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3   The role of social support in physical activity for cancer survivors: A systematic review

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5   Meghan H. McDonough, L. Jayne Beselt, Julia T. Daun, Jena Shank, S. Nicole Culos-Reed,

6   Liam J. Kronlund, & William Bridel

7   Faculty of Kinesiology, University of Calgary

8

9   Author Note

16 **Abstract**

17 Objective: Social support is conceptualized and operationalized in many ways, making it

18 challenging to understand what types of support best predict physical activity (PA) in cancer

19 survivors. This review examined associations between social support and PA among cancer

20 survivors.

21 Methods: Following PRISMA guidelines, we searched eight databases for studies that reported

22 an association between social support and PA among adult cancer survivors. We conducted an

23 appraisal and a narrative synthesis of the findings from quantitative studies.

24 Results: N=50 studies representing 28,366 participants were included. Studies collectively

25 included concepts addressing the presence of relationships, others' PA behavior, perceptions of

26 being supported, and function/quality. Findings were mixed in suggesting a positive or null

27 association with PA.

28 Conclusions: While results are not definitive, this review takes a step toward mapping the social

29 support literature in PA for cancer survivors. Limitations include the homogeneity of the

30 participants in extant studies, and the secondary focus on testing the effects of social support on

31 outcomes. Future research systematically testing the effects of social support is important for

32 facilitating PA in this population.

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Background

Cancer survivors face challenges affecting them physically, psychologically, and socially (1, 2) that may persist after treatment ends (3). Physical activity (PA) can alleviate many of these challenges, and improve quality of life (4, 5). Social support may play an important role in rehabilitation from cancer because it is positively associated with PA (6, 7) and can assist in coping with cancer (8, 9). Interventions often include opportunities for social interactions, such as group PA or peer support. But evidence regarding the effects of social support on PA for adult cancer survivors has not been synthesized.

Social support is multidimensional, and conceptualized in many ways (10). It may include interactions aimed at inducing positive outcomes (11), and interactions that are not necessarily intentionally helpful (e.g., observing PA role models). Social support has been examined from many theoretical perspectives, and may include constructs such as relatedness or subjective norms (12). Due to the variety of concepts studied, and that few studies compare the effects of different forms of support, it is unclear what aspects of support are most important (13). We used structural-functional and degree of subjectivity dimensions as suggested by a framework for classifying social relationships and support in the literature on social relationships and health, and social and health service use (13). The structural-functional dimension ranges from structural concepts that focus on the presence and number of relationships, to the evaluation of functions provided. The degree of subjectivity focuses on whether concepts address contact with others at the least subjective end of the continuum, whether relationships are available if needed or wanted, adequacy of relationships, and affective concepts associated with relating to others at the most subjective end. We used these dimensions to inform categorizing and organizing the social support concepts retrieved from the literature in this review.

60   Social support may benefit cancer survivors by both encouraging PA, and improving

61   well-being. Social constructs such as role modeling, subjective norms, and relatedness feature in

62   most theories of PA behavior (e.g., 14, 15, 16). While group exercise is common in programs,

63   simply assembling people may not be sufficient to foster support or enhance psychosocial

64   outcomes (17). But, social support may enhance PA through mechanisms such as providing

65   information about expected behavior, encouragement, and meeting needs for connection (e.g.,

66   14, 15, 16). However, few interventions have capitalized on group processes that may facilitate

67   social support, beyond bringing people together (17). An understanding of which types of

68   support may be effective targets for intervention is needed.

69   Given the potential importance of social support in PA interventions for cancer survivors,

70   the diversity of conceptual frameworks and measures used, the distinct support concepts, and the

71   need to understand how different types of support affect PA, it is necessary to synthesize this

72   literature. A review can document the variety of social support concepts and measures and guide

73   future research on dimensions of social support that facilitate PA, or need additional research.

74   The purpose of this systematic review was to identify the variety of ways that social support has

75   been conceptualized and assessed in the PA literature with adult cancer survivors and conduct a

76   narrative synthesis of the quantitative associations with PA.

77   **Methods**

78   **Protocol**

79   This review followed PRISMA guidelines (18) and was registered with PROSPERO

80   International Prospective Register for Systematic Reviews prior to commencing the search

81   (www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42016052278).

82   **Eligibility Criteria**

83   **Types of studies.** Included studies investigated PA interventions or programs, or assessed

84   full-body PA behavior, in adult cancer survivors. Studies examining rehabilitation exercises, or

85   behavior change interventions that did not include doing or assessing PA were excluded.

86   Because this review aimed to examine associations between social support and PA, no limits on

87   study design were set. The current paper focuses on quantitative studies. Included studies were

88   published in English in a peer-reviewed journal, up to May 2018.

89   **Types of participants**. Studies including only participants 18 years or older who had

90   received a cancer diagnosis of any type and stage were included.

