

SUPPLEMENTARY DIGITAL MATERIAL 1

Supplementary Table I.—Characteristics of included studies (N.=45).

First author and year	Country	N.	Participant diagnosis	Stage of cancer treatment	Mean age (years)	Intervention and intensity	Control group	Cognition primary or secondary outcome/timing of follow-up assessment	Cognitive outcome measure	
									Self-rated	Performance-based
Cognitive training interventions (N.=15)										
Bellens 2020 ⁴⁴ ★	Belgium	46	Breast cancer survivors	Stages 0-III and N.=3 with metastatic disease	51.8	AquaSnap (Cambridge , MyCQ™) a cognitive training videogame for 3 months, 3 x week for 60 min each session.	Usual care	Primary/Follow up at 3 months and 6 months.	Beck Cognitive Insight Scale (BCIS), Cognitive Failure Questionnaire (CFQ)	My CQ: Trail making tests, Simple, Choice, Go No Go reaction time, Visual and Verbal Memory Recognition, N-back Coding
Bray 2017 ⁴⁵ ★	Australia	242	Adult cancer survivors with a primary malignancy (excluding central nervous system)	Completed three or more cycles of adjuvant chemotherapy in the previous 6 to 60 months	53	15-week, home-based web-based cognitive training - Insight	Usual care	Primary/ Follow up 6 months after intervention	FACT-Cog	Cogstate online test battery
Cherrier 2013 ⁴⁶ ★	USA	28	Cancer survivors	Primary treatment (varied) completed	58.9	7-week group	Waitlist control	Primary/ Follow up 1-2 weeks after intervention	FACT-Cog	Rey Auditory Verbal

			(various cancer types)	at least 6 months prior		cognitive rehabilitation					Learning Test (RAVLT), stroop test, digit symbol and span tests, Wechsler Adult Intelligence Scale (WAIS-III)
Damholdt 2016 ⁴⁷ ★	Denmark	157	Female breast cancer patients	Varied	54.8	30 training sessions over 6 weeks with telephone support for web-based cognitive training	Waitlist control	Primary/ Follow up 5 months after intervention	Cognitive Failures Questionnaire (CFQ)	Paced Auditory Serial Addition Test (PASAT), RAVLT.	
Dos Santos 2020 ²⁷ ★	France	167	Breast, digestive system, hematologic/urologic/gynecologic and other cancers.	During or after chemotherapy.	51 (median)	Computer-assisted Cognitive program (psychologist), or home cognitive self exercises = 9x3mths	Usual care and phone follow-up.	Primary/ Follow up 1 month (T1) and 2 months (T2) (self-report) and 3 months for performance tests	FACT-Cog	Grober and Buschke test for anterograde episodic memory, D2 test for attention and concentration, verbal fluency test, Trail Making	

										Tests, WAIS IV.
Ercoli 2015 ⁴⁸ ★	USA	48	Female breast cancer survivors stage 0-III, 21-75 yrs	Primary treatment (varied) completed 18 months - 5 years prior	53.8	5-week (2 hrs per week) group cognitive rehabilitation	Waitlist control	Primary/ Follow up 2 months after intervention	Patients Assessment of Own Functioning (PAOFI)	Brief Visual Memory Test-Revised, RAVLT, PASAT, Trail Making Tests
Kesler 2013 ⁴⁹ ★	USA	41	Female breast cancer survivors over 40 years	Chemotherapy completed at least 18 months prior	55.5	48 sessions over 12 weeks, cognitive training program (online)	Waitlist control	Primary/ Follow up at 12 weeks when intervention completed.	n/a	Wisconsin card sorting test (WCST), Delis-Kaplan Executive Function System (D-KEFS), Hopkins Verbal Learning Test Revised (HVLTR), WAIS, Behavioral Rating Inventory of Executive Function (BRIEF)
King and Green 2015 ⁵⁰ ★	Australia	29	Adult-onset cancer (not CNS)	Completed major treatments at least 6 months prior.	50.4	4 weekly 2 hr sessions of (ReCog) cognitive	Waitlist control	Primary/ Follow up 3 months after intervention.	FACT Cog Brief Assessment of Prospective Memory EORTC-QLQ-C30	Repeatable Battery for the Assessment

