Multimedia Appendix 3: The characteristics of selected studies

Author /location	Study design	Target behavior change	Intervention tools and behavior change mechanisms	Control tool	Primary measurement	Retention rate	Results
Mental health or Alcohol addiction							
Ainsworth, J[31] 2013 UK	RCT 19 days N=24 Age:18-50yr Participants with schizophrenia	Improving diagnostic real-time assessment score in patients with Serious mental illness	Smartphone app 1.real-time assessment	Text messages	1.Number of data points 2.Time took to complete assessment 3.Patients' quantitative feedback	100% (12/12) in both groups	1.Significant greater number of data points in intervention group 2. Significantly less time to complete the assessment in app group 3. No significant differences in participants' quantitative feedback questionnaire scores about the acceptability and feasibility between the two delivery modalities
Watts, S[32] 2013 Australia	RCT 3 months N=35 Age:over 18yr with major depression	Developing skills in coping sadness in patients with depression	App- based The Sadness Program 1.cognitive behavioral therapy 2.self-report	Computer-based The Sadness Program	PHQ-9	1. 60% (9/15) in intervention group 2. 46.7% (14/30) in control group	Both the Mobile and Computer Groups were associated with statistically significantly benefits in the PHQ-9 score at post-test. At 3 months follow up, the reduction seen for both groups remained significant

Multimedia Appendix 3: The characteristics of selected studies

Ly, K. H[33] 2014 Sweden	RCT 8weeks and 6 months follow up N=81 Mean age 36yr diagnosed with major depressive disorder	Increasing daily activation in patients with depression	Behavioral activation app 1.based on behavioral activation therapy	Mindfulness app	PHQ-9 and BDI-II	1. 77.5% (31/40) in intervention group 2. 70.7% (29/41) in control group	1. The two interventions did not differ significantly from one another 2. For participants with higher severity of depression, the treatment based on intervention app was superior 3. For participants with lower initial severity, the treatment based on control app worked significantly better
Villani, D[34] 2013 Italy	RCT 4weeks and 3moths follow-up N=30 Female oncology nurses	Improving coping of stress related anxiety	Mobile app- The stress inoculation training 1.cognitive behavior therapy 2.self-help	Neutral video through mobile phones	1.Anxiety level 2. Work components 3. Perceived stress 4. Coping skills	Not mentioned	1.Results showed a significant decrease in anxiety among intervention group 2. A significant improvement in affective change in terms of anxiety trait reduction and coping skills acquisition

Gustafson, D. H[27] 2014 United States	RCT 8 months intervention, 4 months follow-up N= 349 adults meet the criteria for DSM-IV alcohol dependence	Reducing alcohol addiction	ACHESS app + usual care 1.based on self-determination theory 2.peer support groups, communication addiction experts 3.self-monitoring 4.reminders	Usual care	Risky drinking days	1. 77.7% (132/170) in intervention group 2. 77.6% (139/179) in control group	Intervention group had significantly fewer risky drinking days than patients in the control group
Gajecki, M[28] 2014 Sweden	3 arms RCT 7 weeks N=1932 Uni students in risky alcohol consumption Mean age: 24.7yr	Reducing problematic alcohol intake	Intervention1.Smartphone App: (Promillekoll) 1.based on theory of planned behavior 2.self-monitoring 3.feedback provide Intervention2. web-based app (PartyPlanner)	Not receive any intervention or feedback on risky drinking	1.Calculating 2. Displaying an individual's eBAC	1. App intervention group: 73.6% (473/643) 2. Web-based intervention group: 60.9% (388/640) 3. Control group: 66.4% (500/649)	1.The apps studied using eBAC calculation did not seem to affect alcohol consumption among university students 2. One app (Promillekoll) may have led to a negative effect among men
Gonzalez. M[35] 2015 United States	RCT 6 weeks N=54 Age:18- 45yr with an alcohol use disorder	Decreasing alcohol use disorders	APP: LBMI-A 1.based on Motivational enhancement therapy	Internet-based motivational intervention plus bibliotherapy	1.Percent days abstinent (PDA) 2.Percent heavy drinking days (PHDD) 3.Drinks per week (DPW)	1.100% (28/28) in intervention group 2. 76.9% (20/26) in control group.	1.Multilevel models revealed that the LBMI-A resulted in a significant increase in PDA over the course of the study 2.Both interventions resulted in significant decreases in PHDD and DPW