91   **Types of outcomes.** Studies were included if they reported associations between social

92   support and PA. The social support criteria included (1) experimental manipulation of social

93   support and/or (2) a measure of social support, broadly defined (see Figure 1). We excluded

94   papers that included social elements in a multicomponent intervention but did not isolate social

95   effects (e.g., studies that compared group PA versus a control, because group PA represents both

96   a social and PA intervention), unless social support was measured. PA criteria required including

97   (1) an experimental manipulation of PA (i.e., aerobic, strength, flexibility, sport, or mind-body

98   activities), and/or (2) PA measured by any method (e.g., accelerometer, pedometer,

99   questionnaire). The studies had to report on the association between social support and PA.

100   **Information Sources**

101   Prior to commencing this review, a search was conducted to determine if any previous

102   systematic reviews on the topic have been published. None were found. Articles for this review

103   were identified by two independent reviewers up to and including May 2018 using Medline,

104   Embase, PsycINFO, Cochrane Central Register of Controlled Trials, Cochrane Database of

105   Systematic Reviews, Cinahl, SportDiscus, Social Work Abstracts and Family and Society

106   Studies Worldwide databases. We also included additional papers known to the authors.

107   **Search**

108   See Figure 1 for the Medline search.

109   **Study Selection**

110   Figure 2 illustrates the study selection process performed by two independent reviewers.

111   Titles and abstracts were screened, and if eligibility was unclear, the full text was examined.

112   Studies were retained if both reviewers arrived at a consensus regarding inclusion.

113   Disagreements were resolved by a third reviewer (lead author).

114   **Data Collection**

115   A data extraction form was created, piloted, and used by a research assistant to collect

116   citation details, participant characteristics, description of interventions, study design, measures,

117   and results from each study. A second reviewer independently verified the data collection, and

118   differences were resolved by a third reviewer (lead author). Data extracted are listed in Table 1.

119   **Risk of Bias in Individual Studies**

120   The quality of each study was independently assessed by two reviewers. The Cochrane

121   Collaborations tool for assessing risk of bias (19) was used to evaluate the randomization,

122   allocation concealment, assessor blinding, and outcome reporting of each RCT. The Risk of Bias

123   Assessment tool for Non-randomized Studies (RoBANS) (20) was used to assess the participant

124   selection, confounding variables, measurement of exposure, assessor blinding, and outcome

125   reporting of quasi-experimental studies. The Quality Assessment Tool for Observational Cohort

126   and Cross-Sectional Studies (21) was used to assess risk of bias for longitudinal and cross-

127   sectional studies. Disagreements among the reviewers were resolved by review and consensus.

128   **Summary Measures and Risk of Bias Across Studies**

129   Results regarding the associations between social support concepts and PA are reported

130   in Table 1. Given that the purpose of the study was to synthesize the research on the ways in

131   which several distinct types of social support may be associated with PA, the range of

132   conceptualizations of social support, and the small number of studies assessing each concept, no

133   quantitative synthesis (i.e., meta-analysis) or assessment of publication bias was performed.

134   **Results**

135   **Study Selection**

136   The search produced 5147 articles, and 5 additional articles were identified by the

137   authors. After removing duplicates, 3455 articles were screened for eligibility based on titles and

138   abstracts, and 52 articles were retained after full text review, representing 50 unique studies.

139   **Study Characteristics**

140   **Methods.** The review included 11 RCTs, 1 non-randomized trial, 5 single-arm

141   prospective trials, 11 longitudinal studies, and 22 cross-sectional studies. Examining associations

142   between social support and PA was not the primary aim of most studies; therefore, in most cases,

143   the evidence extracted was more basic than the overall study design would suggest (e.g.,

144   correlations extracted from an RCT). Sample size ranged from 22-404 in RCT's and quasi-

145   experimental trials, and 50 to 9,331 in the observational studies.

146   **Participants.** 28,366 cancer survivors participated in the included studies: 1,571 in a PA

147   intervention, 437 in interventions involving only non-physical activities (e.g., behavior change),

148   335 were in control groups, and 26,023 participated in observational studies. Among studies that

149   reported average age, mean age ranged from 29-72 years. 88% of participants were women, and

150   78% were survivors of breast cancer. Most participants were post-treatment and Caucasian.

151   **Interventions.** Of the 17 intervention studies, 14 included performing PA, while the

152   other three used online (22, 23) or a phone intervention which included facilitating finding a PA

153   partner/role model (24). Three studies examined interventions including PA in combination with

154   peer support, informational, and/or psychoeducational sessions on coping with cancer (25-27).

155   Interventions ranged from three weeks to 24 months. Only three trials had intervention outcome

156   data that addressed the aims of this review: two studies examining the effects of interventions

157   with versus without a partner (24, 28), and a study examining a team versus group context (29).

158   **Risk of Bias Within Studies**

159   All studies had at least one risk of bias element that was high or unclear (details available

160   from first author). Given the aim to identify how social support is conceptualized and assessed,

161   and potential for association with PA, we did not remove studies due to risk of bias.