						rehabilitation program			(Cognitive function)	of Neuropsychological Status (RBANS) Trail making test
McDougall 2011 ³⁵ ★	USA	22	Community-based adult cancer survivors aged 65+	Post treatment	73.9	Cognitive Behavioral Model of Everyday Memory (CBMEM) training (8 sessions)	Health training group (8 sessions)	Primary/ Follow up 2 years after intervention	Metamemory in Adulthood Questionnaire (MIA). Memory Self-Efficacy Questionnaire (MSEQ)	HVLT-R, Brief Visuospatial Memory Test—Revised, Rivermead Everyday Behavioural Memory Test.
Meneses 2018 ⁵¹ ★	USA	60	Middle-aged and older breast cancer survivors	Six months post primary cancer treatment	54.6	Speed of processing training (10 hours within 6-8 weeks)	No contact. Usual care	Primary/ Follow up 6 months after intervention.	n/a	Useful field of view (UFOV®) test. NIH Toolbox Cognition Battery (NIHTB-CB)
Mihuta 2018 ⁵² ★	Australia	76	Adult-onset cancer excluding central nervous system cancer	Completed primary treatment at least 6 months prior	55	4 week web-based cognitive rehabilitation therapy program (eReCog)	Waitlist control	Primary/Follow up 3 months after intervention.	FACT-Cog Brief Assessment of Prospective Memory	Online test battery WebNeuro: Digit and Spatial Span (Wechsler Memory Scale WMS), California

			Aged 18+ years							Verbal Learning Test (CVLT), Trail Making, Stroop, Finger Tapping, and Rey Complex Figure Test.
Park 2017 ⁵³ ★	South Korea	54	Breast cancer stage I-III aged 20-60	Receiving chemotherapy	44.4	Promoting Cognitive Health Program (PCHP) 12 weeks face to face and 6 telephone health coaching sessions	Usual care	Primary/ Follow up 6 months after intervention.	FACT Cog	Digit span, K-COWAT Korean Controlled Oral Word Association Test; K-WAIS, SVLT Seoul Verbal Learning Test, Trail Making Tests
Peterson 2018 ³⁰ ★	USA	12	Breast, prostate Ovarian, lymphoma, lung multiple myeloma	Undergoing treatment for cancer	57.9	NeuroActive® cognitive training software. Three sessions per week for 12 weeks.	Flexibility group	Primary/Follow up at 12 weeks.		WMS (IV), General Cognitive Screener (BCOG), Trail Making Tests, WAIS-IV, Logical Memory I and II (LMI, LMII), COWAT,

										Block Design (BD)
Von Ah 2012 ²⁹ ★	USA	88	Post-menopausal breast cancer survivors over 40 years	Chemotherapy completed at least 12 months prior (currently disease free)	55.2	Advanced cognitive training: Memory training (N.=29) and speed of processing training (N.=30). 10 x 1-hr sessions over 6–8 weeks	Waitlist control	Primary/Follow up 2 months after intervention.	FACT-Cog, Squire Subjective Memory Questionnaire (SSMQ)	RAVLT, Rivermead Everyday Behavioural Memory Test, Useful Field of View (UFOV)
Wu 2018 ⁵⁴ ★	USA	60	Prostate cancer on androgen deprivation therapy (ADT)	Up to three months of ADT	66.6	BrainHQ online cognitive rehabilitation 1 h/day, 5 days/week for 8 weeks	Usual care	Primary/Follow up 8 weeks after intervention.	Patient Assessment of Own Functioning Inventory (PAOFI)	Online CNS Vital Signs test battery
Cognitive behavioral therapy interventions (N.=4)										
Ferguson 2012 ⁵⁵	USA	40	Female breast cancer survivors stage I-II	At least 18 months post-treatment (currently disease free)	50.3	Memory and Attention Adaption Training (MAAT). 4 x biweekly individual sessions.	Waitlist control	Primary/Follow up 2 months after baseline	Multiple Ability Self-Report Questionnaire (MASQ)	CVLT-II, D-KEFS

