**A picture containing food

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**Cancer Rehabilitation Day 1 Notes**

**[Contained within this document are links to video clips, quizzes, templates, and academic evidence concerning cancer rehabilitation]**

* Eurostat Statics Breakdown Based on EU Nation [Discussed Wednesday morning]. You have full access to death rates from cancer and also cancer healthcare [Link](https://ec.europa.eu/eurostat/statistics-explained/index.php/Cancer_statistics)
* McMillan A-to Z List (Types of Cancer) [Discussed Monday morning] [Link](https://www.macmillan.org.uk/cancer-information-and-support/cancer-types)
* Marti, J., Hall, P.S., Hamilton, P., Hulme, C.T., Jones, H., Velikova, G., Ashley, L. and Wright, P., 2016. The economic burden of cancer in the UK: a study of survivors treated with curative intent. Psycho‐oncology, 25(1), pp.77-83. [Link](http://eprints.leedsbeckett.ac.uk/1539/1/Economic_burden_June2015_final.pdf)
* How does the immune system work? [Discussed Monday afternoon] [Link](https://www.cancerresearch.org/blog/april-2019/how-does-the-immune-system-work-cancer)
* YouTube links (NCI) Immunotherapy: How the Immune System Fights Cancer [Link](https://youtu.be/jDdL2bMQXfE)
* Innate lymphoid cells [Link](https://youtu.be/CXz6FVqPqHw)
* B Cells vs T Cells | B Lymphocytes vs T Lymphocytes - Adaptive Immunity – Mechanism [Link](https://youtu.be/NMOHWry8EDc)
* Immune System: Innate and Adaptive Immunity Explained [Link](https://youtu.be/PzunOgYHeyg)
* The immune system vs. cancer | Jedd Wolchok | TEDxTimesSquare [Link](https://youtu.be/YFsPokpur5A)
* **Video Clip** What are the common categories of cancer? [  
  Cancer Treatment Centres of America - CTCA] [Link](https://youtu.be/5LxR5f-tVww)
* NHS Drug [Link](https://www.nhs.uk/medicines/)
* What do cancer stages and grades mean? [NHS Sources] [Link](https://www.nhs.uk/common-health-questions/operations-tests-and-procedures/what-do-cancer-stages-and-grades-mean/)
* NIH Curriculum Supplement Series [Link](https://www.ncbi.nlm.nih.gov/books/NBK20362/)
  1. Cancer as A Multistep Process [Link](https://www.ncbi.nlm.nih.gov/books/NBK20362/#A324)
* American cancer Society – What is Cancer?

**Animation Clips**

* Cancer Treatments and Animation (NCI Link) [Discussed Monday morning] [Link](https://www.cancer.gov/about-cancer/treatment/types)
* Cancer Treatment: Chemotherapy (Nucleus Medical Media)[Link](https://youtu.be/vKIRWY-LMYc)
* Prostate Cancer Treatment | Cancer Research UK [Link](https://youtu.be/gQeYUEj9i_g)
* Treatments for Lung Cancer | Cancer Research UK [Link](file:///Users/grantralston/Desktop/Can/1.%09https:/youtu.be/vz3SaSpQKqo)
* Cancer Treatment: IMRT (Radiation Therapy) [Link](https://youtu.be/_moypMx05Fw)
* Adjuvant Hormonal Therapy for Estrogen Receptor Positive Early-Stage Breast Cancer - Mayo Clinic [Link](https://youtu.be/euQqLEc2vbk)
* ACSM Cancer Exercise Trainer Quizzes & Flashcards [discussed Monday morning] [Link](https://quizlet.com/201046043/acsm-cancer-exercise-trainer-chapter-1-flash-cards/)

**Quizzes and Flash cards**

* DNA Repair & Cancer Flash Cards [Link](https://quizlet.com/91607435/dna-repair-cancer-flash-cards/)
* The Role of Occupational Theraphy in Cancer Rehab [Link](https://quizlet.com/379901078/the-role-of-ot-in-cancer-rehab-flash-cards/)
* Cancer [Link](https://quizlet.com/135402950/cancer-flash-cards/)
* Cancer Council Common Reaction and Responses [Link](https://www.cancercouncil.com.au/cancer-information/when-you-are-first-diagnosed/emotions-and-cancer/dealing-with-the-diagnosis/)