162   **Results of Individual Studies**

163   We categorized social support concepts extracted in this review into categories based first

164   on the structural-functional dimension (i.e., presence of relationships, others' PA behavior,

165   perceptions of being supported, and function/quality). We considered the degree of subjectivity

166   when grouping similar measures within each category where relevant.

167   **Presence of relationships.** The most common measure was marital status. Most (*n*=17)

168   studies reported that marital status (7, 25, 30-44) and length of marriage (45) were unrelated to

169   PA. Three studies documented positive associations between being married or partnered and PA

170   (26, 46, 47), two reported significant associations that became non-significant in multivariate

171   models (48, 49), and three reported associations with some types of, but not total, PA (50-52).

172   Number of children (42) and being a member of a community organization (31) were not

173   associated with PA. Attendance was greater for those who were members of a team sport versus

174   a PA group in one non-randomized trial (29). Social network measures of network size,

175   integration, and diversity, and number of friendship and community ties were all positively

176   associated, while marital, religious, and relative ties were not (25, 53). The presence of others

177   may not be sufficient to support PA, but larger, diverse, integrated networks of supportive may

178   be important, although more evidence is needed.

179   **Other people's PA behavior** concepts addressed contact with others, with reference to

180   their function as a model or companion. Observing PA role models was positively associated

181   with PA in one study (54), but unrelated in another (55). Positive correlations were observed

182   when the role model was the survivors' spouse (45), but were not significant for caregivers (56),

183   family (57), or other cancer survivors (27, 55). Having other people to participate with, including

184   a spouse, support person, PA partner, or friends was largely not associated with PA (27, 28, 57,

185   58). One study found that survivors who acquired a new PA partner through their intervention

186   had greater PA (24), and another found that having a PA partner was associated with some PA

187   measures, but only among employed survivors (55). Subjective norms were generally not

188   associated with PA (12, 36, 55, 59, 60), except for one positive association with aerobic, but not

189   resistance PA (39, 41). But when defined as injunctive (perceptions that others approve of PA)

190   versus descriptive (perceptions that others participate in PA) norms, two studies found injunctive

191   norms were positively associated (43, 49), while a third found no association (38). Descriptive

192   norms were unrelated (38, 43). Others' PA may be most effective if they are in close

193   relationship.

194   **Perceptions of being supported** included general perceptions of feeling supported, or

195   aggregate scores of multiple support concepts, addressing availability of or satisfaction with

196   support. Perceptions of being supported in general by other people in one's life were positively

197   associated with PA in nine studies (7, 22, 47, 48, 61-64), although in two cases the associations

198   became non-significant in multivariate models (48, 61), and it was not associated in three studies

199   (27, 65, 66). When assessed in terms of source of support, findings were mixed. General family

200   support predicted increased PA (67), and was positively correlated with PA, although not when

201   controlling for friend support (68). Family support for PA was not associated with PA (27, 54,

202   59, 69, 70), except when support was reported by the family member (70), and in one case where

203   it negatively predicted PA (22). General spousal support was correlated with PA, except when

204   controlling for friend support (68), but spouse support for PA was positively associated with PA

205   (45, 59). Providing support to a spouse/partner was positively associated with PA (45). One

206   study with advanced cancer patients showed general support from a caregiver was negatively

207   associated with PA (56), possibly reflecting greater needs.

208   General friend support was positively associated with PA in one study (68), but not in

209   another (67). PA friend support was positively associated with MVPA but not light or total PA in

210   one study (22), and not associated in four others (27, 54, 59, 69). Expectations of support for PA

211   from other survivors was not associated with PA (59), but support from social network friends

212   met as part of an intervention was positively associated with MVPA (but not light or total PA)

213   (22). Expectations of support for PA from physicians was positively associated with PA (59).

214   Support from intervention staff was negatively associated with PA in one study (26), possibly

215   reflecting that those who were struggling to increase PA were recognized by staff as needing

216   greater assistance. While findings were mixed, it may be more important to have supportive

217   people than who that support comes from.

218   **Social support functions and relationship quality**. Autonomy support (support that is

219   empathetic and encourages their volition, choice, and voice) was positively associated with PA

220   (32, 33), while controlling or critical behavior regarding PA from relatives was not associated

221   (57, 70). Confidant, informational, emotional/informational, tangible, and affectionate support;

222   social interaction; and providing rewards were positively associated with PA (47, 51, 55, 57).

223   Affective, instrumental, and emotional support, having a friend or family with whom to discuss

224   health, attachment, social integration, reassurance of worth, reliable alliance, and guidance were

225   unrelated to PA (31, 51, 55, 66). Satisfaction of needs for relatedness (supportive emotional

226   connections) was correlated with PA in one study (33) but was not associated in two others (23,

227   71). Relationship satisfaction with one's spouse was unrelated to PA (45). This initial evidence

228   suggests some supportive functions and relationship quality concepts may be more important for

229   facilitating PA, but the small number of studies makes it difficult to draw conclusions.