Physical activity, weight control and diet control							
Rabbi, M[36] 2015 United States	RCT 3weeks N=17 Age:18-49yr	Increasing physical activity and adopting healthy diet	App: MyBehavior 1.based on contemporary behavioral science theories: (learning theory, social cognitive theory and the Fogg Behavior Model) 2.personalized feedback 3. Self-tracking	Non-personalized, generic suggestions created by professionals	1.Food (calories in per meal consumed) 2.Activity (walking, running or exercise durations per day)	100% (9/9) in both groups	1.MyBehavior users walked significantly more than the control group 2. Users rated app's personalized suggestions more positively than the non-personalized, generic suggestions created by professionals
Laing, B. Y[29] 2014 United States	RCT 6months N=212 Primary care patients with BMI >=25 kg/m2 Interested in weight loss	Increasing calorie counts	MyFitnessPal app +usual care 1.based on social cognitive theory, 2.self-monitoring, 3.self-reminder 4.goal setting, 5.feedback. 6.social networking	Usual care	Weight loss	1. 74% (78 /105) in intervention group 2. 79% (85/107) in control group	Weight change was minimal, with no difference between groups.
Lee, W[26] 2010 Korea	Case-control 6weeks N=36 Mean age:29.5 yr All voluntary participants from the obese clinic at the fitness center in Soul	1.Increasing nutrition knowledge 2.Better Weight control	Mobile-phone based app (SmartDiet) 1.personalized nutrition information 2.self-recording 3.goal setting	Normal care	1.Fat mass 2.Weight 3.BMI	Not mentioned	Fat mass, Weight, Fat mass and BMI decreased significantly in the intervention group, but no significant changes in the control group;

Carter C[43] 2013 UK	3 arms RCT 6months N=128 overweight volunteers Age: 18-65yr, BMI>27	Increasing physical activity and adopting healthy diet	Smartphone app + text-message feedback My Meal Mate (MMM) 1.evidence-based behavioral approach 2.goal setting, 3.self-monitoring 4.feedback tailored weekly text messages	Control 1：Paper food diary Control 2：Online food diary website	Weight BMI Body fat	1. 93% (40/43) in app group 2. 55% (19/42) in the website group	1. Adherence was statistically significantly higher in the smartphone group with a mean of 92 days (SD 67) of dietary recording compared with 35 days (SD 44) in the website group and 29 days (SD 39) in the diary group. 2.Mean weight change, BMI change and body fat change were highest in smartphone group
Medication management							
Perera, A. I[37] 2014 New Zealand	RCT 3months N=28 Adults on ART for at least 6 months	Improving adherence to antiretroviral therapy (ART).	Augmented version of the smartphone app 1.real-time information provided 2. 24 hour timer reminding 3.feed-back	Standard version of the smartphone app 1.Only 24 hour timer reminding	1.Self-reported adherence to ART 2.Viral load 3. Pharmacy dispensing	Not mentioned	1.Intervention group showed a significantly higher level of self-reported adherence to ART at 3 months and decreased viral load as compared to individuals using the standard version 2. No significant differences of pharmacy dispensing between two groups
Mira, J.J[38] 2014 Spain	RCT 3months N=99 Age:65-90yr Patients taking multiple medications	Reducing non-adherence and medication errors	Pillbox App (ALICE) 1.medication self-management 2.personlized advice 3.self-monitoring	Oral and written information on the safe use of their medications	1.Morisky Medication Adherence Scale (MMAS-4) 2. Safety medication use	100% (48/48,51/51) in both groups	1. Patients with no experience with information and communication technologies reported significantly better adherence and fewer missed doses 2. ALICE only helped to significantly reduce medication errors in patients with an initially higher rate of errors