Ferguson 2016 ³¹ ★	USA	47	Breast cancer survivors stage I, II, or IIIA	Chemotherapy completed at least 6 months prior (currently disease free)	54.6	Videoconference-delivered CBT of 8 x weekly sessions.	Supportive therapy	Primary/ Follow up- 2 months after intervention	FACT-Cog	CVLT SDMT
Goedendorp 2014 ⁵⁶ ★	The Netherlands	112	Cancer survivors (various cancer types)	Primary treatment (varied) completed at least 12 months prior	45	Cognitive behavioural therapy (CBT) 5 – 26 individual sessions.	Waitlist control	Primary/ Follow up 6 months after baseline	Alertness Behaviour subscale	SDMT, reaction time task
May 2009 ³⁴	The Netherlands	147	Cancer survivors (various cancer types)	Primary treatment (varied) completed at least 3 months prior	48.8	Physical training with CBT – 12 weeks x 2 hr sessions.	Physical training (no CBT)	Secondary/ Follow up at 9 months	EORTC QLQ-C30 (Cognitive function)	n/a
First author and year	Country	N.	Participant diagnosis	Stage of cancer treatment	Mean age (years)	Intervention	Control group	Cognition primary or secondary outcome/timing of assessment	Cognitive outcome measure	
									Self-rated	Performance-based
Physical activity interventions (N.=16)										
Campbell 2018 ⁵⁸ ★	Canada	19	Breast cancer aged 40 to 65 years, post-menopausal, stages I to IIIA	Following chemotherapy treatment	52.4	24-week aerobic exercise: 150 min/wk aerobic exercise with two 45mins supervised	Usual care	Primary/Follow up 24 weeks after baseline on completion of intervention.	FACT-Cog	HVLT-R, Trail making Tests, COWAT, Stroop test (with fMRI)

						sessions per week. x 2 30-min unsupervised home sessions.					
Carayol 2019 ⁵⁹	France	143	Early breast cancer	During chemotherapy and radiotherapy following surgery	51.6	3 weekly moderate-intensity mixed aerobic and resistance exercise + 9 dietetic consultations for 26 weeks.	Usual care	Primary/Follow up 12 months after intervention.	EORTC QLQ-C30 (Cognitive function)	Test of Attentional Performance	
Derry 2015 ⁶⁰ ★	USA	200	Female stage 0-III breast cancer survivors	Primary treatment (varied) completed 2 months - 3 years prior	51.6	Yoga intervention 12 weeks 2 x week.	Waitlist control	Primary/ Follow up 3 months after intervention	Breast Cancer Prevention Trial (BCPT) Symptom Checklist	n/a	
Gokal 2018 ⁶²	UK	50	Breast cancer stage I-III aged 18-75 years.	Waiting to begin adjuvant or neo-adjuvant chemotherapy	52.1	12 weeks of home-based, self-managed, moderate intensity walking of 30 mins x 5 times a week.	Usual care	Primary/ Follow up after the completion of six cycles of chemotherapy.	Cognitive Failures Questionnaire (CFQ)	Stroop test, forwards/back digit span and WAIS Block Design, Sustained Attention to Response Task (SART).	

