further research is required to better understand the degree and nature of occupational therapists’ current involvement in CRF management, it is likely enabling self-care participation is the current core focus.
6.2. Evidence for participation focused occupational therapy in survivor care is emerging

Beyond limited awareness among healthcare professionals and survivors, underutilisation of occupational therapy in cancer care may be contributed to by limited studies supporting its effectiveness (Rijpkema et al., 2018). Two systematic reviews conducted by Hunter et al., (2017a & 2017b) included 138 articles investigating the effectiveness of non-pharmacological cancer rehabilitation interventions, on activity and participation needs of adult cancer survivors. In other areas of practice, activity and participation needs would be considered within the scope of occupational therapy. Physical activity, symptom management, psychosocial, sexuality, return-to-work and multi-disciplinary rehabilitation were among interventions identified. Strong evidence was reported for exercise in CRF management, with moderate evidence for cognitive-behavioural therapy (Hunter et al., 2017a). However, occupational therapists were not involved in the majority of studies included in this review (Hunter et al., 2017a), despite the latest version of the AOTA Occupational Therapy Practice Guidelines for Cancer Rehabilitation with Adults being based on the findings of these two systematic reviews (Braveman & Hunter, 2017). Consequently, increased quality intervention research is required, to validate effective interventions conducted by occupational therapists.

Randomised controlled trial (RCT) evidence for occupational therapy interventions that investigate participation within cancer populations is growing. Findings from RCT studies have been recently published (Petruseviciene, Surmaitiene, Baltaduoniene & Lendraitiene, 2018; Pilegaard et al., 2018), the CAnceR REhabilitation (CARE) Program RCT is underway (Pergolotti et al., 2015) and future RCT protocols are available (Lozano et al., 2016). A Danish RCT involving 242 participants with advanced cancer aimed to improve activities of daily living motor ability and reduce participation restrictions (Pilegaard et al., 2018). However, the ‘home-living’ occupational therapy intervention was not effective in maintaining or improving activity performance, participation or QoL (Pilegaard et al., 2018). Conversely, a Lithuanian RCT involving 22 breast cancer survivors that investigated an occupation-based community intervention, reported significantly greater participation in meaningful activities for the intervention group versus usual care control (Petruseviciene et al., 2018). Although, no significant inverse relationship was identified between CRF and meaningful activity engagement (Petruseviciene et al., 2018), notably this is in contrast to the CRF and QoL inverse relationship highlighted previously (Schmidt et al., 2012), suggesting the relationship between CRF, participation and QoL is not straightforward.
6.3. Limited occupational therapy CRF intervention studies have been identified

One RCT (Purcell, Fleming, Burmeister, Bennett & Haines, 2011) and three pilot studies (Harrison-Paul & Drummond, 2006; O’Brien, Loughnan, Purcell & Haines, 2014; Yuen, Mitcham & Morgan, 2006) were identified that investigate occupational therapy interventions for CRF. None of the studies reported significant improvement in overall CRF, however, one study reported significant reduction in sensory fatigue (Yuen, 2006). Further, due to recruitment and data collection challenges no results or conclusions were reported in one study (Harrison-Paul & Drummond, 2006). Energy conservation training (Yuen, 2006), a multimodal intervention program (Harrison-Paul & Drummond, 2006), group-based (Purcell et al., 2011) and individual (O’Brien et al., 2014) fatigue education and support programs were the interventions explored. Interestingly, significant within group improvements were identified for vigorous and moderate physical activity participation for participants undergoing radiotherapy that received the group fatigue education intervention pre-radiotherapy (Purcell et al., 2011). Though, activity participation did not improve when a modified version of the same fatigue education intervention was trialled in participants undergoing radiotherapy and/or chemotherapy (O’Brien et al., 2014). Overall, given the limited number and effectiveness of occupational therapy intervention studies for CRF management it is reasonable to assume underutilisation of occupational therapy may be a consequence of a weak evidence-base. Additionally, inadequate measurement options for activity and participation may influence study findings.

Occupational therapy involvement in CRF may be further limited by minimal mentions of occupational therapy in CRF guidelines. For example, occupational therapy is referred to three times in the 2018 NCCN CRF guidelines, each occurrence is in reference to seeking rehabilitation services. The majority of ‘general’ strategies recommended for CRF management during active treatment, post treatment and end-of-life phases (outlined on page FT-5, NCCN, 2018), such as: energy conservation techniques, assistive devices, emphasis on meaningful interactions, do not mention occupational therapy involvement. Therefore, opportunity exists for occupational therapists to immediately advocate for greater involvement in CRF management and by applying specialised professional skills implement existing recommendations with greater precision leading to better outcomes for cancer survivors. However, responding to the participation limitations evidence gap, through high-quality occupational therapy intervention studies, is a significant opportunity to demonstrate
value and raise awareness among healthcare professionals about relevant occupational therapy skills.

6.4. Proliferation of CRF intervention literature - limited attention focused on participation

Hunter et al. (2017a & 2017b) identified a significant evidence gap pertaining to the lack of focus on participation outcomes within included articles. The absence of RCTs, systematic reviews or guidelines addressing participation limitations among cancer survivors has also been identified within rehabilitation literature (Egan et al., 2013). As stated by Hunter et al. (2017), within symptom management, which includes CRF, more occupational therapy research that focuses on return to participation interventions, particularly return to work, is required to address the evidence gap. For survivors living with CRF, effective interventions supporting return to participation in life situations are expected to increase QoL given participation limitations are most frequently attributed to CRF.

Despite the proliferation of intervention studies and systematic reviews within the CRF literature, a rapid review supported the absence of a participation limitation focus. A recent scoping review, searching literature from database inception until August 2014, identified 37 systematic reviews and 447 CRF intervention studies that met stated inclusion criteria (Pearson, Morris, Stefano & McKinstry, 2018). The review reported emerging evidence to support CRF intervention effectiveness, with exercise, pharmacological, mind-body therapies, psycho-education and multi-modality interventions the most commonly studied (Pearson et al., 2018). Six studies were categorised as ‘rehabilitation’ and were described as incorporating a focus on activity and participation outcomes, however, it was beyond the scope of the review to provide further detail. Additional interrogation of supplementary files confirmed overcoming participation limitations were not an explicit focus of these studies. However, one study did use the Community Integration Questionnaire (CIQ) to identify home, social and productivity participation (Gehring et al., 2009).

Further, an additional 30 systematic reviews and/or meta-analysis were identified during development of this literature review, published from September 2014 to December 2018 (see Table 1). These reviews included ‘cancer’ and ‘fatigue’ in the title, except for one which referred to primary brain tumour, however, abstract review identified the tumours as cancerous. Overall, 14 reviews (47%) focused on physical activity interventions; followed by 5 reviews (17%) focused on physical and touch mind-body interventions including
acupuncture, tai chi and yoga. Reviews including multiple intervention categories limited to brain, thyroid and prostate cancer populations were published in 2016 (Day et al.), 2015 (To et al.) and 2014 (Larkin, Lopez & Aromataris). Systematic reviews and meta-analyses covering multiple categories of CRF intervention, for example, physical activity and mind-body interventions, without restriction to specific cancer diagnosis were published in 2018 (Hilfiker et al.) and 2017 (Mustian et al.). Inspection of these recent systematic reviews did not identify an explicit focus on survivor’s participation outcomes. Several reviews focused on overall QoL (see Table 1). One Cochrane review, led by an occupational therapist, briefly mentioned CRF’s connection to participation limitations and extracted data relevant to capacity to perform activities of daily living, physical functioning and global QoL (Bennett et al., 2016). Dennett et al., 2016 briefly discussed activity performance in everyday activities, however, primarily focused on functional activities (i.e. 6-minute walk test). Another Cochrane review extracted domain level data from QoL outcome measures, including physical functioning, role functioning and social functioning, which supports greater insight into survivors’ participation experience, however, did not discuss participation impacts (Poort et al., 2017). Similar to Poort et al. (2017), high-quality systematic reviews have investigated the impact of exercise interventions on overall health-related QoL using domain-level data across the survivorship continuum (Mishra et al., 2012a; Mishra et al., 2012b). However, approaching the reviews from an exercise perspective the authors do not explicitly connect their findings to survivors’ everyday activity performance or participation experiences instead focus on intervention mechanisms including optimal mode or intensity. Overall, an evidence gap pertaining to participation outcomes appears apparent within CRF literature, however, when an occupational therapy perspective is incorporated the focus on survivors’ lived experience improved.
<table>
<thead>
<tr>
<th>Year</th>
<th>No. published</th>
<th>Intervention type</th>
<th>References (First author)</th>
<th>Participation focus</th>
<th>Domain level QoL</th>
<th>Global QoL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>7</td>
<td>Physical activity (4)</td>
<td>Brandenbarg, Horgan, Kessels, Oberoi</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mind-Body (2)</td>
<td>Song, Zhang</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multiple intervention types (1)</td>
<td>Hilfiker</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>9</td>
<td>Physical activity (4)</td>
<td>Juvet, Kelley, Lipsett, Yang</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical activity and nutrition therapy (1)</td>
<td>Baguley, Duong</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mind-Body (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multiple intervention types (1)</td>
<td>Mustian, Seiler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Online intervention delivery (1)</td>
<td>Poort</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Psychosocial (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>5</td>
<td>Physical activity (2)</td>
<td>Dennett, Tian</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mind-Body (1)</td>
<td>O'Neill</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multiple intervention types (1)</td>
<td>Day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Psychosocial (1)</td>
<td>Bennett</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>5</td>
<td>Physical activity (3)</td>
<td>Meneses-Echávez (a), Meneses-Echávez (b)</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Paramanandam</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multiple intervention types (1)</td>
<td>To</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Psychosocial (1)</td>
<td>Du</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014*</td>
<td>4</td>
<td>Physical activity (1)</td>
<td>Tomlinson</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mind-Body (1)</td>
<td>Ling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multiple intervention types (1)</td>
<td>Larkin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Expressive - Music (1)</td>
<td>Tsai</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Includes reviews from September-December

* Both studies include activity performance as a secondary outcome and discuss performance in the context of everyday activities.
7. QoL outcome measures evaluate participation to a limited degree

7.1. Overview of common QoL outcome measures used in CRF research

The comprehensiveness of QoL outcome measures to determine participation in meaningful life situations is limited (Brockow et al., 2004; Van der Mei, Dijkers & Heerkens, 2011). However, cancer-specific QoL instruments, such as the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC-QLQ-C30) and Functional Assessment of Cancer Therapy (FACT-G), and generic instruments such as the Short Form-36 (SF-36) survey, are frequently used as outcome measures in oncology research (Ferrans, 2007; Ghislain et al., 2016). In contrast, the minimal studies conducted by occupational therapists have measured participation using more precise measures. Measures used include the Impact on Participation and Autonomy Questionnaire (IPAQ) (Pilegaard et al., 2018) and the Frenchay Activities Index (FAI) to measure leisure and self-care activity participation (Purcell et al., 2011). Given the majority of CRF intervention studies have not been conducted by occupational therapists, understanding which domains and/or questions within commonly used QoL outcome measures do relate to participation is important. This knowledge supports greater understanding of whether interventions that improve CRF also improve participation.

7.2. Connecting QoL measures to activity and participation using the ICF framework

Multiple studies have linked the SF-36 (Cieza et al., 2002), the EORTC-QLQ-C30 (Letellier, Dawes & Mayo, 2015), and the FACT-G (Van der Mei et al., 2011) to the ICF. Differences in mapping approaches makes direct comparison challenging, however, all studies identified gaps in participation measurement. To illustrate the connection between the most frequently used QoL outcome measures and ICF activity performance and participation components the most recent revision of Cieza et al.’s (2016) ICF linking rules were applied (see Table 2). Questions relating to common occupational categories of self-care, productivity, leisure and social participation were the focus.

