

SUPPLEMENTARY MATERIAL

From Precision Metapharmacology to Patient Empowerment: Delivery of Self-care Practices for Epilepsy, Pain, Depression and Cancer using Digital Health Technologies

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Table S1. Examples of collaborations between pharmaceutical/biotech companies and digital health companies. Some collaborations were discontinued due to business-related reasons.

Pharma company	Digital company	Chronic disorder	References to pharma+digital collaborations
Novartis	Pear Therapeutics	Schizophrenia, Multiple sclerosis	https://www.novartis.com/news/media-releases/novartis-and-pear-therapeutics-develop-digital-therapeutics-patients-schizophrenia-and-multiple-sclerosis
Novartis	Healint	Migraine	https://www.mobihealthnews.com/content/novartis-healint-study-uses-self-tracking-app-examine-migraine-mental-health-connection
Otsuka Pharmaceuticals	Click Therapeutics	Major Depressive Disorder	https://www.otsuka-us.com/discover/otsuka-and-click-therapeutics-collaborate
Otsuka Pharmaceuticals	Proteus Digital Health	Schizophrenia, Bipolar disorder, Depression	https://www.proteus.com/press-releases/otsuka-and-proteus-digital-health-announce-expanded-collaboration-agreement-to-advance-digital-medicines-for-mental-health/
Sanofi	Happify	Multiple sclerosis, Depression	https://www.sanofi.com/en/media-room/articles/2019/happify-collaboration
UCB Pharma	DEARhealth	Epilepsy	https://www.prnewswire.com/news-releases/dearhealth-announces-collaboration-with-ucb-to-improve-care-delivery-through-new-technology-for-patients-living-with-epilepsy-300879032.html
Pfizer	Popit	Rheumatoid arthritis	https://www.mobihealthnews.com/content/europe/pfizer-working-finnish-tech-startup-improve-patient-adherence
Novo Nordisk	Glooko	Diabetes	https://www.novonordisk-us.com/whoweare/digital-health/novo-nordisk-in-digital-health/digital-health-resources.html
Bayer	Upside Health	Chronic pain	https://www.fiercebiotech.com/medtech/bayer-to-back-11-startups-various-digital-health-enterprises
Ironwood Pharmaceutical	Pear Therapeutics	Gastrointestinal disorders	https://peartherapeutics.com/pear-therapeutics-announces-agreement-with-ironwood-pharmaceuticals-to-evaluate-prescription-digital-therapeutics-for-patients-with-gi-indications/
Novartis	Numinous Games	Cancer	https://www.pharma.us.novartis.com/news/media-releases/novartis-launches-galaxies-hope-app-digital-experience-neuroendocrine-tumor-net
Amgen	Kaiku Health	Cancer	https://kaikuhealth.com/press/kaiku-health-and-amgen-roll-out-digital-patient-support-for-multiple-myeloma/
Novartis	Propeller Health	Asthma	https://www.mobihealthnews.com/news/novartis-propeller-health-co-package-new-asthma-treatment
Boehringer Ingelheim	Click Therapeutics	Schizophrenia	https://www.mobihealthnews.com/news/boehringer-ingelheim-click-therapeutics-ink-500m-digital-therapeutics-development

Table S2. Examples of mobile and web-based apps delivering non-pharmacological interventions.