**Ted Talk Video Clips and others on Nutrition and Physical Activity**

* Food as Medicine | Michael Greger, M.D. | TEDxSedona [Link](https://youtu.be/xnKaOL2IBPY)
* Dr. William Li's 2010 TED Talk [Link](https://youtu.be/C_5Z31mUmtc)
* Starving cancer away | Sophia Lunt | TEDxMSU [Link](https://youtu.be/f6rSuJ2YheQ)
* Keeping Active After Breast Cancer (DVD)[Link](https://youtu.be/InLjRtHNnh8)
* Video Eat well, keep active after breast cancer Breast Cancer Care. [Link](https://youtu.be/InLjRtHNnh8)

**Books or Other Readings**

* Breast cancer Survivorship: Consequences of early breast cancer and its treatment [Share Drive [Link](https://documentcloud.adobe.com/link/track?uri=urn:aaid:scds:US:fd07166f-e2b6-49d0-8d1d-7cdb82ba027d)]
* From cancer patient to cancer survivor: lost in transition [Share Drive [Link](https://documentcloud.adobe.com/link/track?uri=urn:aaid:scds:US:7084172a-330c-40e7-839a-282d7acf07ee)]
* Breast Cancer and the Environment: A Life Course Approach [Share Drive [Link](https://documentcloud.adobe.com/link/track?uri=urn:aaid:scds:US:259eee25-f047-4335-a79b-97455650fb4d)]
* Life after breast cancer treatment [Share Drive [Link](https://documentcloud.adobe.com/link/track?uri=urn:aaid:scds:US:4b07a43f-20d3-4759-8c6a-30250480d9d4)]
* Exercising during and after treatment for cancer: A guide for patients and their carers [Link](https://www.christie.nhs.uk/media/6463/540.pdf)
* Lymphoma Action [Link](https://lymphoma-action.org.uk/about-lymphoma-living-and-beyond-lymphoma/exercise-and-physical-activity)
* Physical activity report – Macmillian Cancer Support [Link](https://www.macmillan.org.uk/documents/aboutus/newsroom/physicalactivityreport.pdf)
* Physical activity for people with metastatic bone disease [Link](https://www.macmillan.org.uk/_images/physical-activity-for-people-with-metastatic-bone-disease-guidance_tcm9-326004.pdf)
* Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R.L., Torre, L.A. and Jemal, A., 2018. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: a cancer journal for clinicians, 68(6), pp.394-424. [Link](https://acsjournals.onlinelibrary.wiley.com/doi/pdf/10.3322/caac.21492)
* Lake, B., Fuller, H.R., Rastall, S. and Usman, T., 2019. Breast reconstruction affects coping mechanisms in breast cancer survivors. Indian Journal of Surgery, 81(1), pp.43-50. [Link](https://eprints.keele.ac.uk/4295/1/IJOS-D-16-00898%20(2).pdf)
* ACSM Guidelines for Exercise Testing and Prescription [10th Edition] [Share Drive [Link](https://documentcloud.adobe.com/link/track?uri=urn:aaid:scds:US:0d0c71c4-6b02-4acb-bb9f-e2c5007f1b47)] Page number 423-to- 437
* Kate Lindley Example RAG [Red, Amber and Green] Circuit [Link](https://documentcloud.adobe.com/link/track?uri=urn:aaid:scds:US:071ba96f-79e5-4ab7-9b8c-85a06dbe2cb3)
* saes da Silva, E., Tavares, R., da Silva Paulitsch, F. and Zhang, L., 2018. Use of sunscreen and risk of melanoma and non-melanoma skin cancer: a systematic review and meta-analysis. European Journal of Dermatology, 28(2), pp.186-201. [Link](https://ppgsp.furg.br/images/artigosegressos/Elizabet-Silva-Linjie-Zhang.pdf)
* Sander, M., Sander, M., Burbidge, T. and Beecker, J., 2020. The efficacy and safety of sunscreen use for the prevention of skin cancer. CMAJ, 192(50), pp.E1802-E1808. [Link](https://www.cmaj.ca/content/cmaj/192/50/E1802.full.pdf)
* Rueegg, C.S., Stenehjem, J.S., Egger, M., Ghiasvand, R., Cho, E., Lund, E., Weiderpass, E., Green, A.C. and Veierød, M.B., 2019. Challenges in assessing the sunscreen‐melanoma association. International journal of cancer, 144(11), pp.2651-2668. [Link](https://onlinelibrary.wiley.com/doi/pdf/10.1002/ijc.31997)
* Hermans, K.E., van den Brandt, P.A., Loef, C., Jansen, R.L. and Schouten, L.J., 2021. Alcohol consumption, cigarette smoking and cancer of unknown primary risk: Results from the Netherlands Cohort Study. International Journal of Cancer, 148(7), pp.1586-1597. [Link](https://www.tandfonline.com/doi/pdf/10.1080/14737140.2021.1888719)
* Aredo, J.V., Luo, S.J., Gardner, R.M., Sanyal, N., Choi, E., Hickey, T.P., Riley, T.L., Huang, W.Y., Kurian, A.W., Leung, A.N. and Wilkens, L.R., 2021. Tobacco smoking and risk of second primary lung cancer. Journal of Thoracic Oncology, 16(6), pp.968-979. [Link](https://www.sciencedirect.com/science/article/pii/S1556086421017470)