230   **Discussion**

231   **Summary of evidence**

232   Evidence on the role of social support in PA is mixed. We categorized social support-related

233   concepts as the presence of relationships, other people's behavior, perceptions of being

234   supported, and functional support/relationship quality. These categories may be useful for

235   identifying concepts for future research. While there were many null findings, significant

236   findings existed for most concepts and were largely positive. Other people's presence provides

237   opportunities, but the supportiveness of those relationships may be important to facilitating PA.

238   Modeling or participating in PA together may be predictive of PA, but who the model or partner

239   are may be important for support effectiveness. General perceptions of support, particularly from

240   close or important sources, may be predictive. Furthermore, there is initial evidence for positive

241   associations with supportive functions, but more research is needed.

242   Social support is often a rationale for including social components (e.g., support groups;

243   group PA) in interventions, and occasionally forwarded as a mechanism for how group PA may

244   benefit survivors (27). But the role of social support was rarely the primary focus. Future

245   research is needed to test socially relevant intervention components to strengthen the evidence on

246   whether, and under what conditions, social approaches are effective.

247   Because few studies focused on social support, or addressed whether the tests involving

248   social support were adequately powered, it is difficult to interpret null findings. It seems most

249   prudent to regard this review as a catalogue of what has been tested to date, and to use these

250   results for designing studies comparing the relative roles of different types of social support.

251   While associations, if they exist, are positive, research comparing these effects would be useful.

252   While it is known, for example, that simply providing group format PA may not be sufficient to

253   foster support (17), it would be useful to understand what types of social support cause, mediate,

254   or moderate this process.

255   **Limitations**

256   Social support was rarely the primary focus, and some studies may have been underpowered

257   to test these effects. The heterogeneity of design, intervention, and concepts precluded a meta-

258   analysis and makes it difficult to draw conclusions. We grouped concepts informed by a

259   conceptual model of social support, but other categorizations could be constructed.

260   Generalizability is limited as studies predominantly sampled Caucasian, female, breast cancer

261   survivors. There is a need for research with more diverse participants.

262 **Clinical Implications**

263   Clinical implications include identification of research questions including examining what

264 elements of social support are effective at improving PA behavior, and developing and testing

265 social elements of PA interventions that could lead to improved PA interventions for cancer

266 survivors.

267 **Conclusions**

268   This review synthesizes evidence on social support concepts examined in association with

269 PA among adult cancer survivors. It illustrates evidence gaps, and lack of research comparing the

270 effects of multiple forms of social support. It clarifies that few studies have examined support

271 functions, or causal effects of support. These findings support future research examining the

272 effects of social support in the PA context with cancer survivors, which would aid in facilitating

273 support in interventions.

274 **Conflict of Interest Statement**

275 There is no conflict of interest related to this work.

276

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473 Psychol Health Well Being. 2013;5:369-88.

474   Table 1. Studies assessing associations between social support and PA included in the review

Author, Year, Location	Participants	Intervention, Assessment	Measures	Results
Randomized Controlled Trials				
Bloom 2008 USA	N=404 (I:201, C:203) 23-50yr, F 76% Caucasian breast cancer, 5yr post-diagnosis	C: UC I: 3mo, 6hr group psychoeducational workshop with 30min PA Assessment: baseline, 6mo	SS: Berkman-Syme Social Network Index (BSI), marital status PA: work and leisure PA, perceived change in PA	Those with larger social networks more likely to increase PA. Marital status not associated with change in PA.
Buffart 2015 New Zealand, Australia	N=100 (I:50, C:50) M_{age}=72yr, M prostate cancer, post-treatment	C: PA recommendation, information, pedometer I: C plus 6mo 2x/wk 60min supervised PA and 90min/wk home-based PA. Assessment: baseline, 6mo, 12mo	SS: marital status PA: diary	Marital status not associated with PA.
Courneya 2008 & Courneya, Friedenreich 2009 Canada	N=242 (I1:82, I2:78 C:82) ≥18yr, F breast cancer, in treatment	C: UC I1: duration of chemotherapy (9-24wk), 3x/wk 60min supervised aerobic PA I2: I1 except resistance PA Assessment: baseline, midpoint, post-I, 6mo follow-up	SS: marital status; subjective norms PA: LTEQ, attendance	Marital status not associated with attendance or PA at follow-up. Subjective norms positively predicted PA at follow-up in I1 but not I2.
Courneya, Sellar 2009 Canada	N=122 (I:60, C:62) ≥18yr, 59%M lymphoma, in or post-treatment	C: UC I: 12wk, 3x/wk 15-135min supervised PA Assessment: baseline, 12wk	SS: marital status PA: attendance	Marital status not associated with adherence.
Courneya 2014 Canada	N=301 (I1:96, I2:101, I3:104) M_{age}=50yr, F	I1: duration of chemotherapy (M=16wk),	SS: marital status PA: attendance	Marital status did not predict adherence.