Hartman 2018 ⁶³ ★	USA	87	Breast cancer	Mean 2.5 years post-surgery	57	12-week physical activity individual goals aiming for 150 mins of moderate or vigorous physical activity per week.	Usual care	Primary/ Follow up 12 weeks after intervention.	Patient-Reported Outcomes Measurement Information System (PROMIS)	NIH Cognitive Toolbox
Larkey 2016 ³³ ★	USA	101	Breast cancer survivors stage 0-III, 40-75 years	Primary treatment (varied) completed 6 months - 5 years prior	59	Qigong/Tha i Chi Easy- 12 weekly sessions.	Sham Qigong	Primary/ Follow up 12 weeks after intervention	FACT-Cog	WAIS-III (digit span and letter-number sequencing)
Miki 2014 ⁶⁶	Japan	78	Breast or prostate cancer patients over 65 years	Varied	74.2	Speed-feedback therapy with bicycle ergometer 1 x week for 4 weeks.	Usual care	Primary/ Follow up 4 weeks after intervention.	n/a	Frontal Assessment Battery (FAB)
Myers 2019 ³⁶ ★	USA	50	Breast cancer stage I-III	2 months to 8 years post completion of chemotherapy and radiation therapy.	53.7	Qigong – 8 weekly 60-min Sessions + 15 min at home twice a day.	Gentle exercise (N.=20) and survivorship support (N.=11)	Primary/Follow up 4 weeks after intervention.	FACT-Cog	RAVLT 1-5 total, F-A-S test of verbal fluency, Trail making test.

Northey 2019 ⁶⁸ ★	Australia	17	Breast cancer survivors stages I-III	Less than 24 months post diagnosis	62.9	High-intensity interval training (n = 6); moderate-intensity continuous training (n = 5); on cycle ergometer 3 x week for 12 weeks.	Waitlist control	Primary/ Follow up 12 weeks after intervention.	n/a	Cogstate online test battery
Oh 2012 ⁶⁹ ★	Australia	81	Medical oncology patients of various cancer-types	Varied stages of chemotherapy	62	Medical Qigong – group 10-week program of 2 x 90 mins per week.	Usual care	Primary/ Follow up 10 weeks after intervention.	EORTCQoL C30 (Cognitive function), FACT-Cog	n/a
Pasyar 2019 ⁷⁰	Iran	40	Breast cancer with lymphoedema	One year post surgery	51.7	Yoga - 8 weeks x 2 per week group setting and x 1 week home practice.	Usual care	Secondary/ Follow up 8 weeks after intervention.	EORTCQoL C30 (Cognitive function)	n/a
Peterson 2018 ³⁰ ★	USA	12	Breast, throat/tongue, anaplastic oligodendroglioma,	Undergoing treatment for cancer	57.9	Motion Fitness Brain Bike® recumbent	Flexibility group	Primary/Follow up at 12 weeks.		WMS (IV), General Cognitive Screener (BCOG), Trail Making Tests, WAIS-IV, Logical Memory I and II

			colon cancers			cycle ergometer. Three sessions per week for 12 weeks.				(LMI, LMII), COWAT, Block Design (BD)
Rogers 2009 ⁷³ ★	USA	41	Breast cancer stage I, II, or IIIA	On estrogen receptor modulators or aromatase inhibitors	53	12-wk physical activity behavior change intervention : 6 weekly discussion groups, 12 individual supervised exercise sessions + home based exercise.	Usual care	Secondary/ Follow up 3 months after intervention.	FACT-Cog Self-rated mental acuity, concentration, memory, verbal fluency.	n/a
Schmidt 2014 ³⁷	Germany	101	Breast cancer	Starting chemotherapy	52.7	Supervised, group-based, resistance exercise 2 x week over 12 weeks	12 week relaxation group	Primary/Follow up 1 week after intervention.	EORTCQoL C30 (cognitive function)	Trail making tests
Steindorf 2014 ³⁸	Germany	160	Breast cancer stage 0–III	Undergoing chemotherapy	55.8	Group-based 12-week progressive	12 week relaxation group	Primary/Follow up 1 week after intervention.	Fatigue Assessment Questionnaire (cognitive fatigue)	Trail making tests