**[More Difficult/ Complex Reading] Nutrition, Carcinogens and Cancer Recent Links Below. Please note there will be additional studies in various factors and cancer. I have attempted to provide resources that illuminate evidence [or lack of] in this area.**

**Understanding p53 functions**

**National Cancer Institute Definition [**[**Link**](https://www.cancer.gov/publications/dictionaries/cancer-terms/def/p53-gene)**] p53 gene**

*“A gene that makes a protein that is found inside the nucleus of cells and plays a key role in controlling cell division and cell death. Mutations (changes) in the p53 gene may cause cancer cells to grow and spread in the body. These changes have been found in a genetic condition called Li-Fraumeni syndrome and in many types of cancer. The p53 gene is a type of tumor suppressor gene. Also called TP53 gene and tumor protein p53 gene.”*

* Sabapathy, K. and Lane, D.P., 2019. Understanding p53 functions through p53 antibodies. Journal of molecular cell biology, 11(4), pp.317-329. [Link](https://academic.oup.com/jmcb/article/11/4/317/5320089)
* Mantovani, F., Collavin, L. and Del Sal, G., 2019. Mutant p53 as a guardian of the cancer cell. Cell Death & Differentiation, 26(2), pp.199-212. [Link](https://www.nature.com/articles/s41418-018-0246-9)
* NHS National Cancer Drugs Fund List [Updated] [Link](https://www.england.nhs.uk/publication/national-cancer-drugs-fund-list/)
* Zamora-Ros, R., Knaze, V., Rothwell, J. A., Hémon, B., Moskal, A., Overvad, K., ... & Touillaud, M. (2016). Dietary polyphenol intake in Europe: the European Prospective Investigation into Cancer and Nutrition (EPIC) study. *European journal of nutrition*, *55*(4), 1359-1375. [Link](https://link.springer.com/article/10.1007/s00394-015-0950-x)
* Perez‐Cornago, A., Travis, R. C., Appleby, P. N., Tsilidis, K. K., Tjønneland, A., Olsen, A., ... & Peppa, E. (2017). Fruit and vegetable intake and prostate cancer risk in the European Prospective Investigation into Cancer and Nutrition (EPIC). *International journal of cancer*, *141*(2), 287-297. [Link](https://onlinelibrary.wiley.com/doi/abs/10.1002/ijc.30741)
* Armstrong, F. and Mathers, J.C., 2000. Kill and cure: dietary augmentation of immune defences against colon cancer. Proceedings of the Nutrition Society, 59(2), pp.215-220. [Link](https://www.cambridge.org/core/services/aop-cambridge-core/content/view/C667717A2531DB986C75791DC7E5DB5E/S0029665100000240a.pdf/div-class-title-kill-and-cure-dietary-augmentation-of-immune-defences-against-colon-cancer-div.pdf)
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* McKenzie, F., Biessy, C., Ferrari, P., Freisling, H., Rinaldi, S., Chajès, V., ... & Trichopoulos, D. (2016). Healthy lifestyle and risk of cancer in the European prospective investigation into cancer and nutrition cohort study. Medicine, 95(16). [Link](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4845813/)
* Gallus, S., Bosetti, C., Negri, E., Talamini, R., Montella, M., Conti, E., ... & La Vecchia, C. (2003). Does pizza protect against cancer?. *International journal of cancer*, *107*(2), 283-284. [Link](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4845813/)
* Helleday, T., Petermann, E., Lundin, C., Hodgson, B., & Sharma, R. A. (2008). DNA repair pathways as targets for cancer therapy. *Nature Reviews Cancer*, *8*(3), 193-204. [Link](http://pure-oai.bham.ac.uk/ws/files/10278856/NRC_Helleday_et_al_figs.pdf)
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* Guyton, K. Z., Rusyn, I., Chiu, W. A., Corpet, D. E., van den Berg, M., Ross, M. K., ... & Smith, M. T. (2018). Application of the key characteristics of carcinogens in cancer hazard identification. Carcinogenesis, 39(4), 614-622. [Link](https://academic.oup.com/carcin/article/39/4/614/4883395)
* Siemiatycki, J. (2020). Historical overview of occupational cancer research. In *Occupational Cancers* (pp. 1-20). Springer, Cham. [Link](https://www.researchgate.net/profile/Jack_Siemiatycki/publication/292613632_Historical_Overview_of_Occupational_Cancer_Research/links/56e2a3ce08ae03f02790a4f4/Historical-Overview-of-Occupational-Cancer-Research.pdf)
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* Environmental Carcinogens and Cancer Risk [Link](https://www.cancer.gov/about-cancer/causes-prevention/risk/substances/carcinogens)
* American Cancer Society – Known and Probable Human Carcinogens [Link](https://www.cancer.org/cancer/cancer-causes/general-info/known-and-probable-human-carcinogens.html)
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**The Innate System**