	breast cancer, in treatment	3x/wk 75min total supervised PA I2: I1 except 150min total I3: I1 plus 3x/wk resistance Assessment: baseline, attendance		
Kamen 2016 USA	N=22 (I1:12, I2:10) M_{age}=56yr, 64%F 96% Caucasian 69% breast cancer, post-treatment	I1: 6wk, home-based PA program, equipment. Weekly phone PA check-in. I2: I1, except included caregiver in PA and discussion on PA barriers and cancer stress Assessment: baseline, 6wk	SS: Dyadic Support Questionnaire PA: pedometer	No difference in change in SS from partner or steps/d if caregiver included in intervention or not.
Mama 2017 USA	N=89 (I1:30, I2:29, C:30) M_{age}=59yr, F Hispanic breast cancer, post-treatment	C: UC I1: 16 wk, 2x/wk home-based PA, equipment, bi-weekly phone PA check-in. culturally tailored PA newsletters, 1x/mo group PA I2: I1, except newsletters not tailored Assessment: baseline, 16wk	SS: Social support for exercise scale (SSES) PA: IPAQ	Social support did not moderate effects of I1 or I2 on PA.
Mayer 2018 USA	N=284 (I:144, C:140) M_{age}=59yr, 52%F 89% Caucasian colorectal cancer, $\geq$ 6wk post-surgery, $\leq$12mo post-diagnosis	C: print material on cancer survivorship, pedometer I: C plus 6mo PA behavior change app including peer and coach interaction Assessment: baseline, 3mo, 6mo, 9mo	SS: McTavish bonding scale PA: LTEQ	Relatedness at 3mo not associated with PA at 6mo, did not mediate effect of I on PA.
Rogers 2011 USA	N=41 (I:21, C:20) M_{age}=53yr, F 93% Caucasian	C: UC I: 12wk,1x/wk supervised PA, home-based PA, 6 group	SS: SSES, presence of PA partner/role model PA: LTEQ, accelerometer	SS for PA from family, friends, and total, and having a PA partner, and role model did not mediate the effect of I on PA.

		behavior change and support sessions, 3 counseling sessions Assessments: baseline, 12wk		
	breast cancer, in treatment			
Ungar, Sieverding 2016 Germany	*N*=67 (I:35, C:32) *M*age=55yr, 55%M 33% breast cancer, ≤ 6mo post-treatment	C: 4wk, 1 stress management counseling session, 3 weekly phone follow-ups I: C except PA behavior change counseling, and encouraged to find a same-sex survivor PA role model/partner. Assessment: baseline, 8wk, 18wk	SS: whether partnered with a PA role model/partner (I only) PA: ActiGraph GT3X accelerometer, Short Questionnaire to Assess Health-Enhancing PA (SQUASH)	Those with a partner marginally more likely to meet PA guidelines at T2, significantly more likely at T3.
Valle 2015 USA	*N*=86 (I1:41, I2:45) *M*=32yr, 48%F 91% Caucasian 31% hematologic cancer, ≥1yr post-diagnosis, post-treatment	I1: 12wk, Recommend 150 min/wk MVPA. Facebook group with unmoderated discussion, weekly PA messages. I2: I1, but discussion moderated, and included PA behavior change tools Assessment: baseline, 12wk	SS: SSES PA: LTEQ	Changes in SS from social network friends, friends, and total predicted increased MVPA, but not light or total PA. Family support negatively predicted light and total PA.
Non-Randomized Quasi-Experimental Trials				
Carter 2012 USA	*N*=120 (I1:68, I2:52) *M*age=56yr, F 81% Caucasian 55% breast cancer, in or post-treatment	I1: 8wk, 2x/wk 1hr dragon boat team training I2: I1 but group walking Assessment: baseline, 8wk	SS: Group Environment Questionnaire PA: attendance	Team-cohesion and attendance greater in the team at 8wk.
Single-Arm Prospective Quasi-Experimental Trials				
Courneya 2001 Canada	*N*=24 *M*age=51yr, F	12wk 2x/wk 70min dragon boating pool training	SS: Subjective norms, normative beliefs PA: LTEQ, attendance	PA positively associated with expected SS from spouse and physician, but not from family, friends, other survivors, total expected support, or