NON-PHARMACOLOGICAL MODALITY	NAME OF APP	TYPE OF DIGITAL INTERVENTION: BRIEF DESCRIPTION OF USE	RESEARCH REFERENCE
Breathing exercises (breathwork)	<i>Breathe-easy</i>	Mobile app: asthma in pregnancy.	[2]
	<i>iCanCope with Pain</i>	Mobile app: chronic pain in adolescents.	[4]
	<i>iEXHALE</i>	Mobile app: symptoms in lung cancer survivors.	[6]
	<i>PEP Hero: Heritage</i>	Digital game: adjunct to PEP therapy in children with CF.	[7]
	<i>NeckProtector</i>	Mobile app: neck pain in smartphone users.	[8]
Mindfulness & Meditation	<i>Calm</i>	Mobile app: stress in cancer patients, cancer survivors and college students.	[9, 10]
	<i>Craving to Quit (C2Q)</i>	Mobile app: smoking cessation.	[11, 12]
	<i>EviBaS</i>	Web-based + mobile app: psychosis in schizophrenia.	[13]
	<i>Headspace</i>	Mobile app: stress in women, med students, workplace, college students and breast cancer patients.	[15-20]
Forgiveness	<i>REACH Forgiveness</i>	Web-based: college students- victims of interpersonal harm.	[25]
	<i>Mood Map</i>	Mobile app: emotional self-regulation in workplace.	[26]
Gratitude	<i>BMT Roadmap</i>	Mobile app: family caregivers of patients undergoing HCT.	[27]
	<i>GET.ON Gratitude</i>	Web-based + mobile app: transdiagnostic RNT.	[28]
	<i>ProFibro</i>	Mobile app: fibromyalgia patients.	[30]
Social support	<i>Daybreak</i>	Mobile app + web-accessible: individuals with alcohol dependency.	[32]
	<i>InterWalk</i>	Mobile app: patients with T2D.	[35]
	<i>Superpower Glass</i>	Mobile app + Google smart glasses: social acuity in children with ASD.	[40]
	<i>Empower Stars!</i>	Mobile video game app: children with cancer.	[45]
	<i>EndeavorRx (AKL-T01)</i>	Video game: children with ADHD.	[46, 47]
	<i>mySinusitisCoach</i>	Mobile app: symptoms and disease control in CR patients.	[50]
	<i>reSET</i>	Mobile app: substance use disorders.	[53, 54]
	<i>TOBY Playpad</i>	Mobile (iPad) app: educational intervention for children with ASD.	[57, 58]
Sleep	<i>CBT-i Coach</i>	Mobile app: chronic insomnia in military vets.	[60, 61]
	<i>MORE Energy</i>	Mobile app: fatigue in airline pilots.	[62]
	<i>Sleepio</i>	Web-based + mobile app: cognitive functioning in patients with insomnia disorder.	[64, 65]
	<i>SleepMapper</i>	Mobile app + web-accessible: patients initiating PAP therapy for OSA.	[66]

Music	<i>Memory Tracks</i>	Mobile app: symptom reduction in dementia patients.	[67]
	<i>Music eScape</i>	Mobile app: emotion regulation in young people.	[69]
	<i>MusicGlove</i>	Video game: music-based rehab for stroke patients.	[70, 71]
	<i>Unwind</i>	Mobile app: patients in ED with acute pain.	[73]
Physical activity	<i>Bingocize</i>	Game-centered mobile app: physical and cognitive performance in older adults.	[76]
	<i>eCoFit</i>	Mobile app: patients at risk for or diagnosed with T2D.	[77, 78]
	<i>Jintronix</i>	Mobile video game: rehab for stroke patients in a sub-acute or chronic stage.	[71, 82]
	<i>ReHand</i>	Tablet app: patients who have undergone surgical carpal tunnel release.	[84]
	<i>Untire</i>	Mobile app: cancer-related fatigue.	[87, 88]
Yoga	<i>LoveYourBrain</i>	Web-accessible program: manualized intervention for TBI patients.	[89-91]
	<i>Qigong</i>	Mobile app: use and learn healing practice of qigong in adults.	[93]
Nutrition	<i>FoodFlip</i>	Mobile app: nutrition info delivery in consumers.	[98]
	<i>MyNutriCart</i>	Mobile app: selecting healthier foods in overweight and obese adults.	[100]
	<i>Noom Health</i>	Mobile app: self-monitoring and coach-based intervention for adults with binge eating.	[101, 102]
	<i>OncoFood</i>	Mobile app: dietary behavior of oncology patients.	[104]
	<i>SaltSwitch</i>	Mobile app: supports lower-salt food purchases for CVD patients.	[105]

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Table S3. Opportunities to incorporate diverse self-care modalities into personalized digital interventions for people with epilepsy, pain, cancer and depression. These modalities were selected based on data presented in Table 1 (main text).

Non-pharmacological modality	Epilepsy	Pain	Cancer	Depression	Immunity
Breathing exercises	+	+	+	+	+
Mindfulness/ meditation ¹	+	+	+	+	
Physical activity	+	+	+	+	+
Yoga	+	+	+	+	
Music	+	+	+	+	+
Adequate sleep	+	+	+	+	+
Forgiveness		+		+	
Gratitude ²	+	+	+	+	

Notes:

¹ Based on a systematic review and meta-analysis, mindfulness-based interventions can lower anxiety, depression, fatigue and stress among adult cancer patients and survivors (Xunlin *et al*, (2020) *Support Care Cancer*, 28: 1563-78).

² Since gratitude practice can improve depression, anxiety, cognitive functions and quality sleep (Table 1), this modality can be helpful for prevention and treatment of co-morbidities in people with epilepsy, chronic pain and cancer.