* Vesely, M. D., Kershaw, M. H., Schreiber, R. D., & Smyth, M. J. (2011). Natural innate and adaptive immunity to cancer. *Annual review of immunology*, *29*, 235-271. [Link](https://www.annualreviews.org/doi/pdf/10.1146/annurev-immunol-031210-101324)
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**Cancer-Related Fatigue**

* Mustian, K. M., Alfano, C. M., Heckler, C., Kleckner, A. S., Kleckner, I. R., Leach, C. R., ... & Scarpato, J. (2017). Comparison of pharmaceutical, psychological, and exercise treatments for cancer-related fatigue: a meta-analysis. JAMA oncology, 3(7), 961-968. [Link](https://jamanetwork.com/journals/jamaoncology/fullarticle/2606439)
* O’Higgins, C. M., Brady, B., O’Connor, B., Walsh, D., & Reilly, R. B. (2018). The pathophysiology of cancer-related fatigue: current controversies. *Supportive Care in Cancer*, *26*(10), 3353-3364. [Link](https://www.researchgate.net/profile/Ciara_Ohiggins2/publication/326088130_The_pathophysiology_of_cancer-related_fatigue_current_controversies/links/5c6b2391a6fdcc404ebad3e0/The-pathophysiology-of-cancer-related-fatigue-current-controversies.pdf)

**Cancer-Related/ Relapse Factors**

* Quispe, D., Quispe, M., Shi, R., Burton, G., & Sun, A. (2007). Obesity and risk for relapse of breast cancer in women of low socioeconomic status. [Link](https://cebp.aacrjournals.org/content/16/11_Supplement/A34)
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**ACSM 2010 Main findings and recommendations [During chemotherapy or radiation therapy]. I have still to revamp the newest recommendations and also sourcing of findings from more recent studies [> 2016]**