7.3. Implications for cancer survivors and occupational therapists

Survivors’ lived experience of participation restrictions may be inadequately measured, reported and subsequently evaluated due to reliance on QoL outcome measures in oncology research. Occupational therapists demonstrate selection of outcome measures that evaluate participation with increased granularity. Measuring increased participation in meaningful occupations and life situations is important when evaluating effectiveness of occupational therapy interventions (Dunford, Bannigan & Wales, 2013) and should be increasingly considered within CRF research.
### Table 2: Illustrative example of frequently used QoL outcome measures mapped to ICF framework. Note: Not intended to be an exhaustive list of measures.

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Domain/most indicative of performance and participation</th>
<th>Example of item in each domain</th>
<th>Perspective adopted</th>
<th>Response options</th>
<th>Response option classification</th>
<th>Main concept: What is this information about?</th>
<th>ICF Category of main concept</th>
<th>For domain, % questions directly related to everyday activity performance/participation?</th>
</tr>
</thead>
<tbody>
<tr>
<td>EORTC QLQ-C30</td>
<td>Physical Functioning</td>
<td>Do you need help with eating, dressing, washing yourself or using the toilet?</td>
<td>Needs or dependency</td>
<td>Not at all; A little; Quite a bit; Very much</td>
<td>Intensity</td>
<td>Performance of self-care activities</td>
<td>d550 Eating, d540 Dressing, d510 Washing oneself, d520 Using the toilet</td>
<td>5/5 questions &gt; 100%</td>
</tr>
<tr>
<td></td>
<td>Work Functioning</td>
<td>Were you limited in either your work or other daily activities?</td>
<td>Descriptive; Performance</td>
<td>Not at all; A little; Quite a bit; Very much</td>
<td>Intensity</td>
<td>Participation in life roles</td>
<td>d359 Remunerative employment (work), d230 Carrying out daily routine (daily activities)</td>
<td>2/2 questions &gt; 100%</td>
</tr>
<tr>
<td></td>
<td>Social Functioning</td>
<td>Has your (physical condition or) medical treatment interfered with your social activities?</td>
<td>Descriptive; Performance</td>
<td>Not at all; A little; Quite a bit; Very much</td>
<td>Intensity</td>
<td>Social participation</td>
<td>d229 Recreation and leisure, d3205 Socialising</td>
<td>2/2 questions &gt; 100%</td>
</tr>
<tr>
<td></td>
<td>Pain (Syndrom)</td>
<td>Did pain interfere with your daily activities?</td>
<td>Descriptive; Performance</td>
<td>Not at all; A little; Quite a bit; Very much</td>
<td>Intensity</td>
<td>Pain interference with performance of daily activities</td>
<td>d220 Carrying out daily routine (daily activities)</td>
<td>1/2 questions &gt; 50%</td>
</tr>
<tr>
<td></td>
<td>Global Health Status/Quality of Life</td>
<td>How would you rate your overall quality of life?</td>
<td>Appraisal</td>
<td>1 (very poor) to 10 (excellent)</td>
<td>Intensity</td>
<td>Quality of life</td>
<td>Not covered - Quality of Life</td>
<td>0/2 questions &gt; 0%</td>
</tr>
<tr>
<td>FACT-G</td>
<td>Functional Well-being</td>
<td>Am able to work (include work at home)</td>
<td>Descriptive; Performance</td>
<td>Not at all; A little; Somewhat; Quite a bit; Very much</td>
<td>Intensity</td>
<td>Performance of productivity activities</td>
<td>d359 Remunerative employment (work), d540 Doing housework, (housework)</td>
<td>4/7 questions &gt; 57%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Am enjoying the things I usually do for fun</td>
<td>Descriptive; Performance</td>
<td>Not at all; A little; Somewhat; Quite a bit; Very much</td>
<td>Intensity</td>
<td>Participation in leisure</td>
<td>d220 Recreation and leisure</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Because of my physical condition I have trouble meeting the needs of my family</td>
<td>Descriptive; Performance</td>
<td>Not at all; A little; Somewhat; Quite a bit; Very much</td>
<td>Intensity</td>
<td>Participation in life roles</td>
<td>d599 Assisting others (household members)</td>
<td>2/3 questions &gt; 20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Am forced to spend time in bed</td>
<td>Descriptive; Performance</td>
<td>Not at all; A little; Somewhat; Quite a bit; Very much</td>
<td>Intensity</td>
<td>Interference in performance of daily activities</td>
<td>d230 Carrying out daily routine (daily activities)</td>
<td></td>
</tr>
<tr>
<td>SF-36</td>
<td>Physical Functioning</td>
<td>Does your health limit you in: Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling or playing golf?</td>
<td>Descriptive; Performance</td>
<td>Yes, limited a bit; Yes, limited a little; No, not limited at all</td>
<td>Intensity</td>
<td>Performance of household activities and participation in leisure activities</td>
<td>d430 Lifting and carrying objects (moving a table), d540 Doing housework, (d540 Doing household activities) (pushing a vacuum cleaner), d229 Recreation and leisure (d2201 Sports (including playing golf))</td>
<td>9/10 questions &gt; 100%</td>
</tr>
<tr>
<td></td>
<td>Role limitations due to physical health</td>
<td>During the past 4 weeks, have you had any of the following problems with your work or regular daily activities as a result of your physical health?</td>
<td>Descriptive; Performance</td>
<td>Yes, No</td>
<td>Confirmation or agreement</td>
<td>Participation in life roles</td>
<td>d359 Remunerative employment (work), d230 Carrying out daily routine (daily activities)</td>
<td>4/4 questions &gt; 100%</td>
</tr>
<tr>
<td></td>
<td>Role limitations due to emotional problems</td>
<td>During the past 4 weeks, have you had any of the following problems with your work or regular daily activities as a result of your emotional health?</td>
<td>Descriptive; Performance</td>
<td>Yes, No</td>
<td>Confirmation or agreement</td>
<td>Participation in life roles</td>
<td>d359 Remunerative employment (work), d230 Carrying out daily routine (daily activities)</td>
<td>4/4 questions &gt; 100%</td>
</tr>
<tr>
<td></td>
<td>Social Functioning</td>
<td>During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors or groups?</td>
<td>Descriptive; Performance</td>
<td>Not at all; Slightly; Moderately; Quite a bit; Extremely</td>
<td>Intensity</td>
<td>Social participation</td>
<td>d229 Recreation and leisure</td>
<td>2/2 questions &gt; 100%</td>
</tr>
<tr>
<td></td>
<td>Pain</td>
<td>During the past 4 weeks, how much did pain interfere with your normal work taking both work outside the home and housework?</td>
<td>Descriptive; Performance</td>
<td>Not at all; Slightly; Moderately; Quite a bit; Extremely</td>
<td>Intensity</td>
<td>Pain interference with performance of daily activities</td>
<td>d359 Remunerative employment (work), d540 Doing housework, (housework)</td>
<td>1/2 questions &gt; 50%</td>
</tr>
</tbody>
</table>
8. Conclusion

Unprecedented growth of the cancer survivor population is projected into the future. In Australia, demand for cancer survivorship care is expected to continue to outstrip supply for the foreseeable future as oncology rehabilitation is not yet well-developed. Subsequently, more survivors are expected to live with CRF, which is the most prevalent and distressing symptom reported. Emerging understanding of the underlying mechanisms of CRF, multiple influencing factors and diverse presentations contribute to CRF being underdiagnosed, undertreated and complicates intervention prescription. For survivors, CRF may restrict participation in meaningful life situations involving social, productivity and leisure activities and this is problematic because participation in meaningful activities is connected with QoL. However, currently in oncology research, and CRF research specifically, limited research considers participation limitations or investigates return to participation interventions. Addressing this evidence gap may provide useful in improving CRF management through greater understanding of survivors lived CRF experience and development of corresponding interventions.

As a profession founded on enabling participation in everyday life activities, occupational therapy may provide a critical and valuable contribution to closing this evidence gap. Yet, occupational therapy is underutilised in cancer survivorship care and little is known about the role of occupational therapy in CRF management. Despite the explosion of CRF literature in the past decade, limited intervention studies have been conducted by occupational therapists. Consequently, health professionals with differing frames of reference have conducted the majority of studies and QoL outcome measures have been most frequently used to measure concepts related to participation. However, the extent to which QoL instruments measure participation is questionable. Therefore, a comprehensive review of the CRF research is required to identify whether interventions effective for CRF also have an impact on everyday activity performance and participation outcomes for survivors. It is anticipated this ‘current state’ view would provide future researchers with valuable knowledge to inform studies that seek to close the identified evidence gap.
References


SECTION II: JOURNAL MANUSCRIPT
TARGET JOURNAL:
Australian Occupational Therapy Journal (see Appendix I – author guidelines)

TITLE:
The impact of cancer-related fatigue non-pharmacological interventions on activity performance and participation outcomes in adult cancer survivors: A systematic review.

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Jodie Schroder conducted review, interpreted data and wrote manuscript. Lynette Mackenzie supervised development of work, co-conducted abstract screening, supported data interpretation, development and edit of manuscript.

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CONFLICT OF INTEREST STATEMENT:
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Number of tables: 3
Number of figures: 1
Number of references: 49 (20 ‘usual’ & 29 systematic review data)

Keywords: neoplasms, cancer related fatigue, survivorship, participation, occupational therapy
ABSTRACT

Introduction: Increased cancer survivorship means more people are living with cancer-related fatigue (CRF). CRF is the most distressing symptom survivors experience and is associated with activity performance limitations, restricted participation in meaningful life roles and reduced quality of life. As a profession founded on enabling participation in everyday life activities, occupational therapy may contribute to improved outcomes for survivors living with CRF. Yet, there is a paucity of oncology research focused on return to participation interventions. This systematic review aimed to identify whether non-pharmacological interventions effective in minimising CRF also have an impact on everyday activity performance and participation outcomes for adult cancer survivors.

Methods: The study was a systematic review with narrative synthesis. Eight databases were searched (Medline, CINAHL, PsychINFO, EMBASE, Scopus, OT Seeker, CENTRAL, Cochrane SR database), from 1998-2018 and was limited to studies published in English. Eligibility criteria included: Randomised controlled trials of non-pharmacological CRF interventions in adult cancer survivors with fatigue measured as a primary outcome and activity performance, participation or related measured as a primary or secondary outcome.

Results: The search strategy identified 5762 non-duplicate records, of which 29 studies (0.5%) met the inclusion criteria. In 28 studies (97%) quality of life, not participation or activity performance, was investigated as a primary or secondary outcome. Correspondingly, instruments measuring quality of life were used in 28 studies (97%). Three studies (10%)
used more precise instruments to measure participation, however, outcomes were not always reported. No obvious pattern of impact was identified between intervention type and survivors’ quality of life subscale data.

**Conclusion:** Review findings indicate there is insufficient evidence to determine whether survivors’ activity performance and participation is impacted by CRF interventions. Consideration of the sensitivity and precision of quality of life instruments to measure activity performance and participation should be incorporated into future CRF research designs.
INTRODUCTION

Why is the problem the study addresses important?

Globally, increasing numbers of people are living beyond a cancer diagnosis and are referred to as cancer survivors. Subsequently, more survivors are expected to live with cancer-related fatigue (CRF), which is reported as the most prevalent and distressing symptom by survivors. Despite no universal definition, CRF is commonly defined as: “a distressing, persistent, subjective sense of physical, emotional, and/or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning” (National Comprehensive Cancer Network [NCCN], 2018, pg.MS-3). The World Health Organisation’s International Classification of Functioning (ICF) model defines and conceptualises ‘functioning’ as the interaction between the individual their daily activities and participation in life roles and situations (World Health Organisation [WHO], 2013). ‘Activities’ are actions and tasks executed by individuals and ‘participation’ is involvement in life situations (WHO, 2013). For survivors, living with CRF may restrict participation in meaningful life situations involving social, productivity and leisure activities and this is problematic because participation in meaningful activities is connected with quality of life (QoL).

What is lacking in the current knowledge?

