A systematic review and narrative synthesis to explore the effectiveness of exercise based interventions in improving fatigue, dyspnoea and depression in lung cancer survivors

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Background

Cancer is, for many, a long term condition, as advances in new cancer treatments mean that survival rates are increasing [1], with half of people diagnosed in England and Wales surviving for ten years or more [2]. However, cancer survivors' psychological and physical wellbeing can be negatively affected post cancer due to the multitude of symptoms and side-effects they incur from cancer and its treatment [3].

There are around 47,000 new cases of lung cancer in the UK each year [2]; many of these people have significant smoking related co-morbidities [2] which can negatively impact on their activities of daily living and subsequent quality of life. Lung cancer patients may undergo curative treatment procedures, including surgery, chemotherapy and radiotherapy; these treatments, whilst potentially life-giving, are associated with a number of frequently reported and connected symptoms, such as fatigue, dyspnoea and depression, which can be long lasting and debilitating [4-6].

Fatigue is the most prevalent and disruptive symptom post treatment in cancer patients, affecting between 57-100%, whilst depression is present in around one third [6]. In addition, dyspnoea can substantially add to the onset of fatigue [6]. The presence of these symptoms, which can be made worse by surgery and/or adjuvant radiotherapy and chemotherapy, can have negative implications on the psychological and physical wellbeing of lung cancer survivors [6]. The presence of fatigue, dyspnoea and/or depression can inhibit lung cancer survivors activities of daily living, increase their social isolation, decrease their health and fitness levels and impair their return to work ability [6-9], making them more likely to access healthcare services for support and management of their condition.

Lung cancer patients have been reported to experience more symptom distress than patients with other types of cancer, with profound effects on their emotional and physical wellbeing

[10, 11]. Fatigue, depression and dyspnoea are among the most common symptoms for lung cancer patients, and are often interrelated, with many patients experiencing a combination of symptoms [12, 13]. This can interfere with patients' activities of daily living, with more interference occurring as symptom severity increases [10].

Growing appreciation of the extent to which the mind and body are linked [10, 11] indicates that depressive symptoms may exacerbate symptoms of fatigue and dyspnoea, and vice-versa. This supports the hypothesis that depression may be either the sequela *or* the precursor to uncontrolled physical symptoms such as fatigue and dyspnoea [10, 11]. Poor psychological health is associated with lower physical functioning, suggesting that psychological and physical health outcomes are inter-related [12, 13]. Hence, strategies aimed at improving any one of the symptoms of depression, fatigue or dyspnoea, may incur benefits across all three [10].

Lung cancer survivors use a variety of coping strategies to help to control their symptoms [14]. Exercise is one such strategy, helping lung cancer survivors to regain or maintain physical fitness following their cancer diagnosis [11]. This is illustrated by evidence that lung cancer patients with higher performance statuses have better physical and psychological outcomes than those with lower performance statuses [11]. Recent guidelines recommend that individuals with cancer should be as physically active as possible, 'avoid inactivity' [15, 16] and that any prescribed exercise should be individualised in accordance with cancer survivors' pre-treatment fitness levels and symptom burdens [15].

Research has suggested that exercise is the most common form of self-management practice used post-cancer treatment [17], with people using it for a variety of reasons, including to regain health and fitness, improve treatment side-effects, relax the mind and body and to regain a sense of normality post-cancer [9]. Many self-management programmes including an exercise component have shown improvements in cancer patients' levels of self-efficacy,

empowerment, quality of life, coping mechanisms, healthy behaviours and symptoms such as fatigue, dyspnoea and depression [18-25]. In addition exercise has been found to be a protective factor for fatigue [6, 26, 27]. These findings are strengthened by two recent meta-analyses which recommend physical exercise in the management of several cancers, including lung cancer [22, 23]. In addition the National Institute for Health and Care Excellence (NICE) recommend that people with mild to moderate depression and chronic physical health problems undertake physical activity programmes [28], emphasising the role of exercise in improving health outcomes for those living with long term conditions. Similarly, the American Cancer Society [25] and the National Comprehensive Cancer Network [24] both recommend routine physical activity in lung cancer patients.