|  |  |
| --- | --- |
| **Study** | **Reported Outcomes on Aerobic Fitness** |
| Adamsen et al. (2009) | Improvement was reported in physical capacity for a supervised multimodal intervention: estimated mean difference between groups for maximum oxygen consumption was 0.16 l/min (95% CI 0.1 to 0.2, P<0.01). |
| Campbell et al. (2005) | After 12-weeks subjects who engaged in the exercise programme (n = 12) displayed significantly higher levels of physical functioning and reported higher Quality of Life (QoL) scores than the controls (n = 10). Changes in fatigue and satisfaction with life favoured the intervention group but did not reach significance. |
| Courneya et al. (2007) | Aerobic exercise was superior to traditional care for improving self-esteem (P = 0.02), aerobic fitness (P = 0.01), and percent body fat (adjusted P = 0.08). |
| Courneya et al. (2008) | Aerobic exercise training did not improve QoL or fatigue beyond the established benefits of darbepoetin alpha alone but it did result in favourable improvements in exercise capacity (V0**2peak**) and a more rapid haemoglobin response with lower dosing requirements. |
| Dimeo et al. (1997) | An exercise program consisting of cycling on an ergometer in the supine position after an interval-training pattern for 30 minutes daily during hospitalisation resulted in significantly greater maximal physical performance at discharge (P = 0.04). Duration of neutropenia (P = 0.01) and thrombopenia (P = 0.06), severity of diarrhoea (P = 0.04), severity of pain (P = 0.01), and duration of hospitalisation (P = 0.03) were reduced in the training group compared to non training. |
| Drouin et al. (2006) | The results suggest that moderate intensity aerobic exercise appears to maintain erythrocyte levels during radiation treatment of breast cancer compared with the declines observed in non-training individuals. Aerobic exercise increased VO**2peak** by 6.3% (P = 0.001). Red blood cell increased from 4.10 to 4.21 million cells/μL. The between-group differences [aerobic versus stretching placebo) were significant (P = 0.014). |
| Mock et al. (1997) | A self-paced, home-based walking exercise program can help manage symptoms and improve physical functioning during radiation therapy. The exercise group scored significantly higher than the normal care group on physical functioning (P = 0.003) and symptom intensity, particularly fatigue, anxiety, and difficulty sleeping. |
| Schwartz, Winters-Stone and Gallucci, (2007) | Aerobic exercise preserved bone mineral density (BMD) compared to normal care. Premenopausal women demonstrated significantly greater declines in BMD than postmenopausal women. Aerobic capacity increased by almost 25% for women in the aerobic exercise group and 4% for resistance exercise. Subjects in the normal care group demonstrated a 10% decline in aerobic capacity. The data suggest that weight-bearing aerobic exercise reduces declines in BMD and that aerobic and resistance exercise improve aerobic capacity and muscle strength at a period when women normally show evident declines in functional ability. |
| Schwartz, Winters-Stone and Gallucci, (2009) | Subjects that performed aerobic exercise demonstrated significant improvements in body composition, aerobic capacity, and muscle strength. Exercise during and following cancer treatment is an important intervention to maintain and may improve body composition of cancer survivors, which may improve survival, reduce comorbidities, and improve quality of life. |
| Segal et al. (2001) | Physical functioning increased by 5.7 points and 2.2 points in the self-directed and supervised exercise groups, respectively (P = 0.04). Post hoc analysis showed a moderately large difference between the self-directed and control groups (9.8 points; P = 0.01) and a modest difference between the supervised and control groups (6.3 points; P = 0.09). In a secondary analysis of subjects stratified by therapy type; supervised exercise improved aerobic capacity (+3.5 mL/kg/min; P = 0.01) and reduced body weight (-4.8 kg; P <0.05) compared with normal care only in subjects not receiving chemotherapy. |

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| **Study** | **Reported Outcomes on Muscular Strength** |
| Adamsen et al. (2009) | Improvement was reported in physical capacity for a supervised multimodal intervention: estimated mean difference between groups for muscular strength (leg press) was 29.7 kg (23.4 to 34.9, P < 0.01). |
| Battaglini et al. (2007) | Significant pre-post differences between groups were observed in lean body mass, body fat and muscular strength (P = 0.004, P = 0.004, P = 0.025, respectively). The results suggest that exercise emphasising resistance training promotes positive changes in body composition and strength in breast cancer patients undergoing treatment. |
| Courneya et al. (2007) | Resistance exercise was superior to traditional care for improving self-esteem (P = 0.02), muscular strength (P < 0.001), lean body mass (P = 0.02), and chemotherapy completion rate (P = 0.03). |
| Schwartz, Winters-Stone and Gallucci, (2007) | Subjects were randomised to aerobic or resistance exercise and usual care. At the beginning of chemotherapy and at six months, patients completed exercise testing and BMD assessment of the lumbar spine by dual energy x-ray absorptiometry. BMD, aerobic capacity, and muscle strength. The average decline in BMD was -6.23% for usual care, -4.92% for resistance exercise, and -0.76% for aerobic exercise. |
| Schwartz and Winters-Stone, (2009) | Outcome measurements reported that increases in body fat were significantly greater for the control group (CG) from baseline to 6 months compared with AE and RE (P < 0.01) and at 12 months (P < 0.01). Aerobic capacity significantly improved in AE and RE compared with CG at 6 and 12 months (P < 0.05). Increases in upper and lower body muscle strength for both the AE and RE, from baseline to 6 and 12 months, were statistically significant compared with the CG (P < 0.05 at both points). |