Synergies between the focus of occupational therapy on enabling participation and the challenges experienced by survivors living with CRF suggests opportunity for considerable occupational therapy involvement in CRF management. A recent systematic review identified gaps in oncology research pertaining to minimal occupational therapy involvement in
symptom management, including fatigue, and limited focus on participation restrictions and return to participation interventions (Hunter, Gibson, Arbesman and D’Amico, 2017). Addressing this evidence gap may provide useful in improving CRF management through greater understanding of survivors lived CRF experience and development of corresponding interventions to address participation challenges. Yet, occupational therapy is underutilised in cancer survivorship care and little is known about the role of occupational therapy in CRF management (Purcell, Fleming, Haines & Bennett, 2009). CRF intervention research has proliferated in the past decade, yet little attention has been paid to the impact of interventions on the everyday life and participation experiences of survivors. To respond to the call for more research to better understand survivor’s participation experience and inform intervention development (Egan et al., 2013; Hunter et al., 2017), a comprehensive review of the CRF research is required to identify what is currently known about the impact of CRF interventions on activity performance and participation. A summary of the current state of the literature is anticipated to provide future researchers with valuable knowledge to inform studies that seek to close the identified evidence gap.

Study aim…

Therefore, this systematic review aimed to identify existing evidence for non-pharmacological CRF interventions that measured and reported on concepts related to activity performance and participation. The review addresses the question: Do interventions that are effective for CRF also have an impact on everyday activity performance and participation in adult cancer survivors?
METHODS

This study was a systematic review of randomised trials and was reported in accordance with PRISMA guidelines (Moher, Liberati, Telzlaff & Altman, 2009). The study protocol is registered with the International Prospective Register of Systematic Reviews (PROSPERO registration no: #111124).

Eligibility criteria

- **Types of studies:** Published randomised controlled trials (RCTs) studying the effects of a non-pharmacological interventions on CRF were included. Studies in languages other than English were included if the study results were published in an English-language publication. RCT pilot and feasibility studies were excluded as these studies typically inform future RCT development, therefore, are considered lower level evidence. Studies were excluded if they were ineffective in reducing fatigue between groups post-intervention.

- **Types of participants:** Included studies involving adult cancer survivors (18 years and over), irrespective of gender, type of cancer diagnosis, stage of cancer treatment or treatment type.

- **Types of interventions:** Trials comparing any category of non-pharmacological intervention and any modality were included. Included trials compared non-pharmacological interventions with standard care, waitlist control, sham intervention or another intervention. Pharmacological interventions, including herbal supplements, were excluded as their effectiveness in reducing CRF remains uncertain (Bower, 2014; NCCN, 2018). Further, non-
pharmacological interventions excluding over the counter medicines align more closely to the scope of occupational therapy practice and therefore results about their effectiveness may be more directly applied to future practice and research.

- **Types of outcome measures:** Included studies measured fatigue as a primary study outcome and used any self-reported or observed measure of fatigue. Additionally, included studies measured self-reported activity or occupational performance, participation or QoL as a primary or secondary study outcome. Studies that measured QoL were excluded if only global or overall scores were reported as this limited insight about specific items or sub-scales within the measure that focused on an individual’s lived participation experience.

**Search methods**

A key search term strategy developed in consultation with a medical librarian at the University of Sydney was used to identify studies. Medline, CINAHL, PsychINFO, EMBASE, Scopus, OTseeker, Cochrane Database of Systematic Reviews and CENTRAL were the eight databases searched, accessed via the University of Sydney library. Databases were searched from 1998 to August 2018 and limited to English language publications. This timeframe was selected as CRF intervention studies are rapidly proliferating and a twenty-year timeframe allows for identification of the most up-to-date interventions. Search terms included words related to cancer, fatigue and randomised controlled trials (see Appendix II for full search strategy). The last search was run on 7 September 2018.
**Study selection**

After duplication removal, database search results were transferred from EndNote to an Excel workbook for screening. One researcher (JS) reviewed all titles and excluded clearly irrelevant articles. Two unblinded researchers (LM, JS) independently reviewed abstracts against inclusion/exclusion criteria. Disagreement between researchers was resolved through discussion until consensus was reached. Full-text articles were retrieved for eligible studies at conclusion of the abstract screen phase. One researcher (JS) reviewed all articles and determined eligibility against inclusion/exclusion criteria. Reasons for study exclusion were recorded and documented using the PRISMA flow diagram for each phase of study selection.

**Data extraction**

One researcher (JS) completed data extraction for all studies. Data extraction was checked for quality and completeness by the second researcher (LM). A modified Excel version of the Cochrane Collaboration extraction template (Cochrane Public Health Group, 2011) was developed for data extraction. Information extracted included characteristics about the study, study population, intervention, outcome measures and outcomes of significance to the review question including QoL domain data. QoL domain data was extracted for domains directly related to the major occupational areas of self-care, productivity, leisure and social participation. Modest evidence associates pain with CRF (Richardson et al., 2011), therefore, pain subscale data was extracted when items focused on pain interference with everyday activity performance. Where outcome data was available for more than two timepoints, baseline and post-intervention (timepoint one) data were extracted. This decision was based on a lack of obvious comparable timepoints across studies due to heterogeneity, and to minimise factors making it challenging to...
distinguish intervention effects in long term follow-up including: participant attrition, non-adherence, co-intervention and treatment switching (Herbert, Kasza & Bø, 2018).

**Risk of bias in individual studies**

The Physiotherapy Evidence-Based Database scale (PEDro) (see Appendix III) was used to appraise methodological quality of included studies. This tool considers: randomisation, allocation concealment, blinding of participants and personnel, incomplete outcome data and other biases. A score out of 10 is calculated using the scale, with 10 out of 10 indicating the highest quality. Peer-reviewed ratings published in the PEDro database were used to determine study quality. If quality ratings for studies were not published in the database, one researcher (JS) appraised the methodological quality using the PEDro scale. Quality assessment results were not used to exclude studies from the review, however, provide insight into the characteristics of included studies and differentiate between more or less robust studies in the review.

**Data synthesis**

Meta-analysis was not conducted due to heterogeneity between studies. Included studies were heterogeneous in clinical characteristics, methodologies and statistical approaches, therefore statistical meta-analysis was not appropriate as generalisation of results was likely to be invalid. Heterogeneity in terms of active or inactive cancer treatment, type and duration of intervention and outcome measures used were apparent. Therefore, a narrative synthesis was conducted. The synthesis was guided by good practice narrative synthesis principles (Campbell, Katikireddi, Sowden & Thomson (2019) to increase transparency and minimise selective reporting bias. Synthesis was conducted for each category of intervention identified and focused on describing
patterns of outcome on participation or QoL domains for interventions that effectively reduced fatigue. Included studies were organised into four categories aligned with key intervention groups recommended within the NCCN 2018 Guidelines (NCCN, 2018). Categories consisted of: 1) physical activity including exercise and non-traditional physical activity such as yoga; 2) physically-based or ‘hands on’ therapies involving therapies performed on a person by a therapist such as massage; 3) psychosocial interventions such as cognitive behavioural therapies and educational therapies; 4) multimodal interventions where studies included elements from multiple categories and authors stated the intervention was multi-modal or clearly described more than one modality.

RESULTS

Study selection

The search of electronic databases identified 5762 records, after duplicate removal, of which 29 studies (0.5%) met the inclusion criteria. Figure 1 outlines study flow through the inclusion process, including reasons for exclusion of studies. Of the 384 abstracts screened, decisions regarding inclusion of 28 abstracts (7%) were sources of disagreement between researchers. A joint review of these abstracts was conducted and discussed until consensus was reached. Of the 84 records that were reviewed in full, 29 studies (67%) were excluded because they did not measure or report on activity participation, performance QoL at a level that could be interpreted. For example, studies may have reported the global quality of score, however, did not report on individual domain scores which makes it difficult to identify the impact the intervention had on what an individual can do in their daily life.
Study characteristics

The majority of the included 29 studies (93%) were published in the past decade, from 2008 to 2018. Six included studies (21%) were 3-arm RCTs and 23 studies (79%) were 2-arm RCTs. Studies involved 4546 participants and were from 13 different countries. Eight studies were from the USA (28%), followed by five studies from the Netherlands (17%) and three studies from Australia (10%). By region, Europe, as defined by countries within the European Union, had the largest representation with 13 studies (45%). The average mean age of participants across studies was 54.3 years old. This excludes data from two studies as these studies only provided age ranges for participants (Charalambous et al., 2016; Yun et al., 2012). The mean age range across studies was from 46.3 years (Hwang et al., 2008) to 69.3 years (Monga et al., 2007). Studies predominantly involved female participants (24 studies, 86%), that is, 50% or more of participants in the study were female. Two studies (Ben-Josef et al., 2017; Monga et al., 2007) involved only male participants. One study (Furzer et al., 2016) did not report on participant gender therefore was excluded from gender analysis. Participants with a breast cancer diagnosis were strongly represented across 79% of studies. Eleven studies (38%) involved only breast cancer participants, four studies (14%), involved participants with either breast cancer or one other diagnosis; and eight studies (28%) involved mixed diagnosis participants, however, there was significant representation from breast cancer survivors. Six studies (21%) did not include participants with breast cancer and involved participants with pancreas and periampullary cancer, prostate, colon and hematologic cancers. Treatment type and stage varied across studies. Fourteen studies (48%) involved participants undergoing treatment. Participants in nine of these studies were undergoing chemotherapy, while in the remaining five studies participants were undergoing radiation therapy or radiotherapy. Thirteen studies (45%) involved participants who had
completed treatment, within a range of four weeks to five years prior to commencement of study involvement. See Table 1 for detailed study characteristics.

**Intervention**

The most common category of intervention identified in the included studies involved physical activity, with 15 studies (52%) meeting this description. Within this category 11 studies investigated traditional exercise modalities including aerobics and resistance training, and four studies of non-traditional physical activities such as yoga, qigong and Nia (Ben-Josef et al., 2017; Chuang & Chung, 2017; Reis et al., 2013; Vardar Yagli et al., 2015). Interventions of a psychosocial nature were identified in seven studies (24%) and examined the effectiveness of interventions involving education, guided-imagery, energy and activity management. Four studies (14%) were considered multimodal, and exercise was one component in all studies in this category. Finally, three studies (10%) involved physically-based therapies and included bio-healing, reflexology and acupuncture. Of the 29 included studies, 11 studies (38%) included comparison to usual or standard care as one study arm, a further eight studies (28%) compared to waitlist control. See Table 1 for studies organised by intervention category. Of the 3-arm studies included, three studies compared two different types of exercise intensity to usual care (Mijwel et al., 2018; Van Waart et al., 2015) or waitlist control (Kampshoff et al., 2015); two studies included sham interventions as one study arm (Jain et al., 2012; Wyatt et al., 2012); and one study compared live-delivery versus telemedicine delivery of the same intervention (Freeman et al., 2015).

Nursing health professionals, including advanced practice and oncology nurses, delivered interventions in nine studies (31%). Within five of these studies interventions were delivered
in collaboration with other health professionals including physiotherapists, psychologists and exercise physiologists. Physiotherapists were involved in intervention delivery in six studies (21%). Three studies (10%) did not explicitly state the health professional involved in intervention delivery, although this information may be assumed from the professional affiliations of the study authors. Incorporating a ‘group' component into the intervention, involving two or more participants, was reported in eight studies (28%). Intervention delivery typically involved a face-to-face component, with 24 studies (83%) reporting face-to-face interaction. Of the five studies (17%) without a face-to-face component, two studies used phone contact with participants (Barsevick et al., 2004; Yeo et al., 2012), and one study used phone contact if necessary (Galiano-Castillo et al., 2016), and two studies were online interventions (Willems et al., 2017; Yun et al., 2012). Intervention duration varied and ranged from three weeks to six months. Six studies (21%) had an intervention duration of 12 weeks or three months, followed by five studies (17%) with six-week intervention duration.