	breast cancer, post-treatment	Assessment: baseline, attendance		subjective norms. Attendance not associated with total expected support or subjective norms.
Culos-Reed 2005 Canada	N=109 M_age=53yr, F breast cancer, post-treatment	12-14 wk dragon boat training Assessment: baseline, 12-14wk	SS: subjective norms PA: LTEQ	Baseline subjective norms did not predict post-test PA.
McGuire 2011 USA	N=120 M_age=59yr, F breast cancer, post-treatment	24 mo, 2x/wk unsupervised PA: 8mo home-based, 16mo fitness center, 14 behavior change sessions Assessment: baseline, adherence	SS: marital status; number of times staff provided support PA: % exercises completed	Being married predicted higher adherence. Receiving more support predicted lower adherence.
Morielli 2018 Canada	N=18 M_age=58yr, 67%M 94% Caucasian rectal cancer, in treatment	3x/wk supervised PA during chemoradiotherapy, then ≥ 150 min/wk unsupervised PA until 2wk pre-surgery Assessment: baseline, post-chemoradiotherapy, 1-2wk pre-surgery	SS: marital status, subjective norms PA: attendance, LTEQ	Adherence not associated with marital status or subjective norms.
Ross-Zahavich 2013	N=15 M_age=65yr, M prostate cancer, post-diagnosis	7wk, 1x/wk 75min yoga Assessment: baseline, 7wk, 14wk	SS: brought support person, Social Provisions Scale (SPS) PA: attendance, logs	Bringing a support person associated with greater total SS during the program, but not follow-up, and not associated with attendance.
Longitudinal Observational Studies				
Devoogdt 2010 Belgium	N=267 M_age=55yr, 99%F breast cancer, day before surgery	Assessment: day before surgery, 1, 3, 6, 12mo	SS: marital status PA: Flemish PA Computerized Questionnaire	Being married associated with greater decrease in occupational PA, less decline in household PA. Not associated with change in sport or total PA.
Ellis 2017 USA	N=484 M_age=61yr, 62%F 79% Caucasian 32% breast cancer, advanced	Assessment: baseline, 3mo, 6mo	SS: Social Support Scale PA: frequency/wk walking or MVPA	Total SS from caregiver at baseline negatively associated with PA at T2, but not at baseline or T3, and not T2 SS-T3 PA. PA not associated with caregiver's perceptions of providing support, or caregiver's PA

Emery 2009 USA	*N*=227 *M*$_{age}$=51yr, F 90% Caucasian breast cancer, post-surgery, pre-adjuvant therapy	Assessment: baseline, 4mo, 8mo, 12mo, every 6mo for 4yr	SS: Perceived Social Support from Family and Friends scale PA: 7-day PA Recall	Those with higher family SS increased PA in first 2yr and decreased in next 3yr. Those with lower family SS had higher, stable PA in first 2yr, then decreased. Family SS not associated with baseline PA. Friend SS not associated with PA baseline or change.
Harrison 2009 Australia	*N*=287 *M*$_{age}$=55yr, F breast cancer, 6mo post-diagnosis	Assessment: baseline, 6mo,12mo	SS: marital status; number of children PA: Behavioral Risk Factor Surveillance System	Marital status and number of children not associated with PA change.
Karvinen 2009 Canada	*N*=397 *M*$_{age}$=70yr, 75%M bladder cancer, post-diagnosis	Assessment: baseline, 3mo	SS: marital status, subjective norms PA: LTEQ	Baseline injunctive norm positively correlated with PA at 3mo. Baseline descriptive norm and marital status not correlated with PA at 3mo.
Khadanga 2016 USA	*N*=1,382 *M*$_{age}$=56yr, F 96% Caucasian breast cancer (DCIS), post-diagnosis	Assessment: baseline, up to 3 re-contacts at least 2yr apart	SS: partner status PA: hr/wk PA	Change in PA not significantly associated with partnership status.
Lin 2015 Taiwan	*N*=107 *M*$_{age}$=64yr, 53%M lung cancer, post-diagnosis	Assessment: baseline, 3mo, 6mo	SS: SSES PA: LTEQ	SS total positively predicted changes in walking
Lucas 2017 USA	*N*=548 *M*$_{age}$=56yr, F 92% Caucasian breast cancer, post-diagnosis	Assessment: baseline, 6mo, 12mo	SS: marital status; MOS Social Support Survey (MOS-SSS) PA: Women's Health Initiative PA questionnaire	Low (vs. medium and high) MVPA less likely to be married/partnered, and had less SS, but only significant in bivariate, not multivariate analyses.
Mack 2013 Canada	*N*=144 *M*$_{age}$=55yr, F 87% Caucasian breast cancer, 6mo post-treatment	Assessment: baseline, 3mo	SS: Psychological Need Satisfaction in Exercise Scale (PNSE) PA: LTEQ	Change in relatedness not correlated with change in PA.