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| **Study** | **Reported Outcomes on Body Size and Composition** |
| Battaglini et al. (2007) | Significant pre-post differences between the control and exercise groups were observed in lean body mass, body fat and muscular strength (P = 0.004, P = 0.004, P = 0.025, respectively). The results suggest that exercise emphasising resistance training promotes positive changes in body composition and strength in breast cancer patients undergoing treatment. |
| Battaglini et al. (2008) | Significant changes in total caloric intake were observed among the control and exercise groups (P = 0.009), at treatments 2 and 3, and at the end of the study. A significant negative correlation was found (P < 0.001) between total caloric intake and skinfold and between total caloric intake and fatigue levels (P = 0.014) at the end of the study fort he exercise group. The results suggest that an exercise intervention administered to breast cancer patients undergoing medical treatment may assist in the mitigation of some treatment side effects, including decreased total caloric intake, increased fatigue, and negative changes in body composition. |
| Courneya et al. (2007) | Outcome measurements suggested that aerobic exercise was superior to usual care for percent body fat (adjusted P = 0.076). Resistance exercise was superior to usual care for improving muscular strength (P < 0.001), lean body mass (P = 0.015), and chemotherapy completion rate (P = 0.033). |
| Demark-Wahnefried et al. (2008) | Patients self-reports suggested that increased calcium intakes in all arms, and higher fruit and vegetable and lower fat intake in the calcium-rich diet (CA) + exercise (EX) + high fruit and vegetable, low-fat diet arm (FVLF). However, no differences were observed in physical activity. Measures of adiposity were lower in the CA + EX + FVLF arm but not significantly. The only significant difference was in % body fat (arms and legs); change in pre-post scores (mean +/- standard deviation) were +0.7% +/- 2.3% (CA); +1.2% +/- 2.7% (CA + EX); and +0.1% +/- 2% (CA + EX + FVLF; P = 0.047). Lean body mass was largely preserved, with no differences observed in other outcomes. |
| Schwartz and Winters-Stone, (2009) | Outcome measurements reported that increases in body fat were significantly greater for the control group (CG) from baseline to 6 months compared with AE and RE (P < 0.01) and at 12 months (P < 0.01). Aerobic capacity significantly improved in AE and RE compared with CG at 6 and 12 months (P < 0.05). Increases in upper and lower body muscle strength for both the AE and RE, from baseline to 6 and 12 months, were statistically significant compared with the CG (P < 0.05 at both points). |
| Segal et al. (2001) | Physical functioning increased by 5.7 points and 2.2 points in the self-directed and supervised exercise groups, respectively (P =.04). Post hoc analysis showed a moderately large difference between the self-directed and control groups (9.8 points; P = 0.01) and a modest difference between the supervised and control groups (6.3 points; P = 0.09). In a secondary analysis of subjects stratified by therapy type; supervised exercise improved aerobic capacity (+3.5 mL/kg/min; P = 0.01) and reduced body weight (-4.8 kg; P <0.05) compared with normal care only in subjects not receiving chemotherapy. |

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| **Study** | **Reported Outcomes on Fatigue** |
| Dimeo et al. (1999) | During hospitalisation, patients in the training group showed no significant increment in fatigue was observed during hospitalisation (P = 0.28). However, patients in the control group showed significant increments in the fatigue and somatisation scores (P < 0.02 and P < 0.001, respectively) and a reduction in vigour (P = 0.05) during hospitalisation. |
| Headley, Ownby and John, (2004) | Functional Assessment of Chronic Illness Therapy–Fatigue Version IV (FACIT–F) subscale, reported a significant difference in the decline of scores with time (P = 0.0078), with the exercise group having less decline compared to the control. The exercise group also showed less decline over time on physical well-being (P = 0.0252). |
| Mock et al. (1997) | A self-paced, home-based walking exercise program can help manage symptoms and improve physical functioning during radiation therapy. The exercise group scored significantly higher than the normal care group on physical functioning (P = 0.003) and symptom intensity, particularly fatigue, anxiety, and difficulty sleeping. |
| Schwartz and Winters-Stone, (2009) | Did not directly report outcomes on fatigue as primary purpose of the study was to examine the effects of aerobic and resistance exercise on changes in bone mineral density (BMD) in women newly diagnosed with stage I–III breast cancer receiving chemotherapy. |
| Battaglini et al. (2008) | The relationship between the change in total caloric intake (TCI) and fatigue level (Piper Fatigue Scale) was analysed using a Spearman rho correlation. A negative correlation was found (rho (18) = -0.541; P = 0.014), indicating a significant relationship between TCI and fatigue. Patients with a greater change in TCI tended to have greater changes in fatigue level (fatigue level was lower during final assessment than at pre-surgery). |
| Courneya et al. (2007) | For the aerobic training (AT) versus usual care (UC) comparison, improvements in aerobic fitness were associated with improvements in fatigue (r = 0.25; P < 0.002). For the resistance training (RT) versus UC comparison, no significant improvements in improvements with fatigue were reported. |
| Mock et al. (2004) | The intention‐to‐treat analysis revealed no group differences in part because of a dilution of treatment effect as 39% of the usual care group exercised and 28% of the exercise group did not. When exercise participation was considered using the data analysis method of instrumental variables with principal stratification , a clinically important and statistically significant (P = 0.03) effect of exercise on pretest‐to‐posttest change in fatigue levels was demonstrated. |