**Outcome measures**

As per inclusion criteria, all included studies identified fatigue as a primary study outcome. A total of 13 studies (45%), identified a concept related to activity performance, participation or QoL as an additional primary outcome. Most studies within this category (11 studies) identified ‘quality of life’ as the concept of focus, and one study stated functional performance was a primary outcome (Barsevick et al., 2004). One study defined physical functioning within QoL as the primary outcome (Wyatt et al., 2012). Outcomes related to QoL were identified as secondary for the remaining 16 studies (55%) (see Table 1). The vast majority of studies (28 studies, 97%) used at least one QoL outcome measure. One study by Barsevick et al. (2014) used the Functional Performance Inventory (FPI) to measure
functional performance. The European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC-QLQ-C30) was the most frequently used measurement of QoL, used in 14 studies (48%). This was followed by the Functional Assessment of Cancer Therapy (FACT) system of assessments, used in 10 studies (34%); the Medical Outcomes Short Form-36 Health Survey (SF-36) was used in five studies (17%). Two studies (Kampshoff et al., 2015; Van Waart et al., 2015) specifically measured participation in daily living using the Impact on Participation and Autonomy Questionnaire (IPAQ). Further, Van Waart et al. (2015) used a study specific instrument to understand participants' return to work experience. There was limited variation in the granularity of reporting among studies using QoL measures. Twenty-four studies (84%) reported the lowest level domain data for at least one domain; four studies (14%) reported at a level above domain data, for example, reporting the trial outcome index (TOI) score for FACT instruments. See Table 3 for details.

Risk of bias within studies

The mean PEDro scale score for all included studies was six out of 10 (range, 4 to 8). Five studies (17%) were rated by one researcher (JS) using the PEDro scale as these studies did not have a peer reviewed rating in the PEDro database (see Table 2). The majority of nine studies (31%) scored five out of 10 on the PEDro scale. The highest score observed was eight out of 10 and six studies (21%) received this score. The lowest score was four out of 10 and five studies (17%) received this score. All studies specified inclusion and exclusion criteria for study participants, a criterion relating to external validity, however, this criterion is not used to calculate the PEDro score. All 29 studies (100%), used randomised group allocation, reported baseline comparability of groups, between group statistical comparisons, and
provided a point measure and/or measure of variability (items 2, 4, 10 and 11). Seventeen studies (59%) had adequate follow up and used intention-to-treat analysis (items 8 and 9); 16 studies (55%) concealed allocation from participants (item 3); and seven studies (24%) blinded assessors (item 7). No studies (0%) blinded participants or therapists (items 5 and 6), however, given the nature of the interventions of the included studies, blinding of participants and therapists would not be possible.

**Results synthesis**

As per inclusion criteria, all included studies reported statistically significant positive differences in fatigue change between groups post-intervention at timepoint one. Therefore, this results synthesis describes the outcome of interventions on domains of QoL or other previously identified participation measures as reported at timepoint one. Table 3 summarises the results for EORTC-QLQ-C30, FACT-G and SF-36 outcome measures, a ‘tick’ indicates studies reported statistically significant improvement within indicated domains.

**Physical activity interventions**

Eight (53%) of the 15 studies that investigated physical activity interventions to improve CRF used the EORTC-QLQ-C30 to measure QoL. Five of these studies (63%) reported improved physical functioning (Chuang et al., 2017; Galiano-Castillo et al., 2016; Kampshoff et al., 2015; Mijwel et al., 2018; Van Waart et al., 2015); four studies (50%) reported improved role functioning (Chuang et al., 2017; Galiano-Castillo et al., 2016; Kampshoff et al., 2015; Vardar Yagli et al., 2015); three studies reported reduced pain interference in performance of everyday activities (Chuang et al, 2017; Mijwel et al., 2018; Van Waart et al., 2015); and two studies
(25%) (Chuang et al., 2017; Vardar Yagli et al., 2015) reported improved social functioning.

Two studies reported no significant between group differences for domains of interest on the EORTC-QLQ-C30 (Travier et al., 2015; Van Vulpen et al., 2016). A further five studies (33%) used the FACT-G to measure QoL. Three (75%) of the four studies that reported at the subscale level identified improved physical wellbeing (Ben-Josef et al., 2017; Hagstrom et al., 2016; Monga et al., 2007), while one study (Reis et al., 2013) did not; no studies identified significant functional wellbeing improvements. Furzer et al. (2016) reported significant improvement using the FACT TOI score that aggregates physical and functional wellbeing subscales. Yeo et al. (2012) reported significant improvement within intervention group for most subscales of interest using the SF-36, except for role limitations subsequent to emotional health. Hwang et al. (2008) was the only study that measured QoL using the WHOQOL-BREF and reported significant improvements in physical health and social relationship domains. No significant differences were reported by Kampshoff et al. (2015) or Van Waart et al. (2015) when measuring participation using the IPAQ. Subsequently, both studies did not publish IPAQ domain level data, however, Kampshoff et al. (2015) reported lower scores on the ‘problems at work’ IPAQ subscale in favour of the low-to-moderate intensity intervention when compared to control.

**Psychosocial interventions**

The EORTC-QLQ-C30 was used to measure QoL in four (57%) of the seven studies within the psychosocial intervention category. One study (Reif et al., 2013) reported improvement across physical, role and social functioning domains and reduced pain interference; Yun et al. (2012) reported no improvement across these same domains. Willems et al. (2017) reported improved social functioning; Charalambous et al. (2016) reported no improvement in social functioning.
using the EORTC-QLQ-C30. Significant improvement was reported by Alcântara-Silva et al. (2018) using the FACT TOI score. Freeman et al. (2015) reported no significant result for either intervention group using the SF-36 physical and mental component scales. Barsevick et al. (2014) reported no functional performance changes in any of the FPI domains, however, only reported the total score not domain level data.

**Multi-modal interventions**

Two of the four multi-modal studies (Adamsen et al., 2009; Schmitt et al., 2016) reported no significant physical or role functioning improvement using the EORTC-QLQ-C30. However, although Schmitt et al. (2016) reported in-text nil significant difference between the two intervention groups, the associated statistical table reported significant social functioning and pain (P=0.02) differences in favour of the low-to-moderate exercise intensity intervention group. Adamsen et al. (2009) reported significant physical functioning, physical and emotional role limitation improvements using the SF-36, despite reporting no significant between group improvements for EORTC-QLQ-C30 domains. No significant improvement between groups was identified for studies using the FACT-G (Andersen et al., 2013) or SF-36 (Sandler et al., 2017) domains of interests.

*Physically-based / ‘hands on’ interventions*

Jain et al. (2012) identified significant difference between the biohealing intervention and control groups, yet not between the mock healing and control groups using the aggregated physical and functional wellbeing FACT TOI score. Similarly, Wyatt et al. (2012) identified significant SF-36 physical functioning domain difference between the reflexology
intervention and control groups, however, not between the lay manipulation group and control. Molassiotis et al. (2012) was the only study across all intervention categories that reported significant functional wellbeing domain improvements using the FACT-G.
Tables and figures

Figure 1: PRISMA flow diagram
### Table 1: Characteristics of included studies

<table>
<thead>
<tr>
<th>First author</th>
<th>Year</th>
<th>Country</th>
<th>N</th>
<th>Participant diagnosis</th>
<th>Stage of cancer treatment</th>
<th>Mean age (years)</th>
<th>Gender (% female)</th>
<th>2-arm or 3-arm RCT?</th>
<th>Intervention Group</th>
<th>Control Group</th>
<th>Intervention duration</th>
<th>Health professional delivering intervention</th>
<th>Group?</th>
<th>Face-to-face?</th>
<th>Participation QoL primary or secondary?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ban-Josef et al.</td>
<td>2017</td>
<td>USA</td>
<td>48</td>
<td>Prostate cancer</td>
<td>Undergoing external beam radiation therapy</td>
<td>67.3</td>
<td>0%</td>
<td>2-arm</td>
<td>Elischens Yoga</td>
<td>No yoga</td>
<td>6 to 9 weeks</td>
<td>Trained advanced yoga instructor; Certified yoga instructor</td>
<td>Yes</td>
<td>Yes</td>
<td>Secondary</td>
</tr>
<tr>
<td>Chuang et al.</td>
<td>2017</td>
<td>Taiwan</td>
<td>100</td>
<td>Non-Hodgkin lymphoma</td>
<td>Undergoing chemotherapy</td>
<td>60</td>
<td>43%</td>
<td>2-arm</td>
<td>Chan-Chuang Qigong</td>
<td>Conventional care</td>
<td>3 weeks</td>
<td>Nurse</td>
<td>No</td>
<td>Yes</td>
<td>Secondary</td>
</tr>
<tr>
<td>Furzer et al.</td>
<td>2016</td>
<td>Australia</td>
<td>37</td>
<td>Hodgkin lymphoma; Non-Hodgkin lymphoma; Multiple myeloma</td>
<td>Completed chemotherapy in previous 4 weeks</td>
<td>48.9</td>
<td>Not reported</td>
<td>2-arm</td>
<td>Individualised exercise program (inc. aerobic and resistance exercises)</td>
<td>Usual care and general healthy lifestyle advice</td>
<td>12 weeks</td>
<td>Exercise physiologist</td>
<td>No</td>
<td>Yes</td>
<td>Secondary</td>
</tr>
<tr>
<td>Galano-Castillo et al.</td>
<td>2016</td>
<td>Spain</td>
<td>81</td>
<td>Breast cancer</td>
<td>Completed adjuvant therapy (except hormone therapy)</td>
<td>48.3</td>
<td>100%</td>
<td>2-arm</td>
<td>Individualised telerehabilitation exercise program</td>
<td>Usual care</td>
<td>8 weeks</td>
<td>Not stated</td>
<td>No</td>
<td>No</td>
<td>phone (if required)</td>
</tr>
<tr>
<td>Hagstrom et al.</td>
<td>2016</td>
<td>Australia</td>
<td>39</td>
<td>Breast cancer</td>
<td>Completed treatment</td>
<td>51.9</td>
<td>100%</td>
<td>2-arm</td>
<td>Supervised resistance training program</td>
<td>Waitlist control</td>
<td>16 weeks</td>
<td>Exercise science students (supervised by qualified trainer)</td>
<td>Yes</td>
<td>Yes</td>
<td>Primary (QoL)</td>
</tr>
<tr>
<td>Hwang et al.</td>
<td>2008</td>
<td>South Korea</td>
<td>40</td>
<td>Breast cancer</td>
<td>Undergoing radiotherapy</td>
<td>46.3</td>
<td>100%</td>
<td>2-arm</td>
<td>Supervised exercise program</td>
<td>Shoulder stretching intervention</td>
<td>5 weeks</td>
<td>Unclear</td>
<td>Yes</td>
<td>Primary (QoL)</td>
<td></td>
</tr>
<tr>
<td>Kampffoff et al.</td>
<td>2015</td>
<td>Netherlands</td>
<td>277</td>
<td>Mixed (breast, cervix, colon, ovarian, testis)</td>
<td>Completed adjuvant or neoadjuvant treatment</td>
<td>53.6</td>
<td>80%</td>
<td>3-arm</td>
<td>Group 1: High-intensity resistance and endurance exercise program</td>
<td>Waitlist control</td>
<td>12 weeks</td>
<td>Physiotherapists</td>
<td>Unclear</td>
<td>Yes</td>
<td>Secondary</td>
</tr>
<tr>
<td>Mijwel et al.</td>
<td>2018</td>
<td>Sweden</td>
<td>240</td>
<td>Breast cancer</td>
<td>Undergoing chemotherapy</td>
<td>53.2</td>
<td>100%</td>
<td>3-arm</td>
<td>Group 1: Resistance and high-intensity interval training (RT-HIT) Group 2: Moderate-intensity aerobic and high-intensity interval training (AT-HIT)</td>
<td>Usual care</td>
<td>16 weeks</td>
<td>Exercise physiologist; Oncology nurse</td>
<td>Unclear</td>
<td>Yes</td>
<td>Secondary</td>
</tr>
<tr>
<td>Monga et al.</td>
<td>2007</td>
<td>USA</td>
<td>21</td>
<td>Prostate cancer</td>
<td>Undergoing radiotherapy</td>
<td>69.3</td>
<td>0%</td>
<td>2-arm</td>
<td>Supervised aerobic exercise program</td>
<td>Standard care</td>
<td>8 weeks</td>
<td>Kinesiotherapist (supervised by a physician)</td>
<td>Unclear</td>
<td>Yes</td>
<td>Primary (QoL)</td>
</tr>
<tr>
<td>Reis et al.</td>
<td>2013</td>
<td>USA</td>
<td>41</td>
<td>Breast cancer</td>
<td>Undergoing radiotherapy</td>
<td>56</td>
<td>100%</td>
<td>2-arm</td>
<td>Nia exercise</td>
<td>Usual care</td>
<td>12 weeks</td>
<td>Nurse</td>
<td>No</td>
<td>Yes</td>
<td>Primary (QoL)</td>
</tr>
<tr>
<td>Trayler et al.</td>
<td>2015</td>
<td>Netherlands</td>
<td>204</td>
<td>Breast cancer</td>
<td>Undergoing chemotherapy</td>
<td>49.6</td>
<td>100%</td>
<td>2-arm</td>
<td>Supervised aerobic and resistance exercise program</td>
<td>Usual care and maintenance of habitual physical activity pattern for 18 weeks</td>
<td>18 weeks</td>
<td>Physiotherapists</td>
<td>Not stated</td>
<td>Yes</td>
<td>Secondary</td>
</tr>
<tr>
<td>Van Vulp et al.</td>
<td>2016</td>
<td>Netherlands</td>
<td>33</td>
<td>Colon cancer</td>
<td>Undergoing chemotherapy</td>
<td>58.1</td>
<td>36%</td>
<td>2-arm</td>
<td>Supervised exercise program</td>
<td>Usual care</td>
<td>18 weeks</td>
<td>Physiotherapists</td>
<td>Unclear</td>
<td>Yes</td>
<td>Secondary</td>
</tr>
<tr>
<td>Van Waart et al.</td>
<td>2015</td>
<td>Netherlands</td>
<td>230</td>
<td>Breast cancer; colon cancer</td>
<td>Undergoing adjuvant chemotherapy</td>
<td>51</td>
<td>99%</td>
<td>3-arm</td>
<td>Group 1: Low intensity, home-based physical activity program (Onco-Move) Group 2: Moderate-to-high intensity, supervised resistance and aerobic exercise program (OnTrack)</td>
<td>Usual care</td>
<td>6 months</td>
<td>Specially trained nurse (Onco-Move physiotherapist (OnTrack)</td>
<td>Not stated</td>
<td>Yes</td>
<td>Secondary</td>
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<tr>
<td>Vardar Yag et al.</td>
<td>2015</td>
<td>Turkey</td>
<td>52</td>
<td>Breast cancer (unilateral)</td>
<td>Completed treatment ≥ 3 years prior</td>
<td>48.6</td>
<td>100%</td>
<td>2-arm</td>
<td>Aerobic exercise and yoga program</td>
<td>Aerobic exercise training</td>
<td>6 weeks</td>
<td>Not stated</td>
<td>Yes (Yoga group)</td>
<td>Yes</td>
<td>Primary (QoL)</td>
</tr>
<tr>
<td>Yoo et al.</td>
<td>2012</td>
<td>USA</td>
<td>102</td>
<td>Pancreas and periampullary cancer</td>
<td>Various (reaction with/without adjuvant therapy)</td>
<td>66.5</td>
<td>50%</td>
<td>2-arm</td>
<td>Individualised home walking program</td>
<td>Usual care</td>
<td>3 months</td>
<td>Advanced practice nurse</td>
<td>No</td>
<td>No</td>
<td>(phone contact)</td>
</tr>
</tbody>
</table>