Though much research has focused on the effects of exercise in improving the health outcomes and quality of life in cancer patients [21, 29], the majority has focused on breast cancer survivors and have been conducted during treatment [30]. Despite similarities existing between lung cancer patients and those diagnosed with other types of cancer, there is a need to examine literature focusing specifically on lung cancer survivors. Lung cancer survivors may experience greater symptom distress than other types of cancer survivor [10, 11] and have distinct characteristics, with lung cancer rates consistently higher among men, older people, smokers and those with lower socio-economic statuses [31]. Hence research into the most suitable exercise interventions for lung cancer survivors is required, to ensure that their symptoms are better controlled and that tailored exercise interventions are designed to meet their specific needs.

One systematic review exploring non-invasive interventions in improving wellbeing and quality of life in patients with lung cancer found exercise to have beneficial effects on self-empowerment and physical strength, but no improvement in quality of life [32]. Another review examining the effect of exercise training on lung cancer patients within 12 months of

lung resection found that exercise training may increase the exercise capacity of this population group [33]. No studies, to our knowledge, have examined the effects of different types of exercise interventions on fatigue, dyspnoea and depression in lung cancer survivors, despite these symptoms being commonly experienced by them [4, 5, 34], highlighting an important gap in the literature. This is an important area to examine as less than a third of lung cancer survivors meet recommended physical activity guidelines [35], indicating that more must be done to uncover which exercise interventions may be useful to them. A comprehensive literature review can help determine whether certain exercise types are more effective than others in managing symptoms for lung cancer survivors [36].

Thus, this systematic review will aim to examine the evidence on the effects of exercise based interventions on fatigue, dyspnoea and/or depression in lung cancer survivors. Though the term 'cancer survivor' can be associated with people living with cancer at different stages of the cancer pathway, for the purpose of this study 'cancer survivor' refers to lung cancer patients who have finished their active treatment for cancer. A quantitative narrative synthesis will be undertaken to help to describe, explain and interpret the study findings and to attempt to find explanations for these findings [37].

Methods

The PRISMA guidelines and flow diagram were followed [38]. Ethical approvals were not required.

Criteria for considering studies for this review

Types of studies/interventions

All randomised or quasi-randomised controlled trials (RCTs), observational studies and qualitative studies were considered for inclusion if they focused on the effectiveness of exercise interventions in improving symptoms of fatigue, dyspnoea and/or depression in lung cancer survivors. Lung cancer survivors must have received the exercise intervention for the study to be eligible for inclusion.

Types of participants

Studies were excluded if the majority of participants in the study were cancer patients, rather than survivors. Participants were considered to be cancer patients if they were still undergoing active treatment (surgery, chemotherapy, radiotherapy) for cancer at the time of undertaking the study intervention. Studies reporting on exercise interventions in cancer survivors were excluded if none of the participants were lung cancer survivors, or if participants were less than 18 years of age.

Search methods for identification of studies

The databases CINAHL, MEDLINE, EMBASE and the Cochrane Database were searched between January-May 2017. Both text and indexed terms (MeSH) were used in line with the relevant database search engine systems. The search strategy used is outlined in figure 1. Google and Google Scholar were also searched for any relevant unpublished studies and reference lists of all full text articles included in the review were checked in case they identified any potentially relevant articles. Any relevant systematic reviews were also examined to see if any papers making up the reviews were eligible for inclusion.

Searches were limited to papers published in the English language from the year 2000 onwards as developments in cancer treatments have evolved in the last two decades [39]. As such the symptoms experienced by lung cancer patients may be of a different nature and severity, affecting the impact of any subsequent exercise interventions and limiting the relevance of studies published before this time.

Selection of studies

All of the studies were screened for inclusion in the review, based on the eligibility criteria outlined above. Studies were included in the review if some (or all) of the participants were lung cancer survivors.

Data extraction and risk of bias

Data from the included studies was extracted independently, discussed and summarised by two researchers (CH, HA) using a study specific extraction form which was designed to collect all the relevant study data. The characteristics of the studies are summarised in Table 1. The quality of the included studies was assessed by CH and discussed with HA, using the appropriate Critical Appraisal Skills Programme Checklists [40]. Any uncertainty about the level of bias attributed to an individual study was discussed until a consensus was reached. It was not necessary to contact authors of the included studies to obtain any more detailed study information.

Data synthesis

All of the studies included in the review were quantitative and this data was descriptively summarised. However, due to the different study designs and the varying quality of the statistical data in many studies, it was not appropriate to undertake meta-analyses of the dataset, as a pooling of results across the studies was not possible.

Results

Characteristics of studies

852 records, titles and abstracts were initially screened for inclusion in the review, of which 797 were excluded, leaving 54 remaining after the exclusion of any duplicates (n=14). Of these, 44 were excluded once the full articles were assessed for eligibility, leaving 10 for inclusion in the final review [41-50] (Figure 1).

Characteristics of the 10 studies included in the review are shown in Table 1. Seven studies included only lung cancer survivors [43-46, 48-50], whilst three also included other cancer types [41, 42, 47]. In total 516 cancer survivors were included in the review, of which 298 (58%) were lung cancer survivors. The number of participants in the studies ranged from 10 to 162. The cumulative drop-out rate across the studies was 74 (14%). Seven studies had prospective, single site, pre/post-test designs [41, 43, 45, 46, 48-50], whereas three were RCTs [42, 44, 47]. Of these two were single site [42, 44] and one was multisite [47], taking place at three hospital outpatient departments. The studies took place in a range of settings including hospital inpatient and outpatient departments, community based and home based settings. All study participants had previously received cancer treatment consisting of either surgery, radiotherapy, chemotherapy, or a combination of these. The age of participants ranged from 30 to 80 (age range was not reported in one study [43]). Five studies were carried out in Europe, three in North America, one in Canada and one in Australia. All studies were published between 2004 and 2017.

Risk of bias in included studies

Overall, seven studies were deemed to have a high risk of bias [41-43, 45, 48-50], two an unclear risk of bias [44, 46] and one a low risk of bias [47]. Common reasons for this high level of bias

were related to flaws in the study design, such as selection bias, small sample sizes, lack of blinding and randomization methods and a lack of rigour in data analysis techniques, such as not accounting for confounding factors and a lack of reporting of confidence intervals. The substantial proportion of studies with a high or unclear risk of bias was deemed sufficient to affect the interpretation of the results from the review.

Description of studies

Pre/post-test study designs

Seven studies used single site, pre/post-test designs. One of these studies measured depression as an outcome measure [48], whilst four measured dyspnoea [43, 48-50] and six fatigue [41, 45, 46, 48-50]. The first of these studies aimed to measure the extent exercise impacted on fatigue, physical and psychosocial wellbeing and the quality of life of female cancer survivors [41]. The exercise intervention consisted of an oncology community outreach program offering a 'Get fit, stay fit' programme, with twice weekly low impact aerobics, toning, flexibility exercises and relaxation techniques. The second study [43] explored the effects of an inpatient multi-disciplinary team pulmonary rehabilitation programme on dyspnoea, pulmonary function and exercise capacity. The rehabilitation programme included a five hour educational seminar by a qualified health professional which incorporated chest physiotherapy and breathing techniques for dyspnoea, 30 minute respiratory physiotherapy sessions five times per week, 25 minute supervised cycling sessions three to five times per week and 30 minutes of gymnastics daily that focused on general mobilization and flexibility. Participants were also instructed to walk for one hour per day.

The third study [45] also examined the outcome of a pulmonary rehabilitation programme and measured its effects on fatigue, quality of life and exercise capacity in lung cancer survivors. The exercise programme was supervised by a physiotherapist and took place three times a

week for 12 weeks. It included two 90 minute resistance and endurance training sessions on cycle ergometers and treadmills. In week three, participants trained for 60 minutes, using activities of daily living, such as walking up stairs, regulating breathing during different postures and activities, playing tennis or cycling. The programme additionally included five sessions of relaxation exercises and breathing regulation techniques.

The fourth study [46] examined the effects of supervised aerobic exercise training on fatigue and aerobic fitness among lung cancer survivors who had undergone surgery. The programme was individually tailored to each participant and all sessions were supervised by sports medicine exercise specialists. Exercise consisted of three aerobic cycle ergometry sessions per week on non-consecutive days for 14 weeks.

The fifth study [48] aimed to evaluate the feasibility and efficacy of a progressive resistance exercise training programme in lung cancer survivors, which included leg and chest presses, seated rows, leg extensions, leg curls, shoulder presses, lateral pull downs and abdominal exercises, with 90-120 seconds rest between each exercise. The sessions were supervised by a qualified exercise physiologist and depression, fatigue and dyspnoea were measured.

The sixth study [49] aimed to assess changes in dyspnoea, fatigue, exercise capacity and quality of life of lung cancer survivors before and after a 28 day inpatient rehabilitation training programme which included cycle ergometer exercises in intervals of three to five minutes for 30 minutes daily. This was complemented by oncological rehabilitation measures including health education techniques. In addition, clinical counselling and medical supervision, drug based therapies and psychological support were offered.

Finally, the last study [50] aimed to examine the effects of an inpatient multi-disciplinary rehabilitation programme on dyspnoea, fatigue, pulmonary function and exercise capacity in lung cancer survivors. The programme was supervised by a physiotherapist and took place

over eight weeks, for one to two hours per day. It consisted of ergonomic cycling, treadmill walking, weight training and gymnastics.

Randomised controlled trials

All three RCTs, measured fatigue as an outcome measure[42, 44, 47], one measured dyspnoea[42] and one depression [47]. The first RCT aimed to compare the effect of aerobic exercise and progressive relaxation training on dyspnoea, fatigue, quality of life and the physical performance of cancer patients recovering from surgical treatment [42]. It consisted of 30 minutes cycle ergometer training for five days per week, over three weeks. The relaxation training consisted of a systematic programme of contraction and relaxation of different muscle groups.

The second RCT [44] aimed to investigate the effects of an exercise and balance programme compared to normal medical care on cancer related fatigue severity and fatigability in lung cancer survivors. The intervention group involved a nurse supported (via phone calls and home visits) home exercise intervention using the Nintendo Wii Fit Plus and consisted of light intensity walking and balance exercises that corresponded to usual activities of daily living. Wii walking was self-paced and comfortable. Exercise duration started at five minutes per day and built by five minutes each week with the goal of walking 30 minutes per day by week six. Balance exercises were also undertaken each day from weeks one to six. Participants self-reported their activity levels. The control group received usual medical follow up care from their medical providers. In addition they received phone visits from a nurse to control for staff interaction and data collection.

Finally, the third RCT [47] evaluated the use of medical qigong compared with usual care to improve symptoms of fatigue, depression and quality of life of cancer patients. The intervention group consisted of two 90 minute medical qigong sessions per week for 10

weeks and participants were also encouraged to undertake home practice each day for 30 minutes. The medical qigong programme was devised by an experienced, qualified medical qigong instructor and was modified by the instructor to specifically target the needs of cancer patients to control their emotions and stress as well as to improve their physical function. Each session included a 15 minute discussion of health issues, 30 minutes gentle stretching and body movement in standing postures, 15 minutes movement in seated positions and 30 minutes meditation including breathing exercises, relaxation and visualisation. A self-report diary was used to document home practice. The control group received usual care, which was appropriate medical intervention. Control group participants were advised to undertake normal activities but refrain from joining an outside medical qigong class.

Study Findings

Table 2 provides a narrative summary of the effects of the exercise interventions on fatigue, dyspnoea and/or depression across the studies. Fatigue was reported on in nine studies [41, 42, 44-50], dyspnoea in five studies [42, 43, 48-50] and depression in two studies [47, 48].

Fatigue

Six [42, 44-47, 49] of the nine studies reporting on fatigue found statistically significant reductions in fatigue post-intervention. Three were RCTs [42, 44, 47] and three pre/ post-test studies [45, 46, 49]. Of the RCTs, one study [42] showed statistically significant improvements in fatigue in both the aerobic exercise (6±33%; p=0.009) and relaxation training groups (9±25%; p=0.02) at three weeks post interventions. The reduction of fatigue scores did not differ significantly between groups and there was no significant association between increase of maximal physical performance and reduction of fatigue scores. A second RCT [44] showed statistically significant improvements in fatigue in the exercise and balance programme group compared to the control group ($p<0.001$; 95% CI, -3.3 to -2.1, d=1.8) at six weeks post intervention. In

addition, the study found that fatigue was restored to lower than pre-surgery levels in the exercise and balance group (p>0.001). The third RCT [47] found statistically significant improvements in fatigue in the medical qigong group compared to the control group (mean difference 5.70 (95% CI 3.32 to 8.09) at 10 weeks post intervention. Participants in medical qigong group also reported a clinically significant change in their levels of fatigue.

Of the three pre/post-test studies [45, 46, 49] one showed statistically significant improvements in fatigue at 12 weeks post the exercise intervention ($p \leq 0.01$; mean difference 9.19 (6.18 – 12.14, CI 95%); effect size 1.11) [45]. In addition 64% of participants reached the minimally important clinical difference for fatigue. The second study[46] showed statistically significant improvements in fatigue 14 weeks post intervention (p=0.03; mean difference -7 (95% CI -1 to -17)). It also found statistically significant improvements in fatigue post-intervention for participants who had not received chemotherapy (p=0.03, mean difference -10 (95%CI -18 to -2), whilst no statistically significant improvements in fatigue post-intervention were found in participants (p=0.62, mean difference -2 (95% CI -10 to 7) who had received chemotherapy. Finally, the third study [49] found statistically significant reductions in fatigue at four weeks post intervention (p<0.001).

The remaining three studies [41, 43, 50] showed no statistically significant changes in fatigue pre or post intervention.

Dyspnoea

Of the five studies reporting on dyspnoea, two studies [43, 49] found statistically significant improvements in dyspnoea at four weeks post-intervention, compared to baseline. Glattki et al (2010) showed statistically significant improvements in dyspnoea post intervention (mean difference -0.26 +/- 0.61; p=0.007) compared to baseline [43]; Riesenberg et al (2017) also found statistically significant improvements in dyspnoea post intervention (mean difference -

13.7, p<0.001) compared to baseline [49]. Of the three remaining studies, one was an RCT and showed no statistically significant differences between aerobic exercise and relaxation training groups at three weeks post intervention [42] , whilst the two pre/post-test studies found no differences in dyspnoea at eight [50] and 10 weeks [48] post-intervention, compared to baseline.

Depression

Of the two studies reporting on depression, one was an RCT [47] and one a pre/post-test design [48]. The RCT showed a statistically significant reduction in depression in the medical qigong group compared to the control group at 10 weeks post-intervention (mean difference -2.56 (95% CI-5.14 to 0.01), p=0.029[47]. The pre/post-test study found no statistically significant differences in depression pre (3.8±4.2) or post (4.4±-5.6) intervention [48]. However, mean depression scores did move in a positive direction post intervention.

Adverse Events

One of the studies reported three adverse events relating to the exercise intervention; these were an exacerbation of shoulder arthritis, lower back pain and shoulder pain [48]. All were reported to successfully resolve.

Discussion

This review has examined the effects of exercise interventions on lung cancer survivors' fatigue, dyspnoea and depression levels. The findings suggest there is some evidence that exercise interventions can improve symptoms of fatigue, dyspnoea and depression in this population group. The interventions appear feasible and acceptable but more rigorous, larger scale RCT study designs are needed to determine their effectiveness. This would help identify

whether certain types of exercise interventions can be used to improve multiple symptoms simultaneously, or whether specific exercises are better targeted to specific symptoms.

Our review adds to existing systematic reviews in this area as it includes all studies reporting on any type of exercise intervention. In addition, it focuses on lung cancer survivors, a cancer group who are largely underrepresented in research studies, compares to other cancer types [30]. The review highlights the need for more robust research to be undertaken in this area to provide informed and credible information and facilitate improved outcomes for lung cancer survivors. Additionally, the review has focused on whether exercise specifically improves symptoms of fatigue, dyspnoea and depression in lung cancer survivors. All of these symptoms commonly feature in lung cancer survivors' day to day life and this review sheds light on potential exercise interventions and techniques that might help to alleviate some of these problems post treatment.

Many of the included studies showed statistically significant improvements in fatigue, dyspnoea and/or depression. These studies included a wide range of exercise interventions, with varying levels of intensity, in a number of different locations, over different lengths of time. Furthermore, one study [42] found that there was no significant association between an increase of maximal physical performance and reduction of fatigue scores. This suggests that there are a variety of different exercise interventions that may be beneficial to lung cancer survivors and that there is no 'one-size fits all' approach; instead customised exercise screening and treatment plans are required [6]. Lung cancer survivors who may feel over faced at the prospect of undertaking high levels of resistance training or aerobic exercise can be reassured that gentler exercises such as breathing techniques or medical qigong may also be effective ways of improving their symptom control. Similarly, those people who are keen to get back to their pre- cancer fitness levels can have confidence that by engaging in high levels

of physical activity they can achieve positive results and may improve their symptoms of fatigue, dyspnoea and/or depression in the process.

The lack of reporting of adverse events in the majority of the studies infers that, whilst there is mixed evidence as to the benefits of exercise in improving symptoms of fatigue, dyspnoea and depression in lung cancer survivors, undertaking exercise is unlikely to cause any sustained harm. This is important to note as some cancer survivors may be deterred from exercising post treatment due to fears they may do further damage to their already fragile bodies [51]. Thus, patients can be reassured that undertaking exercise post cancer is safe and is unlikely to cause any untoward, long-term health effects, something which has been verified in other literature on this topic [15, 16]. The low drop-out rate across the studies, also suggests that exercise, at all levels, is generally acceptable to lung cancer survivors and can be maintained and incorporated into their daily lives. This contrasts with a recent study [52] which found that a diagnosis of lung cancer was negatively associated with participating in physical activity programmes, although the study focused on people with metastatic disease. Lung cancer survivors may have different attitudes and abilities regarding undertaking exercise compared to those with more advanced disease.

The review has also identified that relaxation and mind-based therapies may serve as important adjuncts [47] or alternatives [42] to exercise based interventions for improving both depression and fatigue in lung cancer survivors. Previous research [9] has indicated that cancer survivors place value in both mind and body based practices as a way of providing symptomatic relief, relaxation and a sense of control over their cancer. This review adds credence to these findings and suggests that both mind and body based interventions, when used alone, or in conjunction with one another, can be effective ways of improving fatigue and depression in lung cancer survivors. Thus it is important to consider the use of exercise

alongside other supportive care interventions, such as mindfulness, meditation and other psychosocial therapies, for effective patient outcomes [30].

Finally, one study [46] included in the review found statistically significant improvements in fatigue post-intervention in participants who had not received chemotherapy, but these improvements were not found among participants who had received chemotherapy. This indicates that that the gruelling impact of chemotherapy on the body [53, 54] may be hard for lung cancer survivors to recover from, as the intensity of cancer related fatigue experienced increases during this time [6, 55] and may, in addition, make exercise regimes difficult to adhere to [30]. Nurses should consider the treatment pathways of lung cancer survivors when assessing which exercise or mind-based therapies might be useful to them. It may be that patients who have undergone chemotherapy may require more specialist input and resources to help them manage their fatigue in the long term.

Limitations of the review

Whilst the researchers endeavoured to conduct a thorough, comprehensive and systematic review of the existing literature on this topic, it is possible that some relevant studies may not have been captured in the study selection and screening process due to the diversity of exercise interventions being examined and because fatigue, dyspnoea or depression may not have been identified as one of the main outcomes being measured in some studies. In addition, the review does not allow for a comparison between the different types of exercise interventions and their effectiveness in improving fatigue, dyspnoea and/or depression, due to the limited information provided.

Conclusion

This review has identified that exercise interventions may be effective, and are unlikely to cause harm, for lung cancer survivors who wish to improve their symptoms of fatigue, dyspnoea and depression. However, the quality of the evidence provided is limited and more rigorous study designs are required to explore this important area further in order to provide lung cancer survivors with useful advice and guidance about which exercise interventions may be the most beneficial to help them self-manage these symptoms in survivorship.

NICE [56] recommend that the opinions and experiences of lung cancer patients and carers should be collected to improve the delivery of lung cancer services. The findings from this review will be used to inform a larger scale focus group study with lung cancer patients, carers, nurses and other health professionals to explore which types of exercise and or/ mind-based interventions are useful in improving symptoms of fatigue, dyspnoea and depression in lung cancer survivors. This information will be used to develop a self-management app for lung cancer survivors that will be used to provide patient centred, customised and tailored exercise recommendations to improve their symptom control.

Implications for Practice

The review has highlighted the need for nurses to employ a patient focused approach when considering which types of exercise interventions might be suitable for lung cancer patients in survivorship. The 'one-size fits all' approach is inappropriate here; instead customised exercise screening and treatment plans are required to enable nurses to provide lung cancer survivors with tailor made, patient focused exercise activities that complement their lifestyle needs, interests, abilities and requirements. Psychological and mind-based therapies may also

be used alongside, or as an alternative to, exercise to improve symptom control for lung cancer survivors; this should be considered by nurses and other health professionals when providing survivorship advice and support to lung cancer patients. Nurses need to carry out holistic, individualised care plans to ensure comprehensive assessments are conducted and appropriate self-management recommendations are communicated to lung cancer survivors.

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Figure Legends

Figure 1: PRISMA flow diagram outlining search strategy for review