						resistance training x 2 week			EORTCQoL C30 (Cognitive)	
Vadiraja 2009 ³⁹	India	88	Breast cancer patients stage II and III (newly diagnosed)	Currently undergoing radiotherapy	47.6	Integrated yoga program – x 6 weeks daily sessions of 60 min three supervised.	Supportive therapy	Secondary/ Follow up 6 weeks after radiotherapy	EORTCQoL C30 (Cognitive function)	n/a
Supportive therapy interventions (N.=10)										
Bjorneklett 2013 ⁵⁷ ★	Sweden	382	Breast cancer patients (newly diagnosed)	Varied	57.8	Support group intervention- one week residential + 4 days of follow-up after 2 months.	Usual care	Secondary/ Follow up 2 months after intervention	EORTCQoL C30 (Cognitive function)	n/a
Ding 2020 ⁶¹	China	74	Breast cancer, stage I-III.	Completion of at least 6 cycles of chemotherapy	50.8	CALM: a brief, manualised, individual psychotherapy program. 3 to 6 sessions each lasting 30 minutes.	Usual care	Primary/ Follow up after intervention completed.	FACT-Cog	Prospective and Retrospective Memory Questionnaire (PRMQ).
Freeman 2015 ²⁸	USA	118	Breast cancer survivors	Primary treatment	55.4	Imagery-based	Waitlist control	Secondary/ Follow up 3 months after intervention	FACT-Cog	n/a

★				(varied) completed at least 6 weeks prior		behavioural intervention 5 x week for 4-hrs or telemedicine delivery				
Hartman 2019 ⁶⁴	USA	333	Overweight and obese postmenopausal breast cancer survivors	Stage IA- IIC breast cancer within 10 years of enrollment , completed planned surgery, and active treatments.		Telephone- based weight loss intervention delivered by trained lifestyle coaches through 12 phone calls over 6- months.	Usual care + US Dietary Guideli nes for Americ ans, (2010).	Primary? Follow up 6 months after intervention.	n/a	Online NeuroTrax test battery
Johns 2016 ³² ★	USA	71	Breast and colorectal cancer survivors stage 0-III	Chemother apy and/or radiothera py completed 3 months - 5 years prior	56.7	Mindfulness -based stress reduction 8 x weekly 2-hr classes	Educati on and support	Primary/ Follow up 6 months after intervention	Attentional Function Index (AFI)	Stroop test
Johnston 2011 ⁶⁵	USA	13	Female breast cancer survivors	Primary treatment completed (currently disease- free)	54	Patient education integrated with acupuncture - 4 x week education +	Usual care	Secondary/ Follow up at 10 weeks when intervention completed	FACT-Cog	n/a

						8 x 50-minute acupuncture weekly.				
Milbury 2013 ⁶⁷ ★	USA	47	Female breast cancer survivors stage I-III	Chemotherapy received 6-60 months prior	53	Tibetan sound meditation – 2 x week for 6 weeks.	Usual care	Primary/ Follow up one month after intervention	FACT-Cog	Digit span test, SDMT, COWAT, RAVLT.
Rahmani 2014 ⁷¹ ★	Iran	36	Breast cancer stages I-III	More than one month post diagnosis	44	Mindfulness based stress reduction (N.=12) Metacognition (N.=12) x 8 sessions	Usual care	Secondary/ Follow up 2 months after intervention.	EORTCQoL C30 (Cognitive function)	n/a
Reich 2017 ⁷²	USA	322	Breast cancer Stages 0-III	Post treatment	56.6	Mindfulness based stress reduction – 6 weeks and 2 hrs per week	Usual care – not undertaking yoga or meditation.	Primary/Follow up 12 weeks after intervention.	Everyday Cognition (ECog) scale	n/a
Rottmann 2015 ⁷⁴	Denmark	507	Breast, prostate, colon, or rectal cancer patients diagnosed within 2 years prior	Primary treatment (varied) completed	61	Residential x 6 days psychosocial rehabilitation course	Usual care	Secondary/ Follow up 6 months after intervention.	EORTCQoL C30 (Cognitive function)	n/a
Tong 2018 ⁷⁵ ★	China	80	Breast cancer	Post treatment	42	Two 4-week courses of acupuncture with a 3-day rest. Every	Usual care	Primary/ Follow up when intervention completed	FACT-Cog,	AVLT, Verbal fluency test, symbol digit modality

					week, patients were treated once a day for 5 days.				test, clock drawing test, TMT-B.
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★ Studies reporting a significant difference between intervention and control groups ($P \leq 0.05$).

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