**Physical activity - Traditional and non-traditional**

- Supervised aerobic exercise program
- Supervised resistance training program
- Individualised exercise program (inc. aerobic and resistance exercises)
- Standard care
- Usual care
- Usual care and general healthy lifestyle advice
- Shoulder stretching intervention
<table>
<thead>
<tr>
<th>First author</th>
<th>Year</th>
<th>Country</th>
<th>N</th>
<th>Participant diagnosis</th>
<th>Stage of cancer treatment</th>
<th>Mean age (years)</th>
<th>Gender (% female)</th>
<th>Control Group</th>
<th>Intervention Group</th>
<th>Intervention duration</th>
<th>Health professional delivering intervention</th>
<th>Group?</th>
<th>Face-to-face?</th>
<th>Participation (QoL, primary or secondary?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychosocial</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Alcântara-Silva et al.</td>
<td>2018</td>
<td>Brazil</td>
<td>116</td>
<td>Breast cancer; gynecological cancer</td>
<td>Undergoing radiotherapy</td>
<td>52.4</td>
<td>100%</td>
<td>No</td>
<td>Music therapy</td>
<td>4 to 6 weeks</td>
<td>Music therapist</td>
<td>No</td>
<td>Yes</td>
<td>Secondary</td>
</tr>
<tr>
<td>Baravvek et al.</td>
<td>2004</td>
<td>USA</td>
<td>396</td>
<td>Mixed (inc. breast cancer, lung, lymphoma, colonrectal, ovarian, prostate)</td>
<td>Commencing chemotherapy, radiotherapy or concurrent therapy</td>
<td>56.3</td>
<td>85%</td>
<td>No</td>
<td>Energy management and activity management (ECAM)</td>
<td>5 weeks</td>
<td>Nutrition information control</td>
<td>No</td>
<td>No</td>
<td>Primary (Functional Performance)</td>
</tr>
<tr>
<td>Charalambo us et al.</td>
<td>2016</td>
<td>Cyprus</td>
<td>208</td>
<td>Breast cancer; prostate cancer</td>
<td>Undergoing chemotherapy</td>
<td>50%</td>
<td>2-arm</td>
<td>No</td>
<td>Guided Imagery (GI) and Progressive Muscle Relaxation (PMR)</td>
<td>4 weeks</td>
<td>Usual (standardised) treatment</td>
<td>No</td>
<td>Yes</td>
<td>Primary (QoL)</td>
</tr>
<tr>
<td>Freeman et al.</td>
<td>2015</td>
<td>USA</td>
<td>118</td>
<td>Breast cancer</td>
<td>Completed treatment ≥ 6 weeks prior</td>
<td>55.4</td>
<td>100%</td>
<td>3-arm</td>
<td>Group 1: Imagery-based group behavioural intervention (Low-delivery) Group 2: Imagery-based group behavioural intervention (Telemedicine-delivery)</td>
<td>Waitlist control</td>
<td>Waitlist control</td>
<td>Yes</td>
<td>Yes</td>
<td>Primary (QoL)</td>
</tr>
<tr>
<td>Ralf et al.</td>
<td>2013</td>
<td>Germany</td>
<td>261</td>
<td>Mixed (inc. breast cancer, colon, prostate)</td>
<td>Post active treatment and remission of toxic side effects</td>
<td>57.8</td>
<td>80%</td>
<td>2-arm</td>
<td>Structured education program</td>
<td>Waitlist control</td>
<td>Waitlist control</td>
<td>Yes</td>
<td>Yes</td>
<td>Secondary</td>
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<tr>
<td>Willems et al.</td>
<td>2017</td>
<td>Netherlands</td>
<td>409</td>
<td>Mixed (inc. breast cancer, bladder, colorectum, gynecologic, kidney, liver)</td>
<td>Primary treatment completed between 4 to 56 weeks prior</td>
<td>56.3</td>
<td>81%</td>
<td>2-arm</td>
<td>Web-based computer-tailored intervention Kanker Naang Wijzer (Cancer Aftercare Guide)</td>
<td>Waitlist control</td>
<td>Waitlist control</td>
<td>No</td>
<td>No</td>
<td>Primary (QoL)</td>
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<td>Yun et al.</td>
<td>2012</td>
<td>South Korea</td>
<td>273</td>
<td>Mixed (inc. breast cancer, stomach cancer, colon, uterine, lung, thyroid)</td>
<td>Primary treatment completed within past 24 months</td>
<td>53% participants &gt; 45 years</td>
<td>73%</td>
<td>2-arm</td>
<td>Web-based tailored education program (Health Navigation Program)</td>
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<td>No</td>
<td>Secondary</td>
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<tr>
<td>Multimodal</td>
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<tr>
<td>Adamsen et al.</td>
<td>2009</td>
<td>Denmark</td>
<td>269</td>
<td>Mixed (inc. bowel, brain, breast, haematological, ovarian)</td>
<td>Undergoing chemotherapy</td>
<td>47</td>
<td>73%</td>
<td>2-arm</td>
<td>Multi-modal exercise (inc. hi-intensity exercise, relaxation, massage, body awareness training)</td>
<td>Conventional medical care</td>
<td>Physiotherapist; Trained nurse specialist</td>
<td>Yes</td>
<td>Yes</td>
<td>Secondary</td>
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<tr>
<td>Andersen et al.</td>
<td>2013</td>
<td>Denmark</td>
<td>213</td>
<td>Mixed (inc. bowel, haematological, ovaries, testes)</td>
<td>Undergoing chemotherapy</td>
<td>47.5</td>
<td>75%</td>
<td>2-arm</td>
<td>Multi-modal exercise (inc. hi-intensity exercise, relaxation training, body awareness training, massage)</td>
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<td>Yes</td>
<td>Secondary</td>
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<tr>
<td>Sandier et al.</td>
<td>2017</td>
<td>Australia</td>
<td>46</td>
<td>Breast cancer; colon cancer</td>
<td>Completed adjunct therapy (excluding hormonal therapy) 3 to 12 months prior</td>
<td>51</td>
<td>94%</td>
<td>2-arm</td>
<td>Cognitive behavioral therapy (CBT) and graded exercise therapy (GET)</td>
<td>Education booklet and clinical consultation</td>
<td>Exercise physiologist; clinical psychologist</td>
<td>No</td>
<td>Yes</td>
<td>Secondary</td>
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<tr>
<td>Schmitt et al.</td>
<td>2016</td>
<td>Germany</td>
<td>28</td>
<td>Mixed (inc. 95% breast cancer, ovarian, colon, vagina)</td>
<td>Completed chemotherapy or radiation</td>
<td>53.5</td>
<td>100%</td>
<td>2-arm</td>
<td>Supervised high-intensity interval training (HIT) and multimodal rehabilitation specified by German insurance guidelines</td>
<td>Low to moderate intensity exercise (LME) &amp; multimodal rehabilitation specified by German insurance guidelines</td>
<td>Not stated</td>
<td>Yes</td>
<td>Yes</td>
<td>Primary (QoL)</td>
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<tr>
<td>Jain et al.</td>
<td>2012</td>
<td>USA</td>
<td>76</td>
<td>Breast cancer</td>
<td>Completed adjunct or neoadjuvant therapy 1 month to 10 months prior</td>
<td>51.3</td>
<td>100%</td>
<td>3-arm</td>
<td>Group 1: Biofield healing (hands-on healing) Group 2: Mock healing (touch alone)</td>
<td>Waitlist control</td>
<td>Biofield healing practitioners; Mock healing practitioners</td>
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<tr>
<td>Melissiotis et al.</td>
<td>2012</td>
<td>UK</td>
<td>302</td>
<td>Breast cancer</td>
<td>Completed chemotherapy 1 month to 5 years prior</td>
<td>52.5</td>
<td>100%</td>
<td>2-arm</td>
<td>Acupuncture</td>
<td>Enhanced usual care</td>
<td>Degree trained acupuncture therapists</td>
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<td>Yes</td>
<td>Secondary</td>
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<tr>
<td>Wyatt et al.</td>
<td>2012</td>
<td>USA</td>
<td>286</td>
<td>Advanced-stage breast cancer</td>
<td>Undergoing chemotherapy and/or hormonal therapy</td>
<td>55.8</td>
<td>100%</td>
<td>3-arm</td>
<td>Group 1: Reflexology Group 2: Lay foot manipulation</td>
<td>Conventional medical care</td>
<td>Certified reflexologists; lay women trained in lay foot manipulation</td>
<td>No</td>
<td>Yes</td>
<td>Primary (QoL, Physical Functioning)</td>
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### Table 2: PEDro score of included studies