Pinto 2002 USA	*N*=69 *M*_{age}=58yr, F Caucasian breast cancer, ≤1yr post-diagnosis	Assessment: baseline, 3mo, 6mo, 9mo, 12mo	SS: marital status; Duke-UNC Functional Social Support Questionnaire PA: min/wk PA	Confidant support and living with a spouse, but not affective support, positively associated with change in vigorous PA. None of the SS functions associated with change in moderate PA.
Ungar, Wiskemann, 2016 Germany	*N*=56 *M*_{age}=54yr, 56%F 36% breast cancer, post-diagnosis	Assessment: baseline, 4wk	SS: Spousal Involvement in Patient Exercise Scale, SSES PA: 7-Day PA Recall	Family-reported support of patient predicted MVPA and MVPA pus walking at T2, but not at baseline. Patient-reported family support for PA and family control of PA, and family-reported control of patient's PA not associated with MVPA or MVPA plus walking at baseline and T2.
Cross-Sectional Observational Studies				
Alfano 2009 USA	*N*=227 *M*_{age}=62yr, F 93% Caucasian breast cancer, post-diagnosis		SS: MOS-SSS PA: increase/decrease/no change since diagnosis	Increased PA since diagnosis not associated with greater SS.
Charlier 2012 & 2013 Belgium	*N*=464 *M*_{age}=52yr, F breast cancer, post-treatment		SS: Social Support List-Interactions, Social norm for PA, PA model, lack of company to do PA with PA: Flemish PA Questionnaire, SQUASH	Instrumental, informational, and emotional SS not associated with PA in multivariate models, but informational SS negatively correlated with MVPA for those not working. Among working survivors, lack of company negatively associated with leisure PA, and doing PA together positively associated with transportation PA and MVPA. Social norm, modeling, doing PA together, and lack of company not associated with PA.
Coleman 2014 USA	*N*=128 *M*_{age}=58yr, 53%M 80% Caucasian smoking-related cancer, post-diagnosis		SS: Multidimensional Scale of Perceived Social Support PA: <4 vs. ≥4d/wk walking for PA	SS from family, friends, and significant others positively correlated with PA, but only friends significant in multivariate model.
Geng 2018 China	*N*=764 *M*_{age}=54yr, 51%F		SS: Social Support Rating Scale	SS total positively predicted PA.

	Chinese mixed cancer, post-diagnosis		PA: frequency of PA
Hong 2007 USA	N=2816 M_age=53yr, F 85% Caucasian Breast cancer, post-diagnosis	SS: marital status PA: frequency, duration, and intensity of PA and walking	Marital status not associated with PA.
Hughes 2015 USA	N=150 M_age=57yr, F 67% Hispanic breast cancer	SS: SSES, number of people observed doing PA PA: LTEQ	Observing PA models positively predicted PA. SS from family and friends not associated with PA.
Kampshoff 2016 Netherlands, Australia, New Zealand	N=574 M_age=55yr, F Caucasian breast cancer, post-diagnosis	SS: marital status, SSES, MOS-SSS PA: ActiTrainer and Actigraph accelerometer, Yamax pedometer	SS for PA positively predicts PA. Marital status not associated with PA.
Karvinen 2007 Canada	N=354 M_age=65yr, F endometrial cancer, post-diagnosis	SS: marital status; injunctive norms PA: LTEQ	Married participants more active, but not significant in multivariate model. Injunctive norms positively correlated with PA.
Kim 2015 USA	N=873 M_age=65yr, 68%M 81% Caucasian 28% skin cancer, post-diagnosis	SS: BSI PA: MVPA	Marital status, having friends/family to discuss health with, and membership in community organizations not associated with PA.
Kim 2016 South Korea	N=1482 M_age=60yr, 64%F 38% breast or colon cancer, post-diagnosis	SS: marital status PA: IPAQ	Living with a partner associated with greater MVPA.
Kroenke 2017	N=9331 M_age=56yr, F	SS: BSI PA: recreational PA	Social integration, social network diversity, and friendship and community ties positively associated

USA, China	breast cancer, < 2yr post-diagnosis		with PA, no association with marital, religious, and relative ties.
Lee 2018 South Korea	*N*=251 *M*_age_=63, 69%M Korean colorectal cancer, <2yr post-diagnosis	SS: SSES PA: PA diaries	Rewards from family positively associated with MVPA and maintaining PA for >6mo. Family participation and involvement, criticism from family, and friends exercising together not associated with PA.
Liu 2017 China	*N*=351 *M*_age_=57yr, 52%M 32% breast cancer, post-diagnosis	SS: Social Support Rating Scale PA: PA frequency	SS total not associated with PA.
Love 2011 Canada	*N*=64 <40yrs, 73%F 95% Caucasian 52% carcinoma, post-diagnosis	SS: SPS PA: LTEQ	SS availability positively correlated with PA.
Lowe 2012 Canada	*N*=50 n=21 <60yr, n=29 >60yr, 60%F mixed cancer, advanced	SS: marital status; injunctive and descriptive norms PA: PA Scale for the Elderly	Marital status, injunctive norms, and descriptive norms not associated with PA.
Mandelblatt 2011 USA	*N*=2279 *M*_age_=60yr, F 73% Caucasian breast cancer, in treatment	SS: marital status; MOS-SSS PA: Arizona Activity Frequency Questionnaire	Being married and emotional/informational, tangible, affectionate, social interaction, and total SS positively associated with MVPA.
Milne 2008 Australia	*N*=558 *M*_age_=59yr, F breast cancer, post-diagnosis	SS: marital status; Health Care Climate Questionnaire (HCCQ) PA: LTEQ	Marital status not associated with PA. Autonomy support positively associated with meeting PA guidelines.
Myers Virtue 2015 USA	*N*=132 *M*_age_=61yr, M 78% Caucasian	SS: length of relationship; Dyadic Adjustment Scale, Relationship Satisfaction Survey	Meeting PA guidelines positively associated with survivor-reported partner support, and spouse-reported partner support for PA. Couples' PA was positively associated, and couples were