**Meta-Analytical Research on Cancer and Fatigue (>2016)**

* Kessels, E., Husson, O. and Van der Feltz-Cornelis, C.M., 2018. The effect of exercise on cancer-related fatigue in cancer survivors: a systematic review and meta-analysis. Neuropsychiatric disease and treatment, 14, p.479. [Link](https://www.ncbi.nlm.nih.gov/pmc/articles/pmc5810532/)

**Summary Points**

Exercise improved cardio respiratory fitness with large effect size (Cohen’s d 0.605, 95% CI 0.235–0.975) with no significant difference between types of cancer. Aerobic exercise showed a significantly greater effect than a combination of aerobic and resistance exercises. Moderator and meta-regression analyses reported high adherence yielding superior improvements.

* Kelley, G.A. and Kelley, K.S., 2017. Exercise and cancer-related fatigue in adults: a systematic review of previous systematic reviews with meta-analyses. BMC cancer, 17(1), p.693. [Link](https://link.springer.com/article/10.1186/s12885-017-3687-5)

**Summary Points**

Please have a read at the implications for meta-analytical research and potential limitations within the research surrounding the lack of original RCT trials on exercise exercise and cardio respiratory fitness (CRF). This suggests the apparent need for further research given the lack of evidence regarding the benefits of exercise on cardiorespiratory fitness in adults. Kelley and Kelley concluded that ‘*exercise does not appear to increase CRF in adults and there are numerous other health benefits that can been derived from such in both cancer patients and survivors, it would appear plausible to suggest that exercise programs that take into consideration the unique needs of cancer patients be recommended*’.

* Nakano, J., Hashizume, K., Fukushima, T., Ueno, K., Matsuura, E., Ikio, Y., Ishii, S., Morishita, S., Tanaka, K. and Kusuba, Y., 2018. Effects of aerobic and resistance exercises on physical symptoms in cancer patients: a meta-analysis. Integrative cancer therapies, 17(4), pp.1048-1058. [Link](https://journals.sagepub.com/doi/pdf/10.1177/1534735418807555)

**Summary Points**

Ten RCT studies were included in this meta-analysis. Outcome measures in fatigue, pain, dyspnoea, and insomnia were significantly lower in the exercise intervention group than in the control group at postintervention in cancer patients. However, exercise intervention did not promote or suppress nausea/ vomiting, loss of appetite, constipation, and diarrhoea in cancer patients [Have a look at the forest plots if interested]. The effect of exercise type on each symptom was however not different. Exercise intervention was confirmed to improve fatigue, pain, and insomnia and might have reduced dyspnoea in cancer patients. However, the benefits of exercise on nausea/vomiting, loss of appetite, constipation, and diarrhoea were not shown in any exercise type. Further research is warranted to examine the effects of exercise interventions on physical symptoms in cancer patients.

**ACSM 2019 Guidelines**

* ACSM Guidelines for Exercise and Cancer Infographics [Link](https://www.acsm.org/blog-detail/acsm-certified-blog/2019/11/25/acsm-guidelines-exercise-cancer-download)
* ACSM Expert Panel: Cancer Treatment Plans Should Include Tailored Exercise Prescriptions [Link](https://www.acsm.org/read-research/newsroom/news-releases/news-detail/2019/10/16/expert-panel-cancer-treatment-plans-should-include-tailored-exercise-prescriptions)
* Exercise Guidelines for Cancer Survivors: Consensus Statement from International Multidisciplinary Roundtable [Link](https://northcountycancerfitness.org/wp-content/uploads/2020/01/exerciseguidelinescancer.2019.pdf)