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<th>First author</th>
<th>Random allocation</th>
<th>Concealed allocation</th>
<th>Baseline comparability</th>
<th>Blind subjects</th>
<th>Blind therapists</th>
<th>Blind assessors</th>
<th>Adequate follow up</th>
<th>Intention to treat analysis</th>
<th>Between group comparisons</th>
<th>Point estimates and variability</th>
<th>Overall score</th>
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<tr>
<td><strong>Physical activity - Traditional and non-traditional</strong></td>
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<tr>
<td>Ben-Josef et al.</td>
<td>✓</td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>Chuang et al.</td>
<td>✓</td>
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<td>✓</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>Furzer et al.</td>
<td>✓</td>
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<td>✓</td>
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<td>Galiano-Castillo et al.</td>
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<td>Hagstrom et al.</td>
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<td>Kampshoff et al.</td>
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<td>Alcantara-Silva et al.</td>
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<td><strong>Multi-modal</strong></td>
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<td><strong>Physically based therapies</strong></td>
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<td><strong>Total</strong></td>
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<td>59%</td>
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**Table 3:** Summary of outcomes on quality of life domains

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<tr>
<th>Physical activity - Traditional and non-traditional</th>
<th>EORTC-QLQ-C30</th>
<th>FACT-G</th>
<th>SF-36</th>
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<tr>
<td>First author</td>
<td>Outcome measures</td>
<td>PF</td>
<td>RF</td>
</tr>
<tr>
<td>Ben-Josef</td>
<td>FACT-G</td>
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<td>✓</td>
</tr>
<tr>
<td>Chuang</td>
<td>EORTC-QLQ-C30 (Chinese)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Furzer</td>
<td>FACT-G</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Galliano-Castillo</td>
<td>EORTC-QLQ-C30 (Spanish)</td>
<td>✓</td>
<td>✓</td>
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<td>Hagstrom</td>
<td>FACT-G</td>
<td>✓</td>
<td>✓</td>
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<td>Hwang</td>
<td>WHOQOL-BREF* (Korean)</td>
<td>✓</td>
<td>✓</td>
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<td>Kampshoff</td>
<td>EORTC-QLQ-C30; IPA*</td>
<td>✓</td>
<td>✓</td>
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<td>Mijwel</td>
<td>EORTC-QLQ-C30</td>
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<td>✓</td>
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<td>Travier</td>
<td>EORTC-QLQ-C30; SF-36^</td>
<td>✓</td>
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<td>EORTC-QLQ-C30; SF-36^</td>
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<td>Van Waart</td>
<td>EORTC-QLQ-C30; IPA*</td>
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<td>Yeo</td>
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**EORTC-QLQ-C30:** PF = physical functioning; RF = role functioning; SF = social functioning.  
**FACT-G:** PW = physical wellbeing; FW = functional wellbeing; TOI - trial outcome index (sum of PW and FW domain scores, plus 'additional concerns' subscales).  
**SF-36:** PF = physical functioning; RLPH = role limitations due to physical health; RLEH = role limitations due to emotional health; SF = social functioning; PCS = physical component score; MCS = mental component score.  
* See results for these measures in-text. **Note:** for studies with two intervention groups, if outcomes were different they have been reported separately.  
^ Did not report on SF-36 domain data in publication  
# Reported significant difference in intervention group
Table 3: Summary of outcomes on quality of life domains (cont)

<table>
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<tr>
<th>First author</th>
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EORTC-QLQ-C30: PF = physical functioning; RF = role functioning; SF = social functioning.
FACT-G: PW = physical wellbeing; FW = functional wellbeing; TOI - trial outcome index (sum of PW and FW domain scores, plus 'additional concerns' subscales).
SF-36: PF = physical functioning; RLPH = role limitations due to physical health; RLEH = role limitations due to emotional health; SF = social functioning; PCS = physical component score; MCS = mental component score.
* See results for these measures in-text. Note: for studies with two intervention groups, if outcomes were different they have been reported separately.
^ Did not report on SF-36 domain data in publication
# Reported significant difference in intervention group
DISCUSSION

Female survivor perspective dominates CRF research

Breast cancer survivors are one of the most researched populations in CRF literature (Richardson et al., 2011) and were the dominant population represented in this review. Consequently, the female CRF experience is better understood than the male experience and generalisation of findings may be limited. However, in Australia males have a higher risk of cancer up to the age of 75 years, with one in three males versus one in four females being diagnosed (Australian Institute of Health and Welfare [AIHW], 2017). Moreover, CRF is a significant problem for brain cancer survivors, yet a recent review investigating CRF interventions for this population identified just one study that met inclusion criteria (Day et al., 2016). As brain cancer incidence is higher in males (AIHW, 2017), investigation of return to participation interventions within this population could provide valuable.

Quality and risk of bias

No connection was apparent between quality of included studies and direction of impact on QoL subscales. Potential for performance bias should be considered when interpreting review results as all 29 included studies involved unblinded participants and personnel delivering interventions. However, due to the nature of included interventions, blinding is unfeasible, therefore, eight out of ten was the maximum PEDro score attainable for studies included in this review. Selection bias may be apparent in the 13 studies (45%) without adequate allocation concealment and detection bias may exist in the 22 studies (76%) with nonblinded outcome assessors. Subsequently, results of studies without these criteria should be interpreted with caution. Notably, of the three studies that measured activity performance and participation using non-QoL instruments (Barsevick et al., 2014; Kampshoff et al., 2015; Van Waart et al.,
outcome reporting bias was observed, all studies reported insignificant findings and none of the studies reported subscale data. Thus, more comprehensive understanding of the impact of the intervention on participation, including any adverse effects, may have been revealed if more complete data was reported.

Limited focus on participation corresponds with prevalence of QoL outcome measures

In 97% of the 29 studies included in this review, QoL, not participation or everyday activity performance, was the construct investigated as the primary or secondary study outcome. Correspondingly, the majority of studies (97%) used QoL instruments to measure changes associated with activity performance and participation. In this review no obvious pattern of impact was identified between intervention type and participants’ QoL subscale data. Yet, QoL instruments collect data to support measurement, prediction and intervention and may under appreciate the importance of participation (McMullen et al., 2017). Further, the precision in which the studies included in the review reported changes associated with activity performance participation was limited. For example, item five of the EORTC-QLQ-C30 physical functioning domain asks, ‘do you need help with eating, dressing, washing yourself or using the toilet?’ (Aaronson et al., 1993). As this question explores numerous ICF activity and participation categories including: eating (d550), dressing (d540), washing oneself (d510) and using the toilet (d530), it is difficult to determine what changes in scores within this domain actually illustrate about survivors’ everyday life.

Minimal occupational therapy involvement may contribute to limited participation focus

Despite limited focus on participation within QoL instruments (Van der Mei, Dijkers, & Heerkens, 2011), European countries with established cancer rehabilitation programs use QoL and return to work participation as key indicators of program success (Stubblefield et al.,
2013). Yet, whether limited participation measurement is problematic depends on the intention, or perspective, of the researcher (Van der Mei et al., 2011). Therefore, as no studies included in this review identified occupational therapist involvement or directly stated participation as a key focus, outcome measure selection may not have considered breadth of participation measurement. By way of contrast, one occupational therapy study excluded at the abstract phase of this review, measured self-care, leisure and employment participation dimensions (Purcell, Fleming, Burmeister, Bennett & Haines, 2011).

**Measuring meaningful participation in future CRF research**

A need for increased activity and participation measurement in cancer survivorship has been identified (Stubblefield et al., 2013). Findings of this review suggest little attention has been focused on measurement of activity performance and participation within CRF research. However, understanding the meaning survivors attribute to various participation experiences may prove an important lever in designing interventions that not only improve participation but predict QoL. Increased participation has been reported as the strongest predictor of QoL (McMullen et al., 2017), however, the strength of correlation may vary depending on the meaning a person attributes to the activity. For example, based on a study investigating the activity, participation, QoL relationship in a diabetes population, moderately strong correlations were reported between QoL and participation in leisure, work, social and community activities, however, participation in domestic activities was not correlated to QoL (Atler et al., 2018). Consequently, CRF’s interference in usual functioning may be so distressing for survivors because fatigue symptoms are restricting participation in those activities that are personally valued and thus most meaningful, therefore, disproportionately impacting overall QoL.
Therefore, development and use of instruments that measure the effect of interventions on meaningful participation is required in CRF research. However, ‘meaningfulness’ is not considered among the activity monitoring, objective performance measures and item-response theory-based assessments that are currently being evaluated in response to the need for increased activity and participation measurement in survivorship (Stubblefield et al., 2013). Additionally, conducting research similar to Atler et al. (2018) with cancer survivors would be beneficial to identify the categories of activity participation most strongly correlated with QoL in an oncology population.

**Future research implications**

Return to employment participation is a priority for future cancer survivorship research (Hunter et al., 2017; Richardson et al., 2011). CRF is frequently reported as a barrier to employment participation (NCCN, 2018). Yet, given the socioeconomic benefits and intrinsic connection between personal identity and job role, reengagement in employment is undoubtedly meaningful to many survivors. Therefore, future research to develop innovative interventions that maximise employment participation is essential. To ensure adequate focus on meaningful participation, occupational therapists should use comprehensive instruments such as the Meaningful Activity Participation Assessment (MAPA) (Eakman, Carlson & Clark, 2010). The MAPA measures frequency of participation in everyday life activities and the degree of personal meaningfulness associated (Eakman, Carlson & Clark, 2010). Occupational therapists can use this information to identify whether interventions have an impact on activity performance and participation. Further, intervention modification based on the degree to which activities included in the intervention are meaningful to survivors is possible, with the aim of optimal participation in activities with greater meaning as these may predict greater overall QoL improvements.
Strengths and limitations

This study has several strengths including use of a comprehensive search strategy within eight databases. Further, this review may be the first with an objective of articulating the ‘current state’ of participation focused research within survivor populations living with CRF. Although not the original intent of the study, due to the prevalence of QoL outcome measures and relative absence of alternate measures, the results of this study resemble a review seeking to identify the impact of CRF interventions on QoL instead of on activity performance and participation. Limitations of this study include exclusion of studies that did not demonstrate a positive effect on CRF at timepoint one and inclusion of only RCT studies. Consequentially, interventions that required longer time to reach effect and/or studies with a robust participation focus may have been excluded.

Conclusion

This review aimed to identify whether interventions that were effective for CRF also had an impact on everyday activity performance and participation outcomes. Findings of this review indicate there is insufficient evidence to determine whether any impact exists primarily due to reliance on QoL outcome measures. Consequently, there is gap in the research pertaining to return to participation interventions as little attention has been paid to this area within high quality CRF research. Consideration of the sensitivity and precision of QoL instruments to measure activity performance and participation should be incorporated into future CRF research designs.

Key points for occupational therapy

- QoL instruments may provide limited insight into survivors’ participation experience.
• Increased measurement of meaningful activity performance and participation is required in CRF research.