Hammonds, T[39] 2015 United States	RCT 30days N=57 College students Age:18-30yr Prescribed an antidepressant	Increasing adherence to antidepressant medications	A medication reminder app + a manual pill count 1.self-reminder 2.self-monitoring	A manual pill count	1.Medication adherence 2. The Beck Depression Inventory (BDI) scores	1. 67% (20/30) in the treatment group 2. 74 % (20/27) participants in the control group	1. There was a strong trend suggesting that the use of a medication reminder app was beneficial for adherence to antidepressant medication regimens. 2. The magnitude of change in depression symptoms was not greater in the experimental group
Lifestyle improvement							
Van Drongelen, A[30] 2014 Netherlands	RCT 6months N= 502 airline pilots	1.Adopting health-related behavior 2.Reducing sleep problems and fatigue	App (MORE Energy) 1.personal advice 2.general information 3.reminders	Website with standard information about fatigue.	1.Fatigue 2.Sleep quality health-related behavior and health	1.Intervention group:79.3% (199/251) 2.Control group:76% (191/251)	Intervention group showed a significant improvement on fatigue, sleep quality, strenuous physical activity and snacking behavior
Van het Reve, E[40] 2014 Switzerland	3 arms RCT 12 weeks N=48 older than 65yr	1.Improving gait quality 2.Improving physical performance	Social: Tablet app (ActiveLifestyle) social group added Individual: tablet app(ActiveLifestyle) 1. provide instruction on how to perform behavior 2.self- monitors 3.goal setting	A training plan on paper sheets	1.Gait performance under single and dual task conditions 2.Dual task costs of walking 3.Falls efficacy 4.Physical performance (SPPB scores) 5.The Falls Efficacy Scale International (FES-I)	1. 78.6% (11/14) in the social group 2. 84.6% (11/13) in the individual group. 3. 58.8% (10/17) in control group	1. The individual group was significantly faster in gait speed than the control group 2. The individual group was faster than the social group though not statistically significant. 3. Social or individual motivation strategies were equally effective

Diabetes management							
Kirwan, M[41] 2013 Australia	RCT 6-month intervention, 3 month follow-up N=72 Mean age: 35.20yr Mean year of diagnosed with type 1 diabetes: 18.94 years	Improving glycemic control	Smartphone app (Glucose Buddy) + text-message feedback 1.self-monitoring 2.self-management 3.weekly personalized text-message feedback	Usual care	1.HbA1c level 2.Blood test	1.Intervention group: 69.4% (25/36) 2.Control group: 77.8% (28/36)	The intervention group significantly improved glycemic control (HbA1c) from baseline to 9-month follow-up, compared to the control group.
Sun protection							
Buller, D.B[11] 2015 United States	RCT 3weeks intervention, 3weeks and 8weeks follow-up N=202 adults	1.Increasing use of sun protection 2.Reducing time spent outdoors in the midday sun	Smartphone app (Solar Cell) 1.delivering advice 2.feedback 3.provide information 4.self-efficacy	Not receive any app	1. Percentage of days with the use of sun protection 2.Time spent outdoors in the midday sun 3.Number of sunburns	1. 92.7% (89/96) in intervention group 2. 98.1% (104/106) in control group	Intervention group used wide-brimmed hats more at 7 weeks than control participants
Hypertension management							
Moore, J. O[42] 2014 United States	RCT 12 weeks N=44 Adults with uncontrolled essential hypertension	Improving hypertension management	CollaboRhythm app on a tablet 1.self-track 2.personlized feedback 3.self-monitoring	Traditional care	1.Medication adherence 2.Blood pressure (BP)	1.96.5%(22/23) in intervention group 2.95.2%(20/21) in control group	1. Intervention subjects achieved significant decrease in systolic BP at 12 weeks than control subjects. 2.A greater percentage of intervention subjects achieved goal BP ≤ 130/80 mm Hg 3.100% of them achieved goal

							BP ≤ 140/90 mmHg.
Cardiac rehabilitation							
Varnfield, M[44] 2014 Australia	RCT 6-week intervention and 6-month self-maintenance period. N=120 Post-myocardial infarction patients	Improving cardiac rehabilitation use in post-myocardial infarction patients	A smartphone-based home service delivery (apps+sms+telephone consultation) 1.self-monitoring 2.uploading app data to web portal	A traditional, center based program	1. 6-min walking test distance 2.Depression scores	1.Intervention group: 76.7%(46/60) 2. Control group: 43.3%(26/60)	1. Intervention group had significantly higher uptake adherence and completion rates than control group. 2.Both groups showed significant improvements in 6-minute walk test from baseline to 6 weeks
Smoking cessation							
Bricker, J. B[45] 2014 United States	RCT 2months N=196 At least five cigarettes daily for at least past 12 months	Reducing heavy smoking	An innovative app (SmartQuit) 1.acceptance and commitment therapy 2.self-monitoring 3.goal setting 4.self-tracking 5.social support 6.motivated	An app following US Clinical Practice Guidelines (QuitGuide)	1.Participant satisfaction, utilization of the app 2.Smoking cessation outcomes	1.Intervention group: 81.6% (80/98) 2. Control group: 85.7% (84/98)	1. The overall quit rates were 13% in SmartQuit vs. 8% in QuitGuide 2. Promising quit rates compared to QuitