

This item is the archived peer-reviewed author-version of:

The effects of physical self-management on quality of life in breast cancer patients : a systematic review

Reference:

Van Dijck Sophie, Nelissen Paulien, Verbelen Hanne, Tjalma Wiebren, Gebruers Nick.- The effects of physical self-management on quality of life in breast cancer patients : a systematic review
Breast - ISSN 0960-9776 - 28(2016), p. 20-28
Full text (Publishers DOI): <http://dx.doi.org/doi:10.1016/j.breast.2016.04.010>

Manuscript Number: THEBREAST-D-15-693R2

Title: The Effects of Physical Self-management on Quality of Life in Breast Cancer patients: A Systematic Review

Article Type: Review Article

Section/Category: Nursing and Quality of Life

Keywords: Breast cancer; Physical activity; Self-care, Self- management; Quality of Life

Corresponding Author: Prof. Nick Gebruers, PhD, PT

Corresponding Author's Institution: University of Antwerp

First Author: Sophie Van Dijck, MSc

Order of Authors: Sophie Van Dijck, MSc; Paulien Nelissen, MSc; Hanne Verbelen, MSc; Wiebren Tjalma, PhD, MD; Nick Gebruers, PhD, PT

Abstract: The aim of this systematic review is to report on the effects of different physical self-management techniques on quality of life (QoL) of patients with breast cancer. Therefore a systematic literature search was performed using four different databases (PubMed, Cochrane, Embase, Web of science). The inclusion criteria were: 1) adults >18y, 2) patients with breast cancer, 3) physical self-management techniques during or after initial treatment, 4) outcome measure needed to be an indicator of patients' quality of life 5), Randomized Controlled Trials of all ages. The methodological quality of the selected articles was assessed. The results concerning quality of life outcomes were extracted. A total of 13 RCT's, representing 2180 participants were included. Different self-management techniques were identified such as a booklet, brochure, multimedia and recommendations. Disregarding the type of intervention, most studies found a positive effect of physical activity on QoL outcomes such as fatigue, physical functioning, emotional and/or social wellbeing. The results of the interventions during or after primary treatment of breast cancer are discussed separately. Studies that started their intervention during primary treatment found an improvement in QoL or a slower decrease in QoL. Studies that started the intervention after primary treatment found an increase in QoL. In conclusion, physical self-management interventions during breast cancer treatment as well as after the primary treatment seem to generate beneficial effects on QoL.

Antwerp, 1th April 2016

Dear editor-in-chief

Please find enclosed our revised manuscript “The Effects of Physical Self-management on Quality of Life in Breast Cancer patients: A Systematic Review” which we would like to submit for publication to The Breast.

The survival of breast cancer is good with >85% of the patients surviving more than 5y. A good survival implicates that efforts should be made to let patients return to society with an excellent QoL. Since morbidities after breast cancer treatment are numerous, these morbidities will affect QoL. Physical activity is one possibility of improving breast cancer related morbidities, and so improving QoL. We have performed a systematic review on the topic of self-management by physical activities and its influence on QoL in breast cancer patients. The results are of interest for all health workers within the field of breast cancer. The comments on our original manuscript have led to a thorough revision of the introduction and references used. We believe that the quality of the manuscript has been improved.

The corresponding author is:

Nick Gebruers, PT PhD, Department of Rehabilitation Science and Physiotherapy, Faculty of Medicine and Health Sciences, University of Antwerp, Universiteitsplein 1, 2610 Antwerp, Belgium (e-mail: nick.gebruers@uantwerpen.be; M +32 496 18 43 46)

The authors do hope that the enclosed revision will be considered suitable for publication in The Breast.

On behalf of all authors,
Yours sincerely,



Prof. dr. Nick Gebruers
University of Antwerp
Faculty of Medicine and Health Sciences
Department of Rehabilitation Sciences and Physiotherapy-MOVANT

Running head:

physical self-management of breast cancer

Title:

The Effects of Physical Self-management on Quality of Life in Breast Cancer patients: A Systematic Review

Van Dijck Sophie PT^a; Nelissen PaulienPT^a; Verbelen Hanne, PT^a ; Tjalma Wiebren, Ph.D., M.D^{b,c};
Gebruers Nick, Ph.D., PT^a

- a. Department of Rehabilitation Sciences and Physiotherapy (MOVANT), Faculty of Medicine and Health Sciences, University of Antwerp, Universiteitsplein 1, 2610 Antwerp, Belgium (e-mail: sophie.van.dijck@hotmail.com, pauliennelissen@gmail.com, hanne.verbelen@uantwerpen.be, nick.gebruers@uantwerpen.be,)
- b. Multidisciplinary Breast Clinic, Antwerp University Hospital (UZA), Wilrijkstraat 10, 2650 Edegem, Belgium (e-mail: wiebren.tjalma@uza.be)
- c. Department of Medicine, Faculty of Medicine and Health Sciences, University of Antwerp, Universiteitsplein 1, 2610 Antwerp, Belgium (e-mail: wiebren.tjalma@uantwerpen.be)

Corresponding author:

Prof. dr. Nick Gebruers

Department of Rehabilitation Sciences and Physiotherapy

Faculty of Medicine and Health Sciences

University of Antwerp

Universiteitsplein 1

2610 Antwerp

Belgium

nick.gebruers@uantwerpen.be

M: +32 496 18 43 46; Fax: +32 32652501

Financial disclosure:

We certify that no party having a direct interest in the results of the research supporting this article has or will confer a benefit on us or on any organization with which we are associated AND, if applicable, we certify that all financial and material support for this research (eg, NIH or NHS grants) and work are clearly identified in the title page of the manuscript.

Funding

n/a

Conflict of interest

The authors have no conflict of interest to declare.

Acknowledgement

First two authors participated equally.

Response letter

Antwerp, 1th April 2016

Dear Editor,

Dear Reviewer,

We greatly appreciate the thorough review of our manuscript. We believe that your valuable comments have largely contributed to the improvement of our systematic review. Below, you will find a point-to-point response to all comments made; when we report that changes have been made. These changes are depicted in red in the revised manuscript.

Reviewer #2: Review - Manuscript Number THEBREAST-D-15-693R1

The manuscript "The Effects of Physical Self-management on Quality of Life in Breast Cancer Patients: A Systematic Review" aims to verify existing physical self-management programs and determine the effects of such programs on quality of live domains in breast cancer patients. Due to the psychological and social influence of reduced QOL in a growing population of breast cancer survivors, the knowledge is important and required.

The authors have done a fair job to improve the quality of their work. The amendments has clarified essential parts of the manuscript. However, I have still some comments, but only to the introduction part:

* The title of the unstructured abstract (front page) should be identical to the manuscript (remove "protocols" from the abstract title or add it to the main manuscript.

Response: Thank you for pointing out this difference between the manuscript and the electronic submission procedure. We have uniformed the titles.

* The start of the introduction might be improved by more concise writing. The second sentence is not written adequately and there is some inessential repetitions. Beneath I have a suggestion the authors may consider:

Breast cancer is the most common cancer among women in Europe with an incidence of 89.7 per 100.000 (make the reference in the ref.list, and more precisely, cited...). Due to better screening and improved treatment, the mortality rate has decreased and the survival rates has increased accordingly (ref). Then continue with morbidities after treatment...

Response: We thank the reviewer for providing an alternative sentence to start our introduction. We have used this suggestion and have rewritten the first part of the introduction, as depicted in red in the revised manuscript.

* Common morbidities after breast cancer treatment are fatigue, hot flashes, pain, sexual dysfunction, arthralgias, neuropathy, cognitive dysfunction, lymphedema, cardiac morbidity, bone

effects etc., some of these described in line 52-55. However, the references used here (5 and 6) are describing only arm and shoulder problems. Overall, the reported literature on morbidities after breast cancer is in the introduction section rather skewed in the way that ref 2,3,4,5,6,8,and 10 reports on arm, shoulder problems, though we know that these problems are yet not most prevalent. The present review article would have benefitted of using references covering more broadly the most prevalent problems breast cancer patients experience, for example using some reviews or other high quality research covering morbidities/late effects after breast cancer.

Response: We agree with the reviewer that most of our references relate to arm and shoulder problems. This is because we are most familiar with these problems and therefore also the scientific literature.. However, we have used the suggestion of the reviewer to implement more references concerning prevalent problems a part from arm and shoulder problems.

* Regarding the positive effects of physical activity on OQL-issues; Fatigue is the most prevalent reported symptom. Therefore, the Cochrane review Syst Rev. 2012 Nov 14;11: Exercise for the management of cancer-related fatigue in adults may be a considered reference in line 76

Response: We appreciate the suggestion, the references was added to the introduction.

The authors hope that the revision is now suitable for publication.

On behalf of all authors, that have approved this revised version of the manuscript;

Yours sincerely,

Prof. dr. Nick Gebruers

Highlights self-management:

- Self-management after BCT can be performed by different physical activity protocols.
- During BCT self-management by physical activities limit or slow down the decrease in QoL.
- After BCT self-management by physical activities increases QoL.

1 **The Effects of Physical Self-management on Quality of Life in Breast Cancer patients: A**
2 **Systematic Review**

3

4 Abstract (structured, 219w)

5 **Purpose:** This systematic review reports on the effects of different physical self-management
6 techniques on quality of life (QoL) for patients with breast cancer.

7 **Methods:** A systematic literature search was performed using four different databases
8 (PubMed, Cochrane, Embase, Web of science). The inclusion criteria were: 1) adults >18y, 2)
9 patients with breast cancer, 3) physical self-management techniques during or after initial
10 treatment, 4) outcome measure needed to be an indicator of patients' quality of life, 5)
11 Randomized Controlled Trials of all ages. The methodological quality of the selected articles
12 was assessed. The results concerning quality of life outcomes were extracted.

13 **Results:** A total of 13 RCT's, representing 2180 participants were included. Several different
14 self-management techniques were identified such as a booklet, brochure, multimedia and
15 recommendations. Disregarding the type of intervention, most studies found a positive effect
16 of physical activity on QoL outcomes such as fatigue, physical functioning, emotional and/or
17 social wellbeing. The results of interventions during or after primary treatment of breast
18 cancer are discussed separately. Studies that started their intervention during primary
19 treatment found an improvement in QoL or a slower decrease in QoL. Studies that started the
20 intervention after primary treatment found an increase in QoL

21 **Conclusion:** Physical self-management interventions during breast cancer treatment as well
22 as after the primary treatment seem to generate beneficial effects on QoL.

23

24 **Key-words:** Breast cancer, Physical activity, Self-care, Self- management, Quality of Life

25 Abstract (unstructured) 223w

26 The aim of this systematic review is to report on the effects of different physical self-
27 management techniques on quality of life (QoL) of patients with breast cancer. Therefore a
28 systematic literature search was performed using four different databases (PubMed, Cochrane,
29 Embase, Web of science). The inclusion criteria were: 1) adults >18y, 2) patients with breast
30 cancer, 3) physical self-management techniques during or after initial treatment, 4) outcome
31 measure needed to be an indicator of patients' quality of life 5), Randomized Controlled
32 Trials of all ages. The methodological quality of the selected articles was assessed. The results
33 concerning quality of life outcomes were extracted. A total of 13 RCT's, representing 2180
34 participants were included. Different self-management techniques were identified such as a
35 booklet, brochure, multimedia and recommendations. Disregarding the type of intervention,
36 most studies found a positive effect of physical activity on QoL outcomes such as fatigue,
37 physical functioning, emotional and/or social wellbeing. The results of the interventions
38 during or after primary treatment of breast cancer are discussed separately. Studies that started
39 their intervention during primary treatment found an improvement in QoL or a slower
40 decrease in QoL. Studies that started the intervention after primary treatment found an
41 increase in QoL. In conclusion, physical self-management interventions during breast cancer
42 treatment as well as after the primary treatment seem to generate beneficial effects on QoL.

43

44 **Introduction (2994w)**

45 **Breast cancer is the most common cancer among women in Europe with an incidence of 89.7**
46 **per 100.000.[1] Due to better screening services and improved treatment, the mortality rate**
47 **has decreased and survival rates have increased accordingly.[2] When survival rates improve,**
48 **the Quality of Life (QoL) of these patients becomes a key element in the treatment.**
49 **Unfortunately, QoL is hampered by the morbidities caused breast cancer treatment.[3-6]**
50 **Common morbidities described in the scientific literature are fatigue, hot flashes, pain, sexual**
51 **dysfunction, arthralgia, neuropathy, cognitive dysfunction, lymphedema, cardiac morbidity,**
52 **numbness, tightness in breast, loss of range of motion, fatigue, psychological problems.[6-13]**
53 **A number of these problems persist at a high rate even one year after treatment.[4, 14-17] Due**
54 **to morbidities, breast cancer patients will experience a decrease in QoL; a generic term that**
55 **implies physical, psychological and social aspects of daily life.**

56 Self-care or self-management could be an important tool to minimize the number of
57 morbidities in breast cancer treatment. Dean et al. stated that self-care not only includes health
58 maintenance, lifestyle behavior, utilization of preventive services, symptom evaluation, and
59 various self-treatment activities. Additionally, an interaction with the professional sector is
60 warranted.[18] Different definitions of self-care or self-management are available. A
61 common definition is “the systematic provision of education and supportive interventions by
62 health care staff to increase patients' skills and confidence in managing their health problems,
63 including regular assessment of progress and problems, goal setting and problem-solving
64 support”.[19] The importance in this definition is that the patient is in control of his own
65 health. In the current review we will explore self-management techniques that focus on the
66 use of physical activities as a self-management intervention. It is important that patients are
67 responsible for executing, at least part of the intervention. Physical activities can be seen as a
68 universally applicable self-management technique. Most of the breast cancer survivors remain

69 physically inactive after treatment.[20] Physical inactivity implies side-effects such as
70 decrease in muscle strength, fatigue, weakness, decrease in aerobic capacity and decrease in
71 bone density.[21] Research has shown that physical activity is positively related to QoL.[22,
72 23] Additionally, several studies provide evidence that physical activity or exercises are
73 beneficial in breast cancer patients and has an impact on many different domains that
74 influence health related QoL (HRQoL).[24-28] The next step is to understand whether self-
75 management by physical activities has the same effect as supervised exercises. Therefore, this
76 systematic review focuses on the available evidence of physical self-management techniques
77 used in breast cancer patients. The following research question was addressed: ‘What are the
78 existing self-management programs based upon physical activity and what are the effects of
79 these programs on the QoL in breast cancer patients?.

80

81

82 **Method**

83 *Literature search and selection*

84 A systematic literature search based upon the PRISMA (www.prisma-statement.org)
85 guidelines, was performed using four different electronic databases: Pubmed, Web of Science,
86 EMBASE and the Cochrane library for clinical trials. All searches were performed in August
87 2015. To define relevant keywords a PICO(S) method ([http://editorial-
88 unit.cochrane.org/cochrane-pico](http://editorial-unit.cochrane.org/cochrane-pico)) was used. The following keywords were combined in a
89 Boolean search: ‘breast cancer’(P), ‘self-management’(I), ‘self-care’(I), ‘training
90 programs’(I), ‘quality of life’(O) and ‘activities of daily living’(O). Further elaboration on the
91 search strategies can be found in table 1. We limited our review to articles written in English
92 or Dutch. Titles and abstracts were independently assessed twice to determine relevance to the

93 topic of this review. Two raters (P.N. and S.V.D.) screened the selected full-text articles,
94 based on the inclusion and exclusion criteria listed in table 2. In case the raters had diverging
95 opinions, consensus was sought during a meeting. A detailed flowchart of the search and
96 study selection is provided in figure 1.

97 Table 1

98 Table 2

99 *Quality assessment*

100 The methodological quality of the selected studies was assessed independently by 2
101 researchers (PN and SVD). The checklist (10 items) for randomized controlled trial provided
102 by the Dutch Cochrane Centre (<http://Netherlands.cochrane.org/>) was used to score all
103 studies. An item was rated “1” if sufficient information was available and bias was unlikely.
104 An item was rated “0” if it was certain that a criterion was lacking. An item was rated “?” if
105 no information was available. If disagreement persisted about the assignment of a score to an
106 item, a consensus meeting was held. The total quality is expressed as the sum of all criteria
107 that were scored “1”; see table 3. The level of evidence was determined for every study.[29]

108 Figure 1

109

110 **Results**

111 *Selection of studies*

112 Initially, the search yielded 1209 references. After removal of duplicates and a first screening,
113 60 abstracts were selected of which full texts were retrieved. Two reviewers independently
114 assessed the full texts based upon the defined criteria (see table 2); finally a total of 13 RCT-

115 studies [30-42] were included in this review, representing in total 2180 participants. The
116 literature search and study selection process are shown in figure 1.

117

118

119 *Methodological quality*

120 The risk of bias and the level of evidence of the different studies are reported in table 3. In all
121 cases, the two researchers agreed. Scores for study quality ranged from 5/10 to 10/10 with a
122 median score of 7/10. The item that was scored negatively in most studies: ‘Were patients and
123 clinicians blinded to the treatment/ trial?’. Two studies[31, 36] scored level A2 of evidence
124 while all other studies scored level B.

125 Table 3

126

127 *Assessment methods*

128 Different questionnaires were used to measure outcomes related to QoL. Table 3 includes an
129 overview of the questionnaires used as an assessment in the selected articles.

130

131

132

133 *Types of interventions*

134 Different kinds of interventions were found. Nine studies described an intervention that was
135 executed by the patients at home independently. [30-33, 35-38, 41, 42] Among these 9 studies

136 different methods were used: a web based program[36], information sessions[30],
137 multimedia[31, 33], information sessions and booklets[37, 38] and recommendations.[35]

138 Several studies provided a combination of methods to introduce the physical intervention. [32,
139 41, 42] Four studies used a supervised and home-based intervention.[32, 34, 39, 40] Only one
140 study had a three-arm design with an isolated home-based intervention, a supervised
141 intervention and a control group.[40] The used interventions are incomparable; therefore the
142 specific results of each study are listed in table 3.

143

144 *Effects of interventions*

145 To describe the effects of the different interventions a distinction had to be made between
146 studies that started their intervention during initial treatment and studies that started their
147 intervention after the initial treatment for breast cancer was completed. First we discuss the
148 studies that started their self-management intervention while participants were receiving
149 primary treatment for breast cancer.[31-33, 35, 37, 38, 40, 42] Primary treatment is
150 considered to be chemotherapy and/or radiotherapy, alone or in combination with surgery.
151 Four studies[31, 38, 40, 42] showed an actual improvement in QoL, whereas two studies[33,
152 37] showed a decrease in QoL. In both studies the decline in the intervention group was less
153 prominent in contrast to the control group. The interventions conducted by Mock et al.[37],
154 Purcell et al.[38] and Jones et al.[35] showed greater improvement in physical functioning
155 compared to the control group. Of the studies that investigated fatigue, two studies[37, 42]
156 found a significant decrease in fatigue; one study[33] found a slower increase in fatigue and
157 two studies found no effect of their intervention on fatigue.[31, 38] In the study of Purcell et
158 al., the decrease was only significant in the group that received the intervention right after
159 radiotherapy instead of before.[38] Wang et al. demonstrated significant less sleep

160 disturbances compared to the control group.[42] This may also have an effect on overall
161 fatigue on long term.

162 All studies that investigated the effect on physical performance found a higher performance in
163 their intervention group compared to the control group. [21, 24, 26] Segal et al. found that
164 patients who received the home-based intervention, had better physical functioning than those
165 in the supervised intervention, who scored the same as the control group.[40]

166 Secondly, we discuss the studies that have implemented their intervention after patients had
167 ended their initial treatment.[30, 32, 34, 36, 39, 41] All studies, except two[32, 39], found an
168 increase in QoL. Specifically, Basen-engquist et al.[30] showed an increase in general health
169 QoL and pain but not in mental or social QoL and Lee et al.[36] found that the QoL subscale
170 physical functioning improved. Few studies investigated the effect of their self-management
171 on fatigue.[34, 39, 41] Only one study concluded that fatigue improved significantly more in
172 the intervention group in comparison to their control group.[34] The other studies found no
173 difference.[39, 41] Another outcome measured by two studies was the physical performance.
174 [14, 18] One study measured aerobic capacity, strength and balance; they found that the only
175 significant result was a better aerobic capacity in the intervention group, measured with a 6
176 minute walking test.[30] In contrast, the other study that measured aerobic capacity found no
177 difference between intervention and control group.[34] Additionally they were unable to
178 demonstrate an improvement in strength. Noteworthy, Heim et al. were the only researchers
179 that investigated the effect on anxiety and depression and were able to demonstrate a
180 significant improvement.[34]

181 Table 3

182

183 **Discussion**

184 The aim of this study was to systematically review the scientific literature to answer the
185 question: ‘What are the existing self-management programs based upon physical activity and
186 what are the effects of these programs on the QoL in breast cancer patients?’.

187 The results clearly revealed that different methods of self-management are available in the
188 rehabilitation of breast cancer. First of all, most studies, disregarding the type of intervention,
189 found a positive effect of physical activity on QoL and other outcomes regarding QoL such as
190 fatigue, physical functioning and emotional or social QoL.[30, 31, 33, 34, 36-38, 40-42] On
191 the one hand, almost all studies that started their intervention after patients ended their
192 primary treatment for breast cancer, found positive results. [30, 34, 36, 41] On the other hand,
193 the studies that started their intervention during primary treatment found more inconsistent
194 results. [31-33, 35, 37, 38, 40, 42] Several studies[31, 35, 38, 40, 42] demonstrated an
195 improvement in QoL, whereas other studies[33, 37] found a slower decline in QoL. Both can
196 be seen as positive results. In regard to the other outcome measures, the evidence is
197 ambiguous. The authors cannot provide evidence that one self-management method can be
198 recommended over another since most interventions found good results. This is confirmed by
199 another systematic review that researched self-management methods in a broad cancer
200 population.[43] If we consider a more practical approach, multiple methods can be offered to
201 the patient to engage in self-management by physical activities.

202 However, not all studies found beneficial results of their intervention, the reason was not
203 always clear.[32, 38] Cadmus et al., a study of good methodological quality, found no effect
204 of home-based exercise on QoL.[32] Even if they adjusted for variables such as age,
205 treatment, stage at diagnosis, baseline physical activity and time since diagnosis. An
206 explanation could be that although the study participants increased their activity levels in
207 comparison to baseline, only 34% met the study goal of 150 min/week. This could indicate
208 that a certain amount of physical activity is required to obtain an increase in QoL. The study

209 only measured QoL at baseline and at 6 months follow-up. The long duration between
210 measurements could be a potential reason why there was no benefit found. There is a
211 possibility that benefits of physical activity occur early and then fade away. Another
212 explanation could be that most participants already had a high QoL. [32]

213 In the study by Mock et al., the control group became more physical active and the
214 researchers decided to divide their participants in a 'high-walk' and 'low-walk' group instead
215 of comparing intervention and control group.[37] They found that the 'high walk' group (> 90
216 min/week) had a better outcome than the 'low walk' group on QoL, fatigue and physical
217 functioning. Again this could be an indicator that a certain amount of physical activity is
218 needed to obtain benefit from being physical active.[37]

219 All studies assessed whether participants adhered to their program and to the prescribed
220 amount of physical activity.[30-42] This is a valuable outcome because it indicates whether an
221 intervention has led to a behavioral change. Adherence is more pronounced when sufficient
222 time is invested in the intervention. Time-investment can be achieved by means of an activity
223 diary or goal setting in advance to the intervention.[36, 38] Another method that seemed to
224 increase adherence was providing a measuring tool, such as a pedometer or a heart
225 monitor.[41, 42] The most common method to assess the amount of adherence and physical
226 activity was done by a self-reported diary.[31, 33, 34, 36, 37, 39, 40] One study even used
227 recall-interviews.[30] Because of the self-report activity through diaries, results may not be
228 authentic because patients can alter their results (recall bias). Vallance et al. found an increase
229 in self-reported physical activity, but the physical activity measured with a pedometer
230 indicated no change compared to baseline measurements.[41] However, this could be because
231 participants used more vigorous walking instead of more steps overall.

232 Several limitations concerning the included studies need to be discussed. Six out of thirteen
233 studies conducted a trial with patients after they ended their treatment. [30, 32, 34, 36, 39, 41]
234 These patients are often addressed as survivors. There is no clear definition of a breast cancer
235 survivor. According to Lee et al.[36], survivors were patients diagnosed two years prior to
236 their study, whereas Cadmus et al.[32] reckoned survivors 1 to 10 years post-diagnosis.
237 Vallance et al. defined patients as survivors when there was an absence of current breast
238 cancer.[41] The duration of the survivorship may alter results. Comorbidities change over
239 time, even in a short time span of a year and are different dependent on treatment method.[44]
240 Consequently, rehabilitation needs are different. This can also have effects on the use of
241 questionnaires, because some may be less responsive or accurate.[41] Different questionnaires
242 were used to measure QoL, whereas not every questionnaire is as responsive in breast-cancer
243 patients. The EQ-5D is unable to detect small changes in health, in comparison to the EORTC
244 QLQ C30 that is found to be responsive in breast cancer patients.[45] Also, the QLQ C30 has
245 better responsiveness to the detection of ceiling effects.[46] In comparison to this, the FACT-
246 G questionnaire showed better precision in HRQoL.[46] The SF-36 is a more generic
247 questionnaire, not disease-specific, and might be less suitable for breast cancer patients, where
248 the FACT-B is disease-specific and might be more appropriate in the research of QoL in
249 breast cancer patients.

250 Blinding of participants is difficult in behavioral studies. Therefore, participants were mostly
251 aware of the purpose of the study and this itself may have an effect on the intervention.
252 Knowing the purpose of the trial, could be seen as an intervention itself.[39] Patients of the
253 control group may take initiative into their own hands. In some studies, the control group also
254 became more active.[31, 33, 35, 37, 40, 42] This could have biased the results because the
255 difference between both groups could be less and this can make the difference between being
256 statistically significant or not.

257 Four studies conducted a combination of home-based and supervised-intervention. [32, 34, 39,
258 40] Of these studies, only one did this in comparison to an isolated home-based
259 intervention.[40] They found that their home-based intervention scored better than their
260 supervised intervention and that the supervised intervention had similar results to the control
261 group.[40] Another study found no significant difference between their home-based and
262 home-based in addition to supervised intervention.[32] However there are advantages of
263 supervised exercise training, it can improve patient's motivation[34] and it offers the
264 possibility to interact with fellow patients in group sessions.[34]

265 Finally, in behavioral studies it is important to know the long-term effect. It is generally
266 known that employing a more physical active lifestyle is hard to maintain on the long run, this
267 is not different for patients with breast cancer. A long-term follow-up is essential to assess the
268 ceiling effect of physical activity. Not every study demonstrated an adequate follow-up. The
269 authors defined an adequate follow-up as 12 months or more. Only two studies met this
270 criterion.[31, 39] Studies with a short follow-up had different results in comparison to those
271 with a longer follow-up. For example the study by Haines et al. found significant differences
272 between intervention and control group at 3 and 6 months follow-up, however at 12 months
273 follow-up this result was no longer present.[31] This may be due to the fact that the patients
274 reached their maximum. Of the studies that reported on different follow-up assessments, a
275 decrease in effect over time was seen in four studies.[31, 33, 38, 42] This decrease occurred
276 mostly after 3 months. Nonetheless two studies found an increase in effect at their follow-up
277 of respectively 3 and 12 months. [34, 39]

278 Lastly, the strengths and weaknesses of this review are discussed. The strength of this review
279 is the fact that the reviewed studies are all randomized controlled trials and that they all had a
280 fair to good methodological quality. Another strength is that four databases were used to
281 retrieve all eligible studies. The first limitation is that the interventions described in the

282 different studies are too different to compare and so only a conclusion in general can be made.
283 A second limitation is that the selection of studies may have been biased due to an unclear
284 definition of self-management.

285

286

287 Conclusion

288 There are different methods of physical self-management that provide beneficial effects on
289 QoL and outcomes regarding QoL. It is likely that the implementation of physical self-
290 management after adjuvant therapy increases QoL. It is also likely that starting the self-
291 management intervention during adjuvant therapy is beneficial, as it results in an increase or a
292 slower decline in QoL. Nevertheless, it should be noted that at this moment no self-
293 management technique could be chosen over another. Most studies did not organize long-term
294 follow-up, leading to uncertainty of long-term outcome. Therefore, further research on the
295 implementation of self-management in breast cancer patients is highly warranted.

296

297

298 Conflict of interest

299 The authors have no conflict of interest to declare.

300

301

302

303

304

305

306

307

308

309

310

311 **Reference list**

312

- 313 [1] Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of
314 cancer in 2008: GLOBOCAN 2008. *International journal of cancer*. 2010;127:2893-917.
- 315 [2] Allemani C, Weir HK, Carreira H, Harewood R, Spika D, Wang XS, et al. Global surveillance of
316 cancer survival 1995-2009: analysis of individual data for 25,676,887 patients from 279 population-
317 based registries in 67 countries (CONCORD-2). *Lancet (London, England)*. 2015
318 385:977-1010.
- 319 [3] Pusic AL, Cemal Y, Albornoz C, Klassen A, Cano S, Sulimanoff I, et al. Quality of life among breast
320 cancer patients with lymphedema: a systematic review of patient-reported outcome instruments and
321 outcomes. *J Cancer Surviv*. 2013;7:83-92.
- 322 [4] Kibar S, Dalyan Aras M, Unsal Delialioglu S. The risk factors and prevalence of upper extremity
323 impairments and an analysis of effects of lymphoedema and other impairments on the quality of life
324 of breast cancer patients. *European journal of cancer care*. 2016.
- 325 [5] Belmonte R, Garin O, Segura M, Pont A, Escalada F, Ferrer M. Quality-of-life impact of sentinel
326 lymph node biopsy versus axillary lymph node dissection in breast cancer patients. *Value Health*.
327 2012;15:907-15.
- 328 [6] Aerts PD, De Vries J, Van der Steeg AF, Roukema JA. The relationship between morbidity after
329 axillary surgery and long-term quality of life in breast cancer patients: the role of anxiety. *Eur J Surg*
330 *Oncol*. 2011;37:344-9.
- 331 [7] Wernicke AG, Shamis M, Sidhu KK, Turner BC, Goltser Y, Khan I, et al. Complication rates in
332 patients with negative axillary nodes 10 years after local breast radiotherapy after either sentinel
333 lymph node dissection or axillary clearance. *American journal of clinical oncology*. 2013;36:12-9.
- 334 [8] Henneghan A. Modifiable factors and cognitive dysfunction in breast cancer survivors: a mixed-
335 method systematic review. *Support Care Cancer*. 2016;24:481-97.
- 336 [9] Kenyon M, Mayer DK, Owens AK. Late and long-term effects of breast cancer treatment and
337 surveillance management for the general practitioner. *Journal of obstetric, gynecologic, and neonatal*
338 *nursing : JOGNN / NAACOG*. 2014;43:382-98.
- 339 [10] Morean DF, O'Dwyer L, Cherney LR. Therapies for Cognitive Deficits Associated With
340 Chemotherapy for Breast Cancer: A Systematic Review of Objective Outcomes. *Archives of physical*
341 *medicine and rehabilitation*. 2015;96:1880-97.
- 342 [11] Pinto AC, de Azambuja E. Improving quality of life after breast cancer: dealing with symptoms.
343 *Maturitas*. 2011;70:343-8.
- 344 [12] Abrahams HJ, Gielissen MF, Schmits IC, Verhagen CA, Rovers MM, Knoop H. Risk factors,
345 prevalence, and course of severe fatigue after breast cancer treatment: A meta-analysis involving
346 12,327 breast cancer survivors. *Ann Oncol*. 2016.
- 347 [13] Engel J, Kerr J, Schlesinger-Raab A, Sauer H, Holzel D. Quality of life following breast-conserving
348 therapy or mastectomy: results of a 5-year prospective study. *Breast J*. 2004;10:223-31.
- 349 [14] Stan D, Loprinzi CL, Ruddy KJ. Breast cancer survivorship issues. *Hematology/oncology clinics of*
350 *North America*. 2013;27:805-27, ix.
- 351 [15] Gebruers N VH, De Vrieze T, Coeck D, Tjalma W. The incidence and time path of lymphedema in
352 sentinel negative breast cancer patients: a systematic review. *ARCHIVES OF PHYSICAL MEDICINE AND*
353 *REHABILITATION* 2015.
- 354 [16] Verbelen H, Gebruers N, Beyers T, De Monie AC, Tjalma W. Breast edema in breast cancer
355 patients following breast-conserving surgery and radiotherapy: a systematic review. *Breast Cancer*
356 *Res Treat*. 2014;147:463-71.
- 357 [17] Verbelen H, Gebruers N, Eeckhout FM, Verlinden K, Tjalma W. Shoulder and arm morbidity in
358 sentinel node-negative breast cancer patients: a systematic review. *Breast Cancer Res Treat*.
359 2014;144:21-31.

- 360 [18] Dean K. SELF-CARE RESPONSES TO ILLNESS: A SELECTED REVIEW. *Social Science & Medicine Part*
361 *A Medical Psychology & Medical Sociology*.15A:673-87.
- 362 [19] McCorkle R, Ercolano E, Lazenby M, Schulman-Green D, Schilling LS, Lorig K, et al. Self-
363 management: Enabling and empowering patients living with cancer as a chronic illness. *CA: a cancer*
364 *journal for clinicians*. 2011;61:50-62.
- 365 [20] Devoogdt N, Van Kampen M, Geraerts I, Coremans T, Fieuws S, Lefevre J, et al. Physical activity
366 levels after treatment for breast cancer: one-year follow-up. *Breast Cancer Res Treat*. 2010;123:417-
367 25.
- 368 [21] Vardar-Yagli N, Sener G, Saglam M, Calik-Kutukcu E, Arikan H, Inal-Ince D, et al. Associations
369 among physical activity, comorbidity, functional capacity, peripheral muscle strength and depression
370 in breast cancer survivors. *Asian Pacific journal of cancer prevention : APJCP*. 2015;16:585-9.
- 371 [22] Bize R, Johnson JA, Plotnikoff RC. Physical activity level and health-related quality of life in the
372 general adult population: a systematic review. *Preventive medicine*. 2007;45:401-15.
- 373 [23] Bicego D, Brown K, Ruddick M, Storey D, Wong C, Harris SR. Effects of exercise on quality of life
374 in women living with breast cancer: a systematic review. *Breast J*. 2009;15:45-51.
- 375 [24] Zeng Y, Huang M, Cheng AS, Zhou Y, So WK. Meta-analysis of the effects of exercise intervention
376 on quality of life in breast cancer survivors. *Breast cancer (Tokyo, Japan)*. 2014; 21:262-74.
- 377 [25] Kirshbaum MN. A review of the benefits of whole body exercise during and after treatment for
378 breast cancer. *Journal of Clinical Nursing* 2007;16:104-21.
- 379 [26] Mishra SI, Scherer RW, Snyder C, Geigle PM, Berlanstein DR, Topaloglu O. Exercise interventions
380 on health-related quality of life for people with cancer during active treatment. *The Cochrane*
381 *database of systematic reviews*. 2012;8:CD008465.
- 382 [27] Mishra SI, Scherer RW, Geigle PM, Berlanstein DR, Topaloglu O, Gotay CC, et al. Exercise
383 interventions on health-related quality of life for cancer survivors. *The Cochrane database of*
384 *systematic reviews*. 2012;8:CD007566.
- 385 [28] Cramp F, Byron-Daniel J. Exercise for the management of cancer-related fatigue in adults. *The*
386 *Cochrane database of systematic reviews*. 2012;11:CD006145.
- 387 [29] Foster M, Shurtz S, Smith ML. Translating research into practice: criteria for applying literature
388 search results to your work. *Health promotion practice*. 2014; 15:157-60.
- 389 [30] Basen-Engquist K, Taylor CL, Rosenblum C, Smith MA, Shinn EH, Greisinger A, et al. Randomized
390 pilot test of a lifestyle physical activity intervention for breast cancer survivors. *Patient education and*
391 *counseling*. 2006;64:225-34.
- 392 [31] Haines TP, Sinnamon P, Wetzig NG, Lehman M, Walpole E, Pratt T, et al. Multimodal exercise
393 improves quality of life of women being treated for breast cancer, but at what cost? Randomized trial
394 with economic evaluation. *Breast cancer research and treatment*. 2010;124:163-75.
- 395 [32] Cadmus LA, Salovey P, Yu H, Chung G, Kasl S, Irwin ML. Exercise and quality of life during and
396 after treatment for breast cancer: results of two randomized controlled trials. *Psycho-oncology*.
397 2009;18:343-52.
- 398 [33] Headley JA, Ownby KK, John LD. The effect of seated exercise on fatigue and quality of life in
399 women with advanced breast cancer. *Oncol Nurs Forum*. 2004;31:977-83.
- 400 [34] Heim ME, v d Malsburg ML, Niklas A. Randomized controlled trial of a structured training
401 program in breast cancer patients with tumor-related chronic fatigue. *Onkologie*. 2007;30:429-34.
- 402 [35] Jones LW, Courneya KS, Fairey AS, Mackey JR. Effects of an oncologist's recommendation to
403 exercise on self-reported exercise behavior in newly diagnosed breast cancer survivors: a single-
404 blind, randomized controlled trial. *Annals of behavioral medicine : a publication of the Society of*
405 *Behavioral Medicine*. 2004;28:105-13.
- 406 [36] Lee MK, Yun YH, Park HA, Lee ES, Jung KH, Noh DY. A Web-based self-management exercise and
407 diet intervention for breast cancer survivors: pilot randomized controlled trial. *International journal*
408 *of nursing studies*. 2014;51:1557-67.

- 409 [37] Mock V, Pickett M, Ropka ME, Muscari Lin E, Stewart KJ, Rhodes VA, et al. Fatigue and quality of
410 life outcomes of exercise during cancer treatment. *Cancer Pract.* 2001;9:119-27.
- 411 [38] Purcell A, Fleming J, Burmeister B, Bennett S, Haines T. Is education an effective management
412 strategy for reducing cancer-related fatigue? *Supportive care in cancer : official journal of the*
413 *Multinational Association of Supportive Care in Cancer.* 2011;19:1429-39.
- 414 [39] Saarto T, Penttinen HM, Sievanen H, Kellokumpu-Lehtinen PL, Hakamies-Blomqvist L, Nikander
415 R, et al. Effectiveness of a 12-month exercise program on physical performance and quality of life of
416 breast cancer survivors. *Anticancer research.* 2012;32:3875-84.
- 417 [40] Segal R, Evans W, Johnson D, Smith J, Colletta S, Gayton J, et al. Structured exercise improves
418 physical functioning in women with stages I and II breast cancer: results of a randomized controlled
419 trial. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology.*
420 2001;19:657-65.
- 421 [41] Vallance JK, Courneya KS, Plotnikoff RC, Yasui Y, Mackey JR. Randomized controlled trial of the
422 effects of print materials and step pedometers on physical activity and quality of life in breast cancer
423 survivors. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology.*
424 2007;25:2352-9.
- 425 [42] Wang YJ, Boehmke M, Wu YW, Dickerson SS, Fisher N. Effects of a 6-week walking program on
426 Taiwanese women newly diagnosed with early-stage breast cancer. *Cancer nursing.* 2011;34:E1-13.
- 427 [43] Hammer MJ, Ercolano EA, Wright F, Dickson VV, Chyun D, Melkus GD. Self-management for
428 adult patients with cancer: an integrative review. *Cancer nursing.* 2015;38:E10-26.
- 429 [44] Shimosuma K, Ganz PA, Petersen L, Hirji K. Quality of life in the first year after breast cancer
430 surgery: rehabilitation needs and patterns of recovery. *Breast cancer research and treatment.*
431 1999;56:45-57.
- 432 [45] Kimman ML, Dirksen CD, Lambin P, Boersma LJ. Responsiveness of the EQ-5D in breast cancer
433 patients in their first year after treatment. *Health and quality of life outcomes.* 2009;7:11.
- 434 [46] Lockett T, King MT, Butow PN, Oguchi M, Rankin N, Price MA, et al. Choosing between the
435 EORTC QLQ-C30 and FACT-G for measuring health-related quality of life in cancer clinical research:
436 issues, evidence and recommendations. *Annals of oncology : official journal of the European Society*
437 *for Medical Oncology / ESMO.* 2011;22:2179-90.
- 438
- 439
- 440

1 **The Effects of Physical Self-management on Quality of Life in Breast Cancer patients: A**
2 **Systematic Review**

3

4 Abstract (structured, 219w)

5 **Purpose:** This systematic review reports on the effects of different physical self-management
6 techniques on quality of life (QoL) for patients with breast cancer.

7 **Methods:** A systematic literature search was performed using four different databases
8 (PubMed, Cochrane, Embase, Web of science). The inclusion criteria were: 1) adults >18y, 2)
9 patients with breast cancer, 3) physical self-management techniques during or after initial
10 treatment, 4) outcome measure needed to be an indicator of patients' quality of life, 5)
11 Randomized Controlled Trials of all ages. The methodological quality of the selected articles
12 was assessed. The results concerning quality of life outcomes were extracted.

13 **Results:** A total of 13 RCT's, representing 2180 participants were included. Several different
14 self-management techniques were identified such as a booklet, brochure, multimedia and
15 recommendations. Disregarding the type of intervention, most studies found a positive effect
16 of physical activity on QoL outcomes such as fatigue, physical functioning, emotional and/or
17 social wellbeing. The results of interventions during or after primary treatment of breast
18 cancer are discussed separately. Studies that started their intervention during primary
19 treatment found an improvement in QoL or a slower decrease in QoL. Studies that started the
20 intervention after primary treatment found an increase in QoL

21 **Conclusion:** Physical self-management interventions during breast cancer treatment as well
22 as after the primary treatment seem to generate beneficial effects on QoL.

23

24 **Key-words:** Breast cancer, Physical activity, Self-care, Self- management, Quality of Life

25 Abstract (unstructured) 223w

26 The aim of this systematic review is to report on the effects of different physical self-
27 management techniques on quality of life (QoL) of patients with breast cancer. Therefore a
28 systematic literature search was performed using four different databases (PubMed, Cochrane,
29 Embase, Web of science). The inclusion criteria were: 1) adults >18y, 2) patients with breast
30 cancer, 3) physical self-management techniques during or after initial treatment, 4) outcome
31 measure needed to be an indicator of patients' quality of life 5), Randomized Controlled
32 Trials of all ages. The methodological quality of the selected articles was assessed. The results
33 concerning quality of life outcomes were extracted. A total of 13 RCT's, representing 2180
34 participants were included. Different self-management techniques were identified such as a
35 booklet, brochure, multimedia and recommendations. Disregarding the type of intervention,
36 most studies found a positive effect of physical activity on QoL outcomes such as fatigue,
37 physical functioning, emotional and/or social wellbeing. The results of the interventions
38 during or after primary treatment of breast cancer are discussed separately. Studies that started
39 their intervention during primary treatment found an improvement in QoL or a slower
40 decrease in QoL. Studies that started the intervention after primary treatment found an
41 increase in QoL. In conclusion, physical self-management interventions during breast cancer
42 treatment as well as after the primary treatment seem to generate beneficial effects on QoL.

43

44 **Introduction (2994w)**

45 Breast cancer is the most common cancer among women in Europe with an incidence of 89.7
46 per 100.000.[1] Due to better screening services and improved treatment, the mortality rate
47 has decreased and survival rates have increased accordingly.[2] When survival rates improve,
48 the Quality of Life (QoL) of these patients becomes a key element in the treatment.
49 Unfortunately, QoL is hampered by the morbidities caused breast cancer treatment.[3-6]
50 Common morbidities described in the scientific literature are fatigue, hot flashes, pain, sexual
51 dysfunction, arthralgia, neuropathy, cognitive dysfunction, lymphedema, cardiac morbidity,
52 numbness, tightness in breast, loss of range of motion, fatigue, psychological problems.[6-13]
53 A number of these problems persist at a high rate even one year after treatment.[4, 14-17] Due
54 to morbidities, breast cancer patients will experience a decrease in QoL; a generic term that
55 implies physical, psychological and social aspects of daily life.

56 Self-care or self-management could be an important tool to minimize the number of
57 morbidities in breast cancer treatment. Dean et al. stated that self-care not only includes health
58 maintenance, lifestyle behavior, utilization of preventive services, symptom evaluation, and
59 various self-treatment activities. Additionally, an interaction with the professional sector is
60 warranted.[18] Different definitions of self-care or self-management are available. A
61 common definition is “the systematic provision of education and supportive interventions by
62 health care staff to increase patients' skills and confidence in managing their health problems,
63 including regular assessment of progress and problems, goal setting and problem-solving
64 support”.[19] The importance in this definition is that the patient is in control of his own
65 health. In the current review we will explore self-management techniques that focus on the
66 use of physical activities as a self-management intervention. It is important that patients are
67 responsible for executing, at least part of the intervention. Physical activities can be seen as a
68 universally applicable self-management technique. Most of the breast cancer survivors remain

69 physically inactive after treatment.[20] Physical inactivity implies side-effects such as
70 decrease in muscle strength, fatigue, weakness, decrease in aerobic capacity and decrease in
71 bone density.[21] Research has shown that physical activity is positively related to QoL.[22,
72 23] Additionally, several studies provide evidence that physical activity or exercises are
73 beneficial in breast cancer patients and has an impact on many different domains that
74 influence health related QoL (HRQoL).[24-28] The next step is to understand whether self-
75 management by physical activities has the same effect as supervised exercises. Therefore, this
76 systematic review focuses on the available evidence of physical self-management techniques
77 used in breast cancer patients. The following research question was addressed: ‘What are the
78 existing self-management programs based upon physical activity and what are the effects of
79 these programs on the QoL in breast cancer patients?.

80

81

82 **Method**

83 *Literature search and selection*

84 A systematic literature search based upon the PRISMA (www.prisma-statement.org)
85 guidelines, was performed using four different electronic databases: Pubmed, Web of Science,
86 EMBASE and the Cochrane library for clinical trials. All searches were performed in August
87 2015. To define relevant keywords a PICO(S) method ([http://editorial-
88 unit.cochrane.org/cochrane-pico](http://editorial-unit.cochrane.org/cochrane-pico)) was used. The following keywords were combined in a
89 Boolean search: ‘breast cancer’(P), ‘self-management’(I), ‘self-care’(I), ‘training
90 programs’(I), ‘quality of life’(O) and ‘activities of daily living’(O). Further elaboration on the
91 search strategies can be found in table 1. We limited our review to articles written in English
92 or Dutch. Titles and abstracts were independently assessed twice to determine relevance to the

93 topic of this review. Two raters (P.N. and S.V.D.) screened the selected full-text articles,
94 based on the inclusion and exclusion criteria listed in table 2. In case the raters had diverging
95 opinions, consensus was sought during a meeting. A detailed flowchart of the search and
96 study selection is provided in figure 1.

97 Table 1

98 Table 2

99 *Quality assessment*

100 The methodological quality of the selected studies was assessed independently by 2
101 researchers (PN and SVD). The checklist (10 items) for randomized controlled trial provided
102 by the Dutch Cochrane Centre (<http://Netherlands.cochrane.org/>) was used to score all
103 studies. An item was rated “1” if sufficient information was available and bias was unlikely.
104 An item was rated “0” if it was certain that a criterion was lacking. An item was rated “?” if
105 no information was available. If disagreement persisted about the assignment of a score to an
106 item, a consensus meeting was held. The total quality is expressed as the sum of all criteria
107 that were scored “1”; see table 3. The level of evidence was determined for every study.[29]

108 Figure 1

109

110 **Results**

111 *Selection of studies*

112 Initially, the search yielded 1209 references. After removal of duplicates and a first screening,
113 60 abstracts were selected of which full texts were retrieved. Two reviewers independently
114 assessed the full texts based upon the defined criteria (see table 2); finally a total of 13 RCT-

115 studies [30-42] were included in this review, representing in total 2180 participants. The
116 literature search and study selection process are shown in figure 1.

117

118

119 *Methodological quality*

120 The risk of bias and the level of evidence of the different studies are reported in table 3. In all
121 cases, the two researchers agreed. Scores for study quality ranged from 5/10 to 10/10 with a
122 median score of 7/10. The item that was scored negatively in most studies: ‘Were patients and
123 clinicians blinded to the treatment/ trial?’. Two studies[31, 36] scored level A2 of evidence
124 while all other studies scored level B.

125 Table 3

126

127 *Assessment methods*

128 Different questionnaires were used to measure outcomes related to QoL. Table 3 includes an
129 overview of the questionnaires used as an assessment in the selected articles.

130

131

132

133 *Types of interventions*

134 Different kinds of interventions were found. Nine studies described an intervention that was
135 executed by the patients at home independently. [30-33, 35-38, 41, 42] Among these 9 studies

136 different methods were used: a web based program[36], information sessions[30],
137 multimedia[31, 33], information sessions and booklets[37, 38] and recommendations.[35]

138 Several studies provided a combination of methods to introduce the physical intervention. [32,
139 41, 42] Four studies used a supervised and home-based intervention.[32, 34, 39, 40] Only one
140 study had a three-arm design with an isolated home-based intervention, a supervised
141 intervention and a control group.[40] The used interventions are incomparable; therefore the
142 specific results of each study are listed in table 3.

143

144 *Effects of interventions*

145 To describe the effects of the different interventions a distinction had to be made between
146 studies that started their intervention during initial treatment and studies that started their
147 intervention after the initial treatment for breast cancer was completed. First we discuss the
148 studies that started their self-management intervention while participants were receiving
149 primary treatment for breast cancer.[31-33, 35, 37, 38, 40, 42] Primary treatment is
150 considered to be chemotherapy and/or radiotherapy, alone or in combination with surgery.
151 Four studies[31, 38, 40, 42] showed an actual improvement in QoL, whereas two studies[33,
152 37] showed a decrease in QoL. In both studies the decline in the intervention group was less
153 prominent in contrast to the control group. The interventions conducted by Mock et al.[37],
154 Purcell et al.[38] and Jones et al.[35] showed greater improvement in physical functioning
155 compared to the control group. Of the studies that investigated fatigue, two studies[37, 42]
156 found a significant decrease in fatigue; one study[33] found a slower increase in fatigue and
157 two studies found no effect of their intervention on fatigue.[31, 38] In the study of Purcell et
158 al., the decrease was only significant in the group that received the intervention right after
159 radiotherapy instead of before.[38] Wang et al. demonstrated significant less sleep

160 disturbances compared to the control group.[42] This may also have an effect on overall
161 fatigue on long term.

162 All studies that investigated the effect on physical performance found a higher performance in
163 their intervention group compared to the control group. [21, 24, 26] Segal et al. found that
164 patients who received the home-based intervention, had better physical functioning than those
165 in the supervised intervention, who scored the same as the control group.[40]

166 Secondly, we discuss the studies that have implemented their intervention after patients had
167 ended their initial treatment.[30, 32, 34, 36, 39, 41] All studies, except two[32, 39], found an
168 increase in QoL. Specifically, Basen-engquist et al.[30] showed an increase in general health
169 QoL and pain but not in mental or social QoL and Lee et al.[36] found that the QoL subscale
170 physical functioning improved. Few studies investigated the effect of their self-management
171 on fatigue.[34, 39, 41] Only one study concluded that fatigue improved significantly more in
172 the intervention group in comparison to their control group.[34] The other studies found no
173 difference.[39, 41] Another outcome measured by two studies was the physical performance.
174 [14, 18] One study measured aerobic capacity, strength and balance; they found that the only
175 significant result was a better aerobic capacity in the intervention group, measured with a 6
176 minute walking test.[30] In contrast, the other study that measured aerobic capacity found no
177 difference between intervention and control group.[34] Additionally they were unable to
178 demonstrate an improvement in strength. Noteworthy, Heim et al. were the only researchers
179 that investigated the effect on anxiety and depression and were able to demonstrate a
180 significant improvement.[34]

181 Table 3

182

183 **Discussion**

184 The aim of this study was to systematically review the scientific literature to answer the
185 question: ‘What are the existing self-management programs based upon physical activity and
186 what are the effects of these programs on the QoL in breast cancer patients?’.

187 The results clearly revealed that different methods of self-management are available in the
188 rehabilitation of breast cancer. First of all, most studies, disregarding the type of intervention,
189 found a positive effect of physical activity on QoL and other outcomes regarding QoL such as
190 fatigue, physical functioning and emotional or social QoL.[30, 31, 33, 34, 36-38, 40-42] On
191 the one hand, almost all studies that started their intervention after patients ended their
192 primary treatment for breast cancer, found positive results. [30, 34, 36, 41] On the other hand,
193 the studies that started their intervention during primary treatment found more inconsistent
194 results. [31-33, 35, 37, 38, 40, 42] Several studies[31, 35, 38, 40, 42] demonstrated an
195 improvement in QoL, whereas other studies[33, 37] found a slower decline in QoL. Both can
196 be seen as positive results. In regard to the other outcome measures, the evidence is
197 ambiguous. The authors cannot provide evidence that one self-management method can be
198 recommended over another since most interventions found good results. This is confirmed by
199 another systematic review that researched self-management methods in a broad cancer
200 population.[43] If we consider a more practical approach, multiple methods can be offered to
201 the patient to engage in self-management by physical activities.

202 However, not all studies found beneficial results of their intervention, the reason was not
203 always clear.[32, 38] Cadmus et al., a study of good methodological quality, found no effect
204 of home-based exercise on QoL.[32] Even if they adjusted for variables such as age,
205 treatment, stage at diagnosis, baseline physical activity and time since diagnosis. An
206 explanation could be that although the study participants increased their activity levels in
207 comparison to baseline, only 34% met the study goal of 150 min/week. This could indicate
208 that a certain amount of physical activity is required to obtain an increase in QoL. The study

209 only measured QoL at baseline and at 6 months follow-up. The long duration between
210 measurements could be a potential reason why there was no benefit found. There is a
211 possibility that benefits of physical activity occur early and then fade away. Another
212 explanation could be that most participants already had a high QoL. [32]

213 In the study by Mock et al., the control group became more physical active and the
214 researchers decided to divide their participants in a 'high-walk' and 'low-walk' group instead
215 of comparing intervention and control group.[37] They found that the 'high walk' group (> 90
216 min/week) had a better outcome than the 'low walk' group on QoL, fatigue and physical
217 functioning. Again this could be an indicator that a certain amount of physical activity is
218 needed to obtain benefit from being physical active.[37]

219 All studies assessed whether participants adhered to their program and to the prescribed
220 amount of physical activity.[30-42] This is a valuable outcome because it indicates whether an
221 intervention has led to a behavioral change. Adherence is more pronounced when sufficient
222 time is invested in the intervention. Time-investment can be achieved by means of an activity
223 diary or goal setting in advance to the intervention.[36, 38] Another method that seemed to
224 increase adherence was providing a measuring tool, such as a pedometer or a heart
225 monitor.[41, 42] The most common method to assess the amount of adherence and physical
226 activity was done by a self-reported diary.[31, 33, 34, 36, 37, 39, 40] One study even used
227 recall-interviews.[30] Because of the self-report activity through diaries, results may not be
228 authentic because patients can alter their results (recall bias). Vallance et al. found an increase
229 in self-reported physical activity, but the physical activity measured with a pedometer
230 indicated no change compared to baseline measurements.[41] However, this could be because
231 participants used more vigorous walking instead of more steps overall.

232 Several limitations concerning the included studies need to be discussed. Six out of thirteen
233 studies conducted a trial with patients after they ended their treatment. [30, 32, 34, 36, 39, 41]
234 These patients are often addressed as survivors. There is no clear definition of a breast cancer
235 survivor. According to Lee et al.[36], survivors were patients diagnosed two years prior to
236 their study, whereas Cadmus et al.[32] reckoned survivors 1 to 10 years post-diagnosis.
237 Vallance et al. defined patients as survivors when there was an absence of current breast
238 cancer.[41] The duration of the survivorship may alter results. Comorbidities change over
239 time, even in a short time span of a year and are different dependent on treatment method.[44]
240 Consequently, rehabilitation needs are different. This can also have effects on the use of
241 questionnaires, because some may be less responsive or accurate.[41] Different questionnaires
242 were used to measure QoL, whereas not every questionnaire is as responsive in breast-cancer
243 patients. The EQ-5D is unable to detect small changes in health, in comparison to the EORTC
244 QLQ C30 that is found to be responsive in breast cancer patients.[45] Also, the QLQ C30 has
245 better responsiveness to the detection of ceiling effects.[46] In comparison to this, the FACT-
246 G questionnaire showed better precision in HRQoL.[46] The SF-36 is a more generic
247 questionnaire, not disease-specific, and might be less suitable for breast cancer patients, where
248 the FACT-B is disease-specific and might be more appropriate in the research of QoL in
249 breast cancer patients.

250 Blinding of participants is difficult in behavioral studies. Therefore, participants were mostly
251 aware of the purpose of the study and this itself may have an effect on the intervention.
252 Knowing the purpose of the trial, could be seen as an intervention itself.[39] Patients of the
253 control group may take initiative into their own hands. In some studies, the control group also
254 became more active.[31, 33, 35, 37, 40, 42] This could have biased the results because the
255 difference between both groups could be less and this can make the difference between being
256 statistically significant or not.

257 Four studies conducted a combination of home-based and supervised-intervention. [32, 34, 39,
258 40] Of these studies, only one did this in comparison to an isolated home-based
259 intervention.[40] They found that their home-based intervention scored better than their
260 supervised intervention and that the supervised intervention had similar results to the control
261 group.[40] Another study found no significant difference between their home-based and
262 home-based in addition to supervised intervention.[32] However there are advantages of
263 supervised exercise training, it can improve patient's motivation[34] and it offers the
264 possibility to interact with fellow patients in group sessions.[34]

265 Finally, in behavioral studies it is important to know the long-term effect. It is generally
266 known that employing a more physical active lifestyle is hard to maintain on the long run, this
267 is not different for patients with breast cancer. A long-term follow-up is essential to assess the
268 ceiling effect of physical activity. Not every study demonstrated an adequate follow-up. The
269 authors defined an adequate follow-up as 12 months or more. Only two studies met this
270 criterion.[31, 39] Studies with a short follow-up had different results in comparison to those
271 with a longer follow-up. For example the study by Haines et al. found significant differences
272 between intervention and control group at 3 and 6 months follow-up, however at 12 months
273 follow-up this result was no longer present.[31] This may be due to the fact that the patients
274 reached their maximum. Of the studies that reported on different follow-up assessments, a
275 decrease in effect over time was seen in four studies.[31, 33, 38, 42] This decrease occurred
276 mostly after 3 months. Nonetheless two studies found an increase in effect at their follow-up
277 of respectively 3 and 12 months. [34, 39]

278 Lastly, the strengths and weaknesses of this review are discussed. The strength of this review
279 is the fact that the reviewed studies are all randomized controlled trials and that they all had a
280 fair to good methodological quality. Another strength is that four databases were used to
281 retrieve all eligible studies. The first limitation is that the interventions described in the

282 different studies are too different to compare and so only a conclusion in general can be made.
283 A second limitation is that the selection of studies may have been biased due to an unclear
284 definition of self-management.

285

286

287 Conclusion

288 There are different methods of physical self-management that provide beneficial effects on
289 QoL and outcomes regarding QoL. It is likely that the implementation of physical self-
290 management after adjuvant therapy increases QoL. It is also likely that starting the self-
291 management intervention during adjuvant therapy is beneficial, as it results in an increase or a
292 slower decline in QoL. Nevertheless, it should be noted that at this moment no self-
293 management technique could be chosen over another. Most studies did not organize long-term
294 follow-up, leading to uncertainty of long-term outcome. Therefore, further research on the
295 implementation of self-management in breast cancer patients is highly warranted.

296

297

298 Conflict of interest

299 The authors have no conflict of interest to declare.

300

301

302

303

304

305

306

307

308

309

310

311 **Reference list**

312

- 313 [1] Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of
314 cancer in 2008: GLOBOCAN 2008. *International journal of cancer*. 2010;127:2893-917.
- 315 [2] Allemani C, Weir HK, Carreira H, Harewood R, Spika D, Wang XS, et al. Global surveillance of
316 cancer survival 1995-2009: analysis of individual data for 25,676,887 patients from 279 population-
317 based registries in 67 countries (CONCORD-2). *Lancet (London, England)*. 2015
318 385:977-1010.
- 319 [3] Pusic AL, Cemal Y, Albornoz C, Klassen A, Cano S, Sulimanoff I, et al. Quality of life among breast
320 cancer patients with lymphedema: a systematic review of patient-reported outcome instruments and
321 outcomes. *J Cancer Surviv*. 2013;7:83-92.
- 322 [4] Kibar S, Dalyan Aras M, Unsal Delialioglu S. The risk factors and prevalence of upper extremity
323 impairments and an analysis of effects of lymphoedema and other impairments on the quality of life
324 of breast cancer patients. *European journal of cancer care*. 2016.
- 325 [5] Belmonte R, Garin O, Segura M, Pont A, Escalada F, Ferrer M. Quality-of-life impact of sentinel
326 lymph node biopsy versus axillary lymph node dissection in breast cancer patients. *Value Health*.
327 2012;15:907-15.
- 328 [6] Aerts PD, De Vries J, Van der Steeg AF, Roukema JA. The relationship between morbidity after
329 axillary surgery and long-term quality of life in breast cancer patients: the role of anxiety. *Eur J Surg*
330 *Oncol*. 2011;37:344-9.
- 331 [7] Wernicke AG, Shamis M, Sidhu KK, Turner BC, Goltser Y, Khan I, et al. Complication rates in
332 patients with negative axillary nodes 10 years after local breast radiotherapy after either sentinel
333 lymph node dissection or axillary clearance. *American journal of clinical oncology*. 2013;36:12-9.
- 334 [8] Henneghan A. Modifiable factors and cognitive dysfunction in breast cancer survivors: a mixed-
335 method systematic review. *Support Care Cancer*. 2016;24:481-97.
- 336 [9] Kenyon M, Mayer DK, Owens AK. Late and long-term effects of breast cancer treatment and
337 surveillance management for the general practitioner. *Journal of obstetric, gynecologic, and neonatal*
338 *nursing : JOGNN / NAACOG*. 2014;43:382-98.
- 339 [10] Morean DF, O'Dwyer L, Cherney LR. Therapies for Cognitive Deficits Associated With
340 Chemotherapy for Breast Cancer: A Systematic Review of Objective Outcomes. *Archives of physical*
341 *medicine and rehabilitation*. 2015;96:1880-97.
- 342 [11] Pinto AC, de Azambuja E. Improving quality of life after breast cancer: dealing with symptoms.
343 *Maturitas*. 2011;70:343-8.
- 344 [12] Abrahams HJ, Gielissen MF, Schmits IC, Verhagen CA, Rovers MM, Knoop H. Risk factors,
345 prevalence, and course of severe fatigue after breast cancer treatment: A meta-analysis involving
346 12,327 breast cancer survivors. *Ann Oncol*. 2016.
- 347 [13] Engel J, Kerr J, Schlesinger-Raab A, Sauer H, Holzel D. Quality of life following breast-conserving
348 therapy or mastectomy: results of a 5-year prospective study. *Breast J*. 2004;10:223-31.
- 349 [14] Stan D, Loprinzi CL, Ruddy KJ. Breast cancer survivorship issues. *Hematology/oncology clinics of*
350 *North America*. 2013;27:805-27, ix.
- 351 [15] Gebruers N VH, De Vrieze T, Coeck D, Tjalma W. The incidence and time path of lymphedema in
352 sentinel negative breast cancer patients: a systematic review. *ARCHIVES OF PHYSICAL MEDICINE AND*
353 *REHABILITATION* 2015.
- 354 [16] Verbelen H, Gebruers N, Beyers T, De Monie AC, Tjalma W. Breast edema in breast cancer
355 patients following breast-conserving surgery and radiotherapy: a systematic review. *Breast Cancer*
356 *Res Treat*. 2014;147:463-71.
- 357 [17] Verbelen H, Gebruers N, Eeckhout FM, Verlinden K, Tjalma W. Shoulder and arm morbidity in
358 sentinel node-negative breast cancer patients: a systematic review. *Breast Cancer Res Treat*.
359 2014;144:21-31.

- 360 [18] Dean K. SELF-CARE RESPONSES TO ILLNESS: A SELECTED REVIEW. *Social Science & Medicine Part*
361 *A Medical Psychology & Medical Sociology*.15A:673-87.
- 362 [19] McCorkle R, Ercolano E, Lazenby M, Schulman-Green D, Schilling LS, Lorig K, et al. Self-
363 management: Enabling and empowering patients living with cancer as a chronic illness. *CA: a cancer*
364 *journal for clinicians*. 2011;61:50-62.
- 365 [20] Devoogdt N, Van Kampen M, Geraerts I, Coremans T, Fieuws S, Lefevre J, et al. Physical activity
366 levels after treatment for breast cancer: one-year follow-up. *Breast Cancer Res Treat*. 2010;123:417-
367 25.
- 368 [21] Vardar-Yagli N, Sener G, Saglam M, Calik-Kutukcu E, Arikan H, Inal-Ince D, et al. Associations
369 among physical activity, comorbidity, functional capacity, peripheral muscle strength and depression
370 in breast cancer survivors. *Asian Pacific journal of cancer prevention : APJCP*. 2015;16:585-9.
- 371 [22] Bize R, Johnson JA, Plotnikoff RC. Physical activity level and health-related quality of life in the
372 general adult population: a systematic review. *Preventive medicine*. 2007;45:401-15.
- 373 [23] Bicego D, Brown K, Ruddick M, Storey D, Wong C, Harris SR. Effects of exercise on quality of life
374 in women living with breast cancer: a systematic review. *Breast J*. 2009;15:45-51.
- 375 [24] Zeng Y, Huang M, Cheng AS, Zhou Y, So WK. Meta-analysis of the effects of exercise intervention
376 on quality of life in breast cancer survivors. *Breast cancer (Tokyo, Japan)*. 2014; 21:262-74.
- 377 [25] Kirshbaum MN. A review of the benefits of whole body exercise during and after treatment for
378 breast cancer. *Journal of Clinical Nursing* 2007;16:104-21.
- 379 [26] Mishra SI, Scherer RW, Snyder C, Geigle PM, Berlanstein DR, Topaloglu O. Exercise interventions
380 on health-related quality of life for people with cancer during active treatment. *The Cochrane*
381 *database of systematic reviews*. 2012;8:CD008465.
- 382 [27] Mishra SI, Scherer RW, Geigle PM, Berlanstein DR, Topaloglu O, Gotay CC, et al. Exercise
383 interventions on health-related quality of life for cancer survivors. *The Cochrane database of*
384 *systematic reviews*. 2012;8:CD007566.
- 385 [28] Cramp F, Byron-Daniel J. Exercise for the management of cancer-related fatigue in adults. *The*
386 *Cochrane database of systematic reviews*. 2012;11:CD006145.
- 387 [29] Foster M, Shurtz S, Smith ML. Translating research into practice: criteria for applying literature
388 search results to your work. *Health promotion practice*. 2014; 15:157-60.
- 389 [30] Basen-Engquist K, Taylor CL, Rosenblum C, Smith MA, Shinn EH, Greisinger A, et al. Randomized
390 pilot test of a lifestyle physical activity intervention for breast cancer survivors. *Patient education and*
391 *counseling*. 2006;64:225-34.
- 392 [31] Haines TP, Sinnamon P, Wetzig NG, Lehman M, Walpole E, Pratt T, et al. Multimodal exercise
393 improves quality of life of women being treated for breast cancer, but at what cost? Randomized trial
394 with economic evaluation. *Breast cancer research and treatment*. 2010;124:163-75.
- 395 [32] Cadmus LA, Salovey P, Yu H, Chung G, Kasl S, Irwin ML. Exercise and quality of life during and
396 after treatment for breast cancer: results of two randomized controlled trials. *Psycho-oncology*.
397 2009;18:343-52.
- 398 [33] Headley JA, Ownby KK, John LD. The effect of seated exercise on fatigue and quality of life in
399 women with advanced breast cancer. *Oncol Nurs Forum*. 2004;31:977-83.
- 400 [34] Heim ME, v d Malsburg ML, Niklas A. Randomized controlled trial of a structured training
401 program in breast cancer patients with tumor-related chronic fatigue. *Onkologie*. 2007;30:429-34.
- 402 [35] Jones LW, Courneya KS, Fairey AS, Mackey JR. Effects of an oncologist's recommendation to
403 exercise on self-reported exercise behavior in newly diagnosed breast cancer survivors: a single-
404 blind, randomized controlled trial. *Annals of behavioral medicine : a publication of the Society of*
405 *Behavioral Medicine*. 2004;28:105-13.
- 406 [36] Lee MK, Yun YH, Park HA, Lee ES, Jung KH, Noh DY. A Web-based self-management exercise and
407 diet intervention for breast cancer survivors: pilot randomized controlled trial. *International journal*
408 *of nursing studies*. 2014;51:1557-67.

- 409 [37] Mock V, Pickett M, Ropka ME, Muscari Lin E, Stewart KJ, Rhodes VA, et al. Fatigue and quality of
410 life outcomes of exercise during cancer treatment. *Cancer Pract.* 2001;9:119-27.
- 411 [38] Purcell A, Fleming J, Burmeister B, Bennett S, Haines T. Is education an effective management
412 strategy for reducing cancer-related fatigue? *Supportive care in cancer : official journal of the*
413 *Multinational Association of Supportive Care in Cancer.* 2011;19:1429-39.
- 414 [39] Saarto T, Penttinen HM, Sievanen H, Kellokumpu-Lehtinen PL, Hakamies-Blomqvist L, Nikander
415 R, et al. Effectiveness of a 12-month exercise program on physical performance and quality of life of
416 breast cancer survivors. *Anticancer research.* 2012;32:3875-84.
- 417 [40] Segal R, Evans W, Johnson D, Smith J, Colletta S, Gayton J, et al. Structured exercise improves
418 physical functioning in women with stages I and II breast cancer: results of a randomized controlled
419 trial. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology.*
420 2001;19:657-65.
- 421 [41] Vallance JK, Courneya KS, Plotnikoff RC, Yasui Y, Mackey JR. Randomized controlled trial of the
422 effects of print materials and step pedometers on physical activity and quality of life in breast cancer
423 survivors. *Journal of clinical oncology : official journal of the American Society of Clinical Oncology.*
424 2007;25:2352-9.
- 425 [42] Wang YJ, Boehmke M, Wu YW, Dickerson SS, Fisher N. Effects of a 6-week walking program on
426 Taiwanese women newly diagnosed with early-stage breast cancer. *Cancer nursing.* 2011;34:E1-13.
- 427 [43] Hammer MJ, Ercolano EA, Wright F, Dickson VV, Chyun D, Melkus GD. Self-management for
428 adult patients with cancer: an integrative review. *Cancer nursing.* 2015;38:E10-26.
- 429 [44] Shimosuma K, Ganz PA, Petersen L, Hirji K. Quality of life in the first year after breast cancer
430 surgery: rehabilitation needs and patterns of recovery. *Breast cancer research and treatment.*
431 1999;56:45-57.
- 432 [45] Kimman ML, Dirksen CD, Lambin P, Boersma LJ. Responsiveness of the EQ-5D in breast cancer
433 patients in their first year after treatment. *Health and quality of life outcomes.* 2009;7:11.
- 434 [46] Lockett T, King MT, Butow PN, Oguchi M, Rankin N, Price MA, et al. Choosing between the
435 EORTC QLQ-C30 and FACT-G for measuring health-related quality of life in cancer clinical research:
436 issues, evidence and recommendations. *Annals of oncology : official journal of the European Society*
437 *for Medical Oncology / ESMO.* 2011;22:2179-90.
- 438
- 439
- 440

Table 1 : Overview of the boolean search strategies in different databases used

Pubmed	("breast neoplasms"[MeSH] OR "breast neoplasms"[All Fields] OR "breast cancer"[All Fields]) AND ("self-care"[MeSH] OR "self care"[All Fields] OR "self-management"[All Fields] OR "self-education"[All Fields] OR "education"[Subheading]) AND ("quality of life"[MeSH] OR "quality of life"[All Fields] OR "activities of daily living"[MeSH] OR "activities of daily living"[All Fields])
Web of Science	TS=("breast neoplasms" OR "breast cancer") AND TS=("self-care" OR "self-management" OR "self-education" OR "training programs" OR "training program" OR "courses") AND TS=("quality of life" OR "activities of daily living")
EMBASE	('breast neoplasms' OR 'breast cancer') AND ('self care' OR 'self management' OR 'self education' OR 'training program' OR 'training programs' OR 'courses') AND ('quality of life' OR 'activities of daily living')
Cochrane Library for clinical trials	(breast neoplasms OR breast cancer) AND (self care OR self management OR self education OR patient education) AND (quality of life OR activities of daily living)

TS = Topic Specific

Table 2 : Inclusion and exclusion criteria used during both screenings

Inclusion	Exclusion
<ul style="list-style-type: none"> • Adults (> 18y) • Patients with breast cancer • Physical self-management techniques during the treatment of breast cancer or when the treatment was finished (meaning surgery, chemo- and/or radiotherapy had to be finished) • Outcome had to be an indicator of the patients' quality of life • Study design = RCT • Publication date = all ages 	<ul style="list-style-type: none"> • Results of the interventions were not expressed as an outcome for QoL • Constant supervision during self-management was seen as an imposed intervention

Table 3: Table of evidence

Author, year, reference	Sample size	Duration and follow-up	Population	Intervention	Physical activity used in intervention	Control	Assessment	Results	QA/LoE
Basen - Engquist et al. ²² (2006)	n= 60 C = 25 I = 35	6 months	Patients who ended primary treatment	Home-based Information sessions	Moderate intensive activity. Patients were free to choose exercise, walking was recommended	Written information	Questionnaires QoL : - SF-36 Physical assessment - 6MWT - minutes/day spend being physical active	QoL : - SF-36 : I > C (<i>p</i> = 0.006) Physical performance : - aerobic capacity (6MWT) : I > C (<i>p</i> = 0.005) - minutes/day spend being physical active : I vs. C : ns	7/10 B
Cadmus et al. ²⁴ (2009)	Impact n = 50 C = 25 I = 25 YES n= 74 C = 38 I = 37	6 months	Patients who ended primary treatment (YES) and patients during treatment (IMPACT)	IMPACT : Home-based Infomation session + booklet + provided heart monitor YES : Combination of supervised with additional home-based exercise	Moderate to vigorous physical activity, most woman chose walking	Received same material, only at 6-months follow-up	Questionnaires - QoL: FACT-B, SF-36 Physical assessment - 7-day PAL, 7-day pedometer log	QoL: IMPACT: I vs. C: ns YES: I vs. C : ns	8/10 B
Haines et al. ²³ (2010)	n= 89	12 months	Patients during treatment	Home-based Multimedia	Strength, balance, shoulder mobility exercises +	Flexibility, relaxation exercises	Questionnaires - QoL: EORTC-C30	QoL : - EORTC-C30 : I > C (3 m follow-up <i>p</i> = 0.005, 6 m	10/10 A2

	C= 43 I= 46				cardiovascular endurance program		- Fatigue : MFI Physical assessment - Aerobic capacity : 6MWT - Strength : grip strength, leg press - Balance : functional reach	<i>follow up p=0.03</i>), not at 12m follow-up Fatigue : - MFI : I vs. C: ns Physical capacity : - aerobic capacity (6MWT) : I vs. C: ns - strength (grip strength, leg press) : I vs. C: ns - balance (functional reach) : I vs. C: ns	
Headley et al. ²⁵ (2004)	n = 32 C = 16 I = 16	3 months	Patients during treatment	Home-based Multimedia	Moderate intensity. Seated exercise program	No material, permitted to continue exercise	Questionnaires - QoL: FACIT-F - Fatigue : FACIT-F	QoL : - FACIT-F : QoL \blacktriangledown less decrease in intervention ($p= 0.0254$) Fatigue : - FACIT-F : fatigue \blacktriangleright less increase in intervention ($p= 0.0078$)	7/10 B
Heim et al. ²⁶ (2007)	n= 63 C = 31 I = 32	During inpatient rehabilitations (duration unknown) Follow-up : 3 months	Patients who ended primary treatment	Combination home-based/supervised Information session + booklet + group exercises	Aerobic, strength stretching, coordination and relaxation exercises	Information session + physiotherapy + group exercises	Questionnaires - QoL: FACT - Fatigue: MFI Physical assessment - Aerobic capacity : Harvard step test - Muscle strength : digimax multifunktionste	QoL : - FACT : I > C ($p=0.0015$) Fatigue : - MFI : I > C ($p=0.028$) Physical performance ; - aerobic capacity (Harvard step test) : I vs. C: ns - muscle strength : I vs. C: ns	6/10 B

							st		
Jones et al. ²⁷ (2004)	n= 450 C= 150 I ₁ = 150 I ₂ = 150	1 month	Patients during treatment	Home-based Recommendation (I ₁) Recommendation + referral (I ₂)	Patients were free to choose exercise, brisk walking was recommended	No recommendation	Questionnaires - Self-reported exercise behaviour - LSI - Recall of the recommendation	Physical activity level - Total exercise (METhr/week) : I ₁ > C (<i>p</i> =0.011), I ₂ vs. C: ns - Total frequency (MET times/week) : I ₁ > C (<i>p</i> =0.007), I ₂ vs. C: ns In an ancillary analysis they compared patients who remembered the recommendation and patients who didn't. - Total exercise (METhr/week) : remembering > not-remembering (<i>p</i> < 0,001) - Total frequency (MET times/week) : remembering > not-remembering (<i>p</i> <0,001)	9/10 B
Lee et al. ²⁸ (2014)	n= 59 C = 29 I= 30	I : 5 months Follow-up : 12 weeks	Patients who ended primary treatment	Home-based Web based program	Patients were free to choose an aerobic exercise	Educational booklet	Questionnaires/ web based survey: - 3-day dietary recall -DQI = Diet Quality Index - QoL: EORTC	QoL : - EORTC-QLQ-C30 : I > C (<i>p</i> =0.023) Fatigue : - BFI : I > C (<i>p</i> =0.032)	9/10 A2

							<p>QLQ C30</p> <ul style="list-style-type: none"> - Depression: HADS - Fatigue: BFI - Stage of Change - Perceived self-efficacy 		
Mock et al. ²⁹ (2001)	n= 52 I and C not specified	6 weeks if RT 3-4 months if CT	Patients during treatment	Home-based Information sessions + booklets	Walking intervention	Standard practice	<p>Questionnaires</p> <ul style="list-style-type: none"> - QoL: MOS SF36 - Fatigue: PFS <p>Physical assessment:</p> <ul style="list-style-type: none"> - MOS SF 36 <p>Emotional distress:</p> <ul style="list-style-type: none"> - POMS 	<p>QoL :</p> <ul style="list-style-type: none"> - MOS SF36 : QoL \blacktriangledown less decrease in intervention ($p \leq 0.05$) <p>Fatigue :</p> <ul style="list-style-type: none"> - Diary : I > C - POMS fatigue : I > C ($p = 0.00$) <p>Physical performance :</p> <ul style="list-style-type: none"> - MOS- SF 36 physical functioning : I > C - 12 min walk test : I > C ($p = 0.01$) 	6/10 B
Purcell et al. ³⁰ (2011)	n=110 C= 28 I ₁ = 27 I ₂ = 28	6 weeks	Patients during treatment	Home-based Information sessions + booklets - Pre- and post radiotherapy fatigue and support (RFES) = I ₁ - Pre RFES = I ₂ - Post RFES = I ₃	Not-specified	Standard care: one-to-one verbal communication	<p>Questionnaires:</p> <ul style="list-style-type: none"> - QoL: EQ 5D - Self-care activities: FAI - Anxiety and depression: HADS - Sleep disturbances: 	<p>QoL :</p> <ul style="list-style-type: none"> - EQ-5D : I₂ vs. C: ns, I₃ > C ($p < 0.05$) <p>Fatigue :</p> <ul style="list-style-type: none"> - MFI mental fatigue : I₂ vs. C: ns, I₃ > C ($p < 0.05$) <p>Combination of pre- and post sessions (I₁) did not</p>	7/10 B

	I ₃ = 27						<p>MOSS</p> <ul style="list-style-type: none"> - Employment and domestic work: HLQ - Fatigue: MFI <p>Physical assessment:</p> <ul style="list-style-type: none"> - Karnofsky performance status scale 	show any significant benefit compared to the single session interventions pre or post radiotherapy.	
Saarto et al. ³¹ (2012)	n= 573 C= 271 I= 302	Intervention : 2 years Follow up : 1 year study : 3 years (including follow up)	Patients who ended primary treatment	Combination of supervised with additional home-based exercise	Supervised : Step aerobics + circuit training class Home-based: Endurance training such as walking	Encouragement to maintain previous level of physical activity	<p>Questionnaires:</p> <ul style="list-style-type: none"> - QoL: EORTC QLQ C30 - Fatigue: FACIT F - Depression: RBDI - Menopausal symptoms: WHQ <p>Physical assessment:</p> <ul style="list-style-type: none"> - Aerobic capacity: 2 km walk test -Neuromuscular performance: Figure 8 	<p>QoL :</p> <ul style="list-style-type: none"> - EORTC- QLQ-C30 : I vs. C: ns Physical performance - neuromuscular performance (figure 8 running time): I > C (<i>p</i><0.001) - aerobic capacity (2km walk test): I vs. C: ns Fatigue - sleeping problems: I vs. C: ns <p>Although there was no significant improvement in QoL or fatigue, a significant linear trend was found between higher physical activity and</p>	8/10 B

							running test	improved QoL and recovery from fatigue.	
Segal et al. ³² (2001)	n= 123 C= 41 I ₁ = 40 I ₂ = 42	26 weeks	Patients during treatment	Home-based (I ₁) + combination of supervised with additional home-based exercise (I ₂)	Progressive walking program	Usual care (Oncologist's advice)	Questionnaires: - QoL: SF 36, FACT-G, FACT-B Physical assessment: - Aerobic capacity: mCAFT	QoL : - SF-36 : I ₁ > C ($p>0.05$), I ₂ vs. C: ns - FACT-G, FACT-B : I ₁ vs. I ₂ : ns, I ₁ vs. C: ns I ₂ vs. C: ns Physical performance : - Aerobic capacity : I ₁ vs. I ₂ : ns, I ₁ vs. C: ns I ₂ vs. C: ns	6/10 B
Vallance et al. ³³ (2007)	n= 377 C= 96 PM= 94 PED = 94 COM= 93	Intervention : 4 months Follow up : 12 weeks	Patients who ended primary treatment	Home-based - printed materials (PM) group : booklet - pedometer (PED) group : pedometer - combination (COM) : booklet + pedometer	Moderate to vigorous physical activity : walking	No additional intervention materials	Questionnaires: - QoL: FACT B - Fatigue: FACT F Physical assessment: - Self report physical activity: LSI - 7 day step test	QoL : - FACT-B : COM > C ($p=0.003$) , PED vs. C: ns, PM vs. C: ns Fatigue : - COM, PED, PM vs. C: ns Self-reported physical activity : - PM vs. C: ns - PED > C ($p=0.017$) - COM > C ($p=0.022$) No change was found in objectively measured walking across all groups.	8/10 B

Wang et al. ³⁴ (2011)	n= 72 C= 37 I = 35	6 weeks	Patients during treatment	Home-based Booklet + provided heart monitor	Walking intervention	Usual care	Questionnaires: -QoL: FACT-G -Fatigue: FACIT-F - Sleep Quality: PSQI - Self efficacy: ESES Physical assessment: - Exercise behavior: GLTEQ - Exercise capacity: 6 MWD	QoL : - FACT-G : I > C (<i>p</i> <0.001) Fatigue: - FACIT-F: I > C (<i>p</i> =0.003), only at 9 days after chemotherapy and at 6 weeks follow-up - sleep disturbances (PSQI): I > C (<i>p</i> =0.006)	7/10 B
----------------------------------	--------------------------	---------	---------------------------	---	----------------------	------------	--	--	-----------

Legend and abbreviations:

I : intervention, C : control

>: significant difference between groups (in favour of the intervention-group)

ns : no significant difference between groups

results apply to the whole duration of the study, unless otherwise specified

Quality assessment (QA) : methodological quality score (x/10) and level of evidence (LoE) are listed

EORTC QLQ C30 The European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire Core 30

SF 36 Short form 36 health survey

EQ-5D EuroQoL five dimension scale

FACT-B Functional Assessment of Cancer Therapy- Breast definition

FACT-G Functional Assessment of Cancer Therapy- General

LSI Leisure Score Index

MFI Multidimensional Fatigue Inventory

7-DPARQ 7 Day Physical Activity Recall Questionnaire

7-day PAL 7 Day Physical Activity Log

BFI Brief Fatigue Inventory

PFS	Piper Fatigue Scale
FACIT-F	Functional Assesment of Cancer Therapy- Fatigue
FAI	Frenchay Activities Index
GLTEQ	Goldin Leisure Time Exercise Questionnaire
MOSS	Medical Outcomes Study Sleep
PSQI	Pittsburgh Sleep Quality Index
HADS	Hospital Anxiety and Depression scale
RBDI	Finnish modified version of Beck's 13-item depression scale
POMS	Profile of Moods States
ESES	Exercise Self-Efficacy Scale
DQI	Dietary quality index
HLQ	Health and Labour Questionnaire
WHQ	Women's Health Questionnaire
6MWD	6 minutes walking distance
6MWT	6 minutes walking test
mCAFT	Modified Canadian Aerobic Fitness Test
QoL	Quality of life
RT	Radiotherapy
CT	Chemotherapy
MET	Metabolic equivalent of task

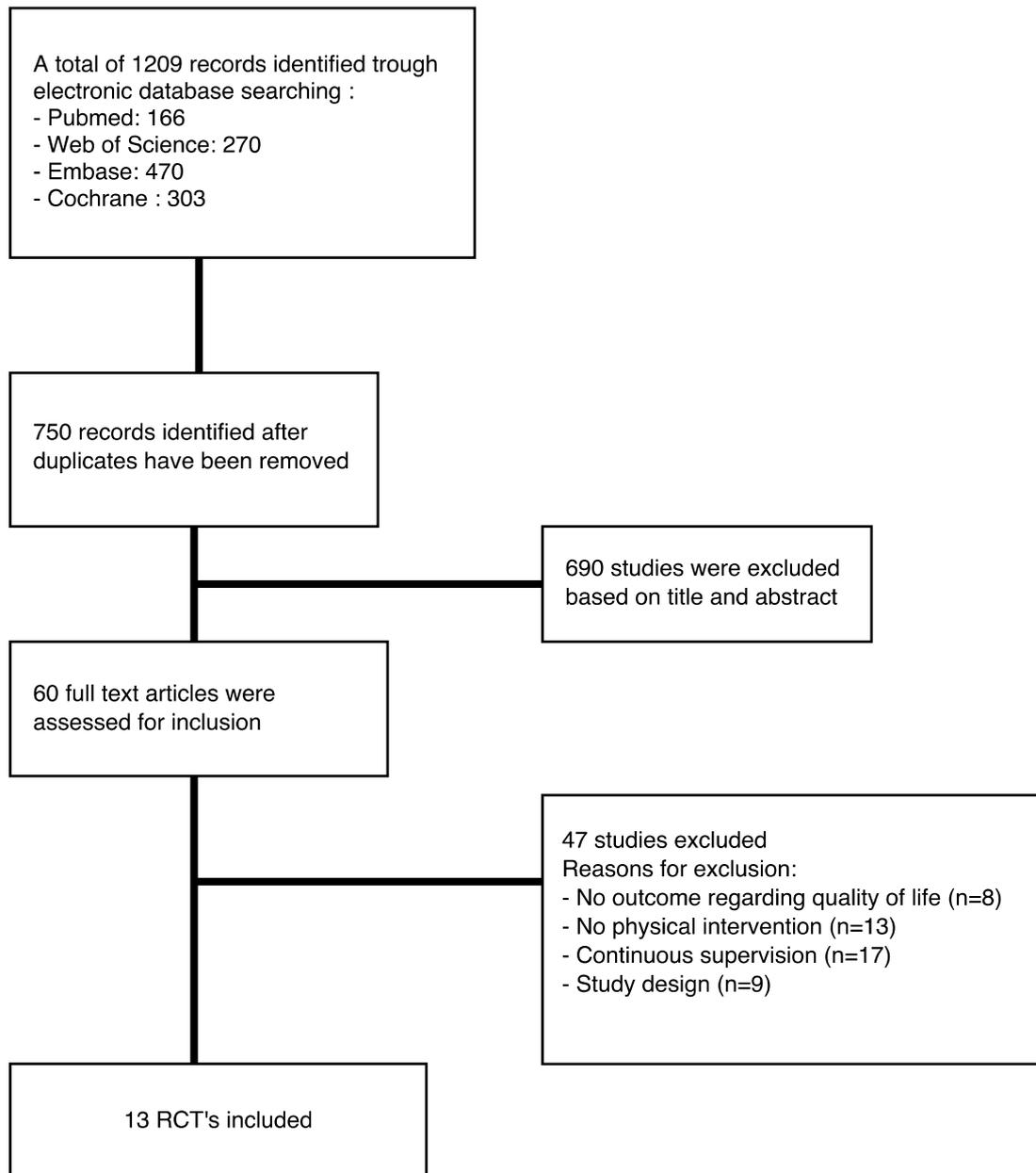


Fig 1. Flowchart of the study selection procedure

author declaration

[Click here to download Additional Files \(Article Transfer\): Author declaration-signed.pdf](#)

Prisma Checklist

[Click here to download Additional Files \(Article Transfer\): PRISMA Checklist TB.doc](#)