• Return to participation interventions, specifically return to employment, are opportunities for occupational therapists in CRF management.
References


Appendix I: Australian Occupational Therapy Journal - Author Guidelines

Author Guidelines

CONTENTS
1. SUBMITTING TO AUSTRALIAN OCCUPATIONAL THERAPY JOURNAL
2. EDITORIAL CONSIDERATIONS
3. ETHICAL CONSIDERATIONS
4. ARTICLE TYPES AND REQUIREMENTS
5. PREPARING THE MANUSCRIPT
6. COPYRIGHT, LICENSING AND ONLINE OPEN
7. PUBLICATION PROCESS AFTER ACCEPTANCE
8. POST PUBLICATION
9. EDITORIAL OFFICE CONTACT DETAILS

1. SUBMITTING TO AUSTRALIAN OCCUPATIONAL THERAPY JOURNAL
Thank you for your interest in Australian Occupational Therapy Journal. Submissions are only received through the “Scholar One” manuscript central website accessed through the journal home page. Authors should register at https://mc.manuscriptcentral.com/aotj and follow online submission instructions. Manuscripts that fail to meet requirements of the Author Guidelines will be rejected without review. For help with submissions, please contact the Editorial Assistant: aot.eo@wiley.com

Australian Occupational Therapy Journal Article Submission “Checklist for Authors”
The following checklist will appear as part of the online submission process. Authors must confirm adherence to all items.
I have adhered to all of the following in the manuscript submitted
• The manuscript was double-spaced in 12 point Times New Roman or Times Roman font and does not exceed the permitted word count.
• I used Australian-English spelling.
• The abbreviation of “OT” or “OTs” was not used.
• The submitted manuscript did not contain any identifying information about specific people, programs, locations or study sites.
• I consulted the Publication Manual of the American Psychological Association, Sixth Edition and/or the official companion APA Style Blog (http://blog.apastyle.org/apastyle/) to prepare correct citations and references. All journal articles published after 1997 included the digital object identifier (doi) presented according to APA style rules.
• The corresponding author obtained and included his/her ORCID number.
The “Abstract” was no longer than 300 words and used the following headings: Introduction; Methods; Results; Conclusion.

Abbreviations followed the Publication Manual of the American Psychological Association, Sixth Edition or the official companion APA Style Blog (http://blog.apastyle.org/apastyle/); this included abbreviations in the reference list.

Up to five keywords were selected from either the U.S National Library of Medicine Medical Subject Headings (MeSH) (https://www.nlm.nih.gov/mesh/) or the Cumulative Index to Nursing and Allied Health Literature Thesaurus. Only MeSH or CINAHL words were used.

The Main Document used subheadings set out in the Guidelines.

If my study used humans, I provided details of the Institutional Review Board, Human Research Ethics Committee or equivalent delegated authority in the Scholar One form where indicated and these details were also written into the Method Section of the manuscript (blinded for review)

Research articles followed the reporting guidelines presented in http://www.equator-network.org/. I note reviewers will be asked to evaluate the manuscript in light of these guidelines. I provided evidence of adherence as a supplementary document: e.g., prospective clinical trial registration.

A section called “Key Points for Occupational Therapy” was included at the end of the paper, before “references”.

A section called “Declaration of Authorship” was included after “Key Points” and before “references”. The declaration stated the contribution of each author to the paper and any conflict of interest. I used wording that demonstrated adherence to the roles and responsibilities of authors described in the International Committee of Medical Journal Editors (ICMJE) recommendations (http://www.icmje.org/).

A section called “Funding” was included after the author declaration.

People or institutions who were acknowledged gave written permission.

2. EDITORIAL CONSIDERATIONS

Aims and Scope

The Australian Occupational Therapy Journal is a leading international peer reviewed publication presenting influential, high quality innovative scholarship and research relevant to occupational therapy.

The journal is the official research publication of the professional peak body, Occupational Therapy Australia. The journal publishes empirical studies, theoretical papers, reviews and invited scholarly commentary.

The aim of the journal is to be a leader in the dissemination of scholarship and evidence to substantiate, influence and shape policy and occupational therapy practice locally and globally.

Preference will be given to papers that have a sound theoretical basis, methodological rigour with sufficient scope and scale to make important new contributions to the occupational therapy body of knowledge.

Topics may include:
- how participation in occupation is affected by body structures and function domains
- participation in occupations across the lifespan
- environments affecting engagement in occupation and occupational therapy services (physical, social, policy etc.)
- interaction of person, environment and occupation factors to influence health
- people who receive, could receive or who are impacted by occupational therapy practice, policy or education;
- assessments measuring constructs relevant to and applied in occupational therapy research, practice or education;
- occupational therapy interventions (development, implementation and impact)
- scope of occupational therapy practice
- professionalisation and professionalism in occupational therapy
- pedagogy and educational practice involving occupational therapy, including interprofessional, multidisciplinary, transdisciplinary and single discipline research that includes occupational therapy and/or occupational therapy students/staff.

AOT does not publish protocols for any study design

Authors must position their study in an appropriate and sound theoretical and empirical context; with a critical analysis of relevant literature in the Introduction section. The manuscript must demonstrate how findings make an important contribution to knowledge in the field.

For quantitative papers, authors are encouraged to demonstrate how their studies enable replication, generalizability and contribute to understanding possible or actual causality. Typically this will involve reporting using guidelines such as those available in the EQUATOR network. Authors must use measures that are well validated and have proven psychometric properties.

Authors are encouraged to triangulate data to substantiate their findings where appropriate, for example: self-report measures and performance observation measures; therapist and consumer measures/perspectives.

The journal preferences qualitative research that contributes to development of substantive or formal theory, is empirically grounded, is internally reflexive and has explored its value for different groups including study participants. Studies that demonstrably illuminate aspects of occupational therapy and can thus inform decision making will be of particular interest to readers. Qualitative studies must demonstrate transferability, dependability, trustworthiness, and credibility.

In mixed method research, authors are required to clearly outline how the a-priori design demonstrates integration of qualitative and quantitative methods during data collection, analysis and reporting. When a mixed method approach is reported, authors should clearly identify the design (e.g., sequential explanatory, sequential explanatory, concurrent nested, etc.) and report which data took priority during data collection and analysis (e.g., did qualitative data lead the results with support from the quantitative?). Consideration should be given to whether the approach used is mixed or multiple methods.

Instrumentation studies present the development and/or evaluation of the psychometric properties of a tool - reliability, validity, sensitivity, clinical utility. The journal has a preference for standardised taxonomies such as COSMIN.
The *Australian Occupational Therapy Journal* receives many more papers than it can publish. Studies may be methodologically appropriate, have significant or original results, but that may not mean the paper is a significant contribution to new knowledge. The journal aims to publish research that will provide a rigorous, relevant evidence base to inform professional practice and decisions relating to occupational therapy. Authors must demonstrate that their research is thus not only technically competent but is an original and significant contribution to knowledge and practice.

The journal will consider multidisciplinary or interprofessional studies that include occupational therapy, occupational therapists or occupational therapy students, so long as ‘key points’ highlight the specific implications for occupational therapy, occupational therapists and/or occupational therapy students and/or consumers.

If authors extract material from single larger interprofessional or multidisciplinary studies for an occupational therapy-specific study, these papers are only acceptable if distinct and separate questions are asked, if a theoretically and empirically grounded rationale is provided for the extracted study, and if the methodology is appropriate to the question.

If authors are submitting a paper where data is derived from a larger study, authors are required to disclose all related publications that are published, submitted or under review. If authors state that aspects of the study have already been published, a case must be made to demonstrate how the present paper is distinctive and makes a significant contribution to knowledge.

**Conditions of submission**

Papers submitted to the journal must not be presenting content that has been previously published. The only exceptions to this rule are the following: conference abstracts; part of a published lecture or academic thesis; as an electronic preprint; poster/abstract/oral presentation presented at a conference or scientific meeting where proceedings are available on a pre-print server.

Papers that present clinical trials are not deemed to have been previously published if they appear in clinical trials registers and/or if results in such registers are presented as a brief summary or table.

Papers submitted to the journal must not be under consideration for publication elsewhere.

If accepted for publication, authors agree the paper will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder which is the journal publisher. Authors must be aware that in signing the copyright form they are entering a legal agreement not to disseminate or republish the journal-article on any file sharing site, by email attachment, in thesis dissertations or in any other form. Authors are able to disseminate the pre-production manuscript if they own the copyright and they are able to include citation details of the *Australian Occupational Therapy Journal* published paper on such documents.

All papers submitted to the *Australian Occupational Therapy Journal* are subject to automated text-matching software screening which reports a % similarity index.

**Editorial Processes**

All submissions are inspected by the Editorial Team first to determine whether all criteria in the “Checklist for Authors” have been met. A paper that does not meet criteria will be rejected and returned to authors.

Second, Editorial inspection determines whether or not papers are within the journal “Aims and Scope”. The Editorial Board may decide to reject any paper not deemed to be within the Aims and Scope of the journal. A reason for rejection will be provided. The decision is final.
A paper deemed to be in line with the “Aims and Scope” of the journal will be blind-reviewed by one member of the Editorial or Review Board and either a specialist guest-reviewer or another member of the Editorial or Review Board. Reviewers will provide feedback using the Australian Occupational Therapy Journal review form. Reviewers will be directed to consider the methodological quality of the study and may choose to use standardised critical appraisal tools. Reviewers will provide blind comments to authors regarding the manuscript. Reviewers will make recommendations to the Editorial Board regarding publication priority. The Editorial Board will use reviewer reports to inform decisions regarding acceptance, rejection, or provision of opportunities to revise and resubmit. Resubmissions have no guarantee they will be accepted. A rejection decision is final; no further correspondence will be entered into.

An accepted paper is submitted to the WILEY production process.

Authors will receive the page proofs for their paper and are required to review for accuracy; any changes beyond accuracy may incur a charge. The author-approved proof is sent to the Editor in Chief for final review. The Editor and the Publisher reserve the right to make minor modifications to typescripts to correct spelling or grammar issues that have been overlooked, or eliminate ambiguity and repetition. A paper is not approved for publication, regardless of the stage of review or correspondence sent and received until the Editor in Chief approves publication of the final proof. If an author identifies an error after publication that is their responsibility, he/she/they are responsible for costs associated with correction and publication of a corrigendum.

3. ETHICAL CONSIDERATIONS

This journal is a member of the Committee on Publication Ethics (COPE).

Human Studies

For manuscripts reporting studies involving human participants or data originally generated from human participants (e.g., chart reviews, program evaluations, secondary data analyses), we require a statement identifying how ethical and/or research governance approval was obtained, where and under what authority it was granted. Authors must provide the name of the committee and state the reference number where appropriate. The name of the approving committee should be included in the manuscript (but de-identified for blind review purposes) – it is not acceptable to refer to “researcher institutional ethics committees” in general.

For research conducted in Australia or through Australian institutions the National Statement on Ethical Conduct in Human Research 2007 - updated May 2015 applies (https://www.nhmrc.gov.au/guidelines-publications/e72); for research with Indigenous Australians this also includes the companion document “Values and Ethics - Guidelines for Ethical Conduct in Aboriginal and Torres Strait Islander Health Research” (NHMRC, 2003).

For research conducted by investigators in countries other than Australia, there is a requirement for authors to demonstrate that the research complied with principles of the World Medical Association Declaration of Helsinki Ethical Principles for Medical Research Involving Human Subjects as amended October 2000 and that research was conducted with institutional or equivalent approvals consistent with the World Health Organization “Standards and operational guidance for ethics review of health-related research with human participants” (2011). Failure to provide this information or demonstrate this requirement will result in the submission being rejected.

Clinical Trial Registration

Clinical trials will normally be prospectively registered in a publicly accessible database and clinical trial
Clinical trials will normally be prospectively registered in a publicly accessible database and clinical trial registration numbers should be included in all papers that report results. Include the name of the trial register and your clinical trial registration number at the end of your abstract.

If your trial is not registered, or was registered retrospectively, please explain the reasons for this in the cover letter.

Research Reporting Guidelines

Accurate and complete reporting enables readers to fully appraise research, replicate it, and use it. The *Australian Occupational Therapy Journal* will publish positive, negative and inconclusive results as long as the research is rigorous.

Authors must adhere to research reporting standards presented in the EQUATOR network (http://www.equator-network.org/).

Authors must submit the relevant EQUATOR reporting guideline checklist as a not-to-be-published supplementary document to the submission. If authors do not believe one of these guidelines is appropriate a rationale must be provided in the cover letter and an alternative standards benchmark provided.