	prostate cancer, <1yr post-treatment	PA: LTEQ	significantly more likely to be concordant in whether they met PA guidelines. Providing support for PA for each other was higher among couples who were concordant in meeting PA guidelines. Length of relationship and relationship satisfaction not associated with concordance in meeting PA guidelines
Peddle 2008 Canada	*N*=413 *M*=60yr, 54%M colorectal cancer, ≥1yr post-treatment	SS: marital status, HCCQ, PNSE PA: LTEQ	Marital status not associated with PA. Autonomy support and relatedness positively associated with PA.
Slater 2016 USA	*N*=158 M_{age}=29yr, 54%F 95% Caucasian childhood cancer, post-treatment	SS: marital status PA: IPAQ	Living with a partner negatively associated with active transportation.
Stephenson 2009 Canada	*N*=67 M_{age}=60yr, 52%M 91% Caucasian colorectal cancer, in treatment	SS: SPS PA: LTEQ	Attachment, social integration, reassurance of worth, reliable alliance, guidance, opportunity to nurture, and total SS not associated with meeting MVPA guidelines.
Stevinson 2014 UK	*N*=748 M_{age}=65yr, 68%F 97% Caucasian 48% breast cancer, post-diagnosis	SS: marital status PA: LTEQ	Marital status not associated with meeting MVPA guidelines.

475   Note: PA (physical activity), SS (social support), I (intervention), C (control), UC (usual care). Significant ($p<.05$), marginal ($p≤.10$),

476   not significant ($p>.10$)

477   Figure 1.

478   Search terms used in the Medline search

479
480   **Social Support:** exp Social Support/ OR social support* OR
481   (peer adj3 support*) OR (group adj3 support*) OR
482   psychosocial support* OR autonomy support* OR perceived
483   support* OR received support* OR emotion* support* OR
484   tangible support* OR listening support* OR support quality
485   OR support quantity OR support appraisal* OR support*
486   function* OR support* exchange* OR social network* OR
487   (famil* adj3 support*) OR (spous* adj3 support*) OR (partner
488   adj3 support*) OR (personal adj3 relationship*) OR (social
489   adj3 relationship*) OR camaraderie OR relatedness OR role
490   model* OR exp Friends/ OR friend* OR companion* OR
491   (social adj3 acceptance) OR (peer adj3 acceptance) OR
492   belonging OR Peer Group/ OR connectedness OR cohesion
493   OR interpersonal support* OR marital status OR reality
494   confirmation
495   AND
496   **PA:** physical active* OR exp Exercise/ OR exercise* OR exp
497   Sports/ OR sport* OR walk* OR exp Bicycling/ OR bicycle*
498   OR exp Resistance Training OR resistance train* OR exp
499   Yoga/ OR yoga OR dragon boat* OR aerobic* OR exp
500   Walking/ OR Motor Activity/ OR exp Tai Ji/ OR tai ji OR tai
501   chi OR qi gong OR quigong OR exp Exercise Therapy/ OR
502   pilates
503   AND
504   **Cancer***:*** exp Neoplasms/ OR cancer* OR neoplasm* OR exp
505   Survivors/ OR survivor* OR exp Leukemia/ OR leukemia*
506
507

508   Figure 2.

509   *Flow diagram of study selection*

510

Identification

Records identified through search
(*n*=5147)
- Cinahl *n*=553
- Cochrane Central *n*=228
- Cochrane Database *n*=442
- Embase *n*=1769
- Family and Society *n*=261
- Medline *n*=1266
- PsycINFO *n*=409
- Social Work *n*=7
- Sport Discus *n*=212

Records identified through other sources
(n=5)

Screening

Records after duplicates removed
(*n*=3455)

Records screened
(*n*=3455)

Records excluded for not meeting inclusion criteria
(*n*=3162)

Eligibility

Full-text articles assessed for eligibility (*n*=293)

Full-text articles excluded, with reasons
(n=241)
- Duplicates (n=7)
- <18 years old (n=1)
- No cancer diagnosis (n=7)
- Not empirical study (n=58)
- No PA variable (n=67)
- No social support variable (n=55)
- Association between social support and PA not reported (n=13)
- Qualitative studies (n=33)

Included

Articles included in qualitative synthesis
(n=52)