Roles and Responsibilities of Authors

An author is someone who demonstrates roles and responsibilities defined by the International Committee of Medical Journal Editors (ICMJE) (http://www.icmje.org/). A declaration must be made to this effect.

The ICMJE recommends that authorship be based on the following criteria: (i) Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; (ii) Drafting the work or revising it critically for important intellectual content; (iii) Final approval of the version to be published; and (iv) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest

Authors should disclose any actual or perceived conflicts of interest. Any interest or relationship, financial or otherwise that might be perceived as influencing an author’s objectivity is considered a potential source of conflict of interest. These must be disclosed when directly relevant or directly related to the work that the authors describe in their manuscript. Potential sources of conflict of interest include, but are not limited to, patent or stock ownership, membership of a company board of directors, membership of an advisory board or committee for a company, and consultancy for or receipt of speaker’s fees from a company. The existence of a conflict of interest does not preclude publication. If the authors have no conflict of interest to declare, they must also state this at submission. It is the responsibility of the corresponding author to review this policy with all authors and collectively to disclose with the submission ALL pertinent commercial and other relationships.

Funding

Authors must make a funding statement. This will appear at the end of the paper before the reference section. Authors should list all funding sources. All funding received for work described within a submitted manuscript must be acknowledged in the funding disclosure section. Provide the name of the funder, the grant number, and the name of the principal investigator as applicable. If there was no specific study funding, then the authors should report the following statement: “This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.”
Acknowledgements

The contribution of colleagues or institutions can be acknowledged. Personal thanks and thanks to anonymous reviewers are not appropriate. Acknowledgements should contain information on individuals who have contributed to this work but did not meet the criteria for authorship or decline to be included as an author. All those individuals who are named in the acknowledgements must be contacted by the author and agree to have their name included. Each individual's specific contribution to the work must be briefly stated. Acknowledgements of general support or mentorship will be deleted by the editor as acknowledgements are only for those individuals who have provided a specific contribution to this work. In addition, the authors must provide information on previous dissemination of this work, in part or whole, at conferences or workshops. Prior presentation of the paper at a meeting should be briefly described last.

4. ARTICLE TYPES AND REQUIREMENTS

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* Refer to full detail regarding length, references and tables for Review Articles below
# Usually published in online-only format

All articles

All articles must be accompanied by a cover letter that addresses how the paper complies with conditions of submission.

If content is derived from a larger study, study series or previously published work, the authors must explain in the cover letter how their submission makes an original and substantial contribution to new knowledge and they must include citations and doi links for all related/derivative studies.

The cover letter should include a statement regarding written permissions for photographs, personal communications, and copyrighted material. These written permissions should be attached to the cover letter.

The cover letter should confirm that any person or institution named in the acknowledgements has given permission
Reviews
Narrative reviews, scoping reviews, meta-syntheses, systematic reviews and meta-analyses are included in this category. The journal does not publish articles that present only review protocols.

Review articles should contain the following:

**Title page:** This will be a separate file to the main document - upload using the “title page” option in Scholar One. The title page should contain:

(i) a short informative title that contains the major content concepts. The title should not contain abbreviations (see our best practice SEO tips);

(ii) the full names, qualifications and designations of the authors;

(iii) the full addresses of the authors’ affiliations;

(iv) a short running title (no more than 40 characters, abbreviations are permitted);

(v) authors' declaration of authorship contribution*;

(vi) funding statement*;

(vii) conflict of interest statement*;

(viii) acknowledgements*;

(ix) word length for the main text excluding references, abstract and tables;

(x) word length of the abstract;

(xi) the number of references, figures and tables include as part of article;

(xii) designate the corresponding author by providing his or her full address, telephone and fax numbers, and e-mail address.

(xiii) A minimum of five MeSH or CINAHL terms should be included as key words; Note that MeSH key words are reviewed by an indexer and may be edited.

*In the printed publication these will appear at the end of the paper before “references” – they are included here in the title page because this is not sent out to reviewers.

**Structured abstract:** No more than 300 words including Introduction, methods, results and conclusion.

**Introduction:** A rationale and context for the review must be provided. The aim of the review should be stated at the end of the introduction section.

**Methods:** The methodology used to design and conduct the review should be presented in sufficient detail to allow the work to be repeated by others.

**Results:** Results should be presented in a logical sequence in the text, tables and figures. Details of sources retrieved and analysis findings are presented in results. The same data should not be presented repetitively in different forms.

**Discussion:** The discussion should consider the results in relation to the study purpose, practice and scholarly context. The relationship of your results to the work of others and relevant methodological points could also be discussed. Limitations of the review should be identified. Implications for practice and future research should be considered. A conclusion section may be used but is not mandatory.
Key Points for Occupational Therapy: This is included at the end of the paper, before “references”. It comprises a bulleted list of three points summarising implications of the paper for occupational therapy practice/policy or and or education. These should not exceed 45 words in total (that is, 10-15 words each). Each point should reflect the journal’s aim and scope above and must not simply restate the findings.

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Author Guidelines updated 17 July 2018
Appendix II: Sample search results

1) MEDLINE search results – 6 September 2018

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<thead>
<tr>
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<th>Searches</th>
<th>Results</th>
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<td>2</td>
<td>Fatigue</td>
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<td>3</td>
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<tr>
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## CINAHL search results - 7 September 2018

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<tr>
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<td>Limiters - English Language; Published Date: 19950801-20100331</td>
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<td>Limiters - English Language</td>
<td>Interface - EBSCOhost: Research Databases</td>
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<td>Interface - EBSCOhost: Research Databases</td>
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<td>S19</td>
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<tr>
<td>S15</td>
<td>(MH &quot;Randomized Controlled Trials&quot;) OR &quot;randomized controlled trials&quot; OR (MH &quot;Clinical Trials+&quot;) OR (MH &quot;Cochrane Library&quot;)</td>
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<td>(MH &quot;Neoplasms++&quot;)</td>
<td>247,606</td>
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### PEDro scale

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<th>PEDro scale</th>
<th>yes</th>
<th>no</th>
<th>where:</th>
</tr>
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<tbody>
<tr>
<td>1. eligibility criteria were specified</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. allocation was concealed</td>
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<td></td>
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</tr>
<tr>
<td>4. the groups were similar at baseline regarding the most important prognostic indicators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. there was blinding of all subjects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. there was blinding of all therapists who administered the therapy</td>
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<td></td>
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</tr>
<tr>
<td>7. there was blinding of all assessors who measured at least one key outcome</td>
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<td></td>
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<tr>
<td>8. measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>9. all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by “intention to treat”</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10. the results of between-group statistical comparisons are reported for at least one key outcome</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. the study provides both point measures and measures of variability for at least one key outcome</td>
<td></td>
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</tbody>
</table>

The PEDro scale is based on the Delphi list developed by Verhagen and colleagues at the Department of Epidemiology, University of Maastricht (Verhagen AP et al (1998). The Delphi list: a criteria list for quality assessment of randomised clinical trials for conducting systematic reviews developed by Delphi consensus. *Journal of Clinical Epidemiology*, 51(12):1235-41). The list is based on “expert consensus” not, for the most part, on empirical data. Two additional items not on the Delphi list (PEDro scale items 8 and 10) have been included in the PEDro scale. As more empirical data comes to hand it may become possible to “weight” scale items so that the PEDro score reflects the importance of individual scale items.

The purpose of the PEDro scale is to help the users of the PEDro database rapidly identify which of the known or suspected randomised clinical trials (RCTs or CCTs) archived on the PEDro database are likely to be internally valid (criteria 2-9), and could have sufficient statistical information to make their results interpretable (criteria 10-11). An additional criterion (criterion 1) that relates to the external validity (or “generalisability” or “applicability” of the trial) has been retained so that the Delphi list is complete, but this criterion will not be used to calculate the PEDro score reported on the PEDro web site.

The PEDro scale should not be used as a measure of the “validity” of a study’s conclusions. In particular, we caution users of the PEDro scale that studies which show significant treatment effects and which score highly on the PEDro scale do not necessarily provide evidence that the treatment is clinically useful. Additional considerations include whether the treatment effect was big enough to be clinically worthwhile, whether the positive effects of the treatment outweigh its negative effects, and the cost-effectiveness of the treatment. The scale should not be used to compare the “quality” of trials performed in different areas of therapy, primarily because it is not possible to satisfy all scale items in some areas of physiotherapy practice.
Notes on administration of the PEDro scale:

All criteria **Points are only awarded when a criterion is clearly satisfied.** If on a literal reading of the trial report it is possible that a criterion was not satisfied, a point should not be awarded for that criterion.

Criterion 1 This criterion is satisfied if the report describes the source of subjects and a list of criteria used to determine who was eligible to participate in the study.

Criterion 2 A study is considered to have used random allocation if the report states that allocation was random. The precise method of randomisation need not be specified. Procedures such as coin-tossing and dice-rolling should be considered random. Quasi-randomisation allocation procedures such as allocation by hospital record number or birth date, or alternation, do not satisfy this criterion.

Criterion 3 **Concealed allocation** means that the person who determined if a subject was eligible for inclusion in the trial was unaware, when this decision was made, of which group the subject would be allocated to. A point is awarded for this criterion, even if it is not stated that allocation was concealed, when the report states that allocation was by sealed opaque envelopes or that allocation involved contacting the holder of the allocation schedule who was “off-site”.

Criterion 4 At a minimum, in studies of therapeutic interventions, the report must describe at least one measure of the severity of the condition being treated and at least one (different) key outcome measure at baseline. The rater must be satisfied that the groups’ outcomes would not be expected to differ, on the basis of baseline differences in prognostic variables alone, by a clinically significant amount. This criterion is satisfied even if only baseline data of study completers are presented.

Criterion 4, 7-11 **Key outcomes** are those outcomes which provide the primary measure of the effectiveness (or lack of effectiveness) of the therapy. In most studies, more than one variable is used as an outcome measure.

Criterion 5-7 **Blinding** means the person in question (subject, therapist or assessor) did not know which group the subject had been allocated to. In addition, subjects and therapists are only considered to be “blind” if it could be expected that they would have been unable to distinguish between the treatments applied to different groups. In trials in which key outcomes are self-reported (e.g. visual analogue scale, pain diary), the assessor is considered to be blind if the subject was blind.

Criterion 8 This criterion is only satisfied if the report explicitly states **both** the number of subjects initially allocated to groups and the number of subjects from whom key outcome measures were obtained. In trials in which outcomes are measured at several points in time, a key outcome must have been measured in more than 85% of subjects at one of those points in time.

Criterion 9 **An intention to treat** analysis means that, where subjects did not receive treatment (or the control condition) as allocated, and where measures of outcomes were available, the analysis was performed as if subjects received the treatment (or control condition) they were allocated to. This criterion is satisfied, even if there is no mention of analysis by intention to treat, if the report explicitly states that all subjects received treatment or control conditions as allocated.

Criterion 10 A **between-group** statistical comparison involves statistical comparison of one group with another. Depending on the design of the study, this may involve comparison of two or more treatments, or comparison of treatment with a control condition. The analysis may be a simple comparison of outcomes measured after the treatment was administered, or a comparison of the change in one group with the change in another (when a factorial analysis of variance has been used to analyse the data, the latter is often reported as a group × time interaction). The comparison may be in the form hypothesis testing (which provides a “p” value, describing the probability that the groups differed only by chance) or in the form of an estimate (for example, the mean or median difference, or a difference in proportions, or number needed to treat, or a relative risk or hazard ratio) and its confidence interval.

Criterion 11 A **point measure** is a measure of the size of the treatment effect. The treatment effect may be described as a difference in group outcomes, or as the outcome in (each of) all groups. **Measures of variability** include standard deviations, standard errors, confidence intervals, interquartile ranges (or other quantile ranges), and ranges. Point measures and/or measures of variability may be provided graphically (for example, SDs may be given as error bars in a Figure) as long as it is clear what is being graphed (for example, as long as it is clear whether error bars represent SDs or SEs). Where outcomes are categorical, this criterion is considered to have been met if the number of subjects in each category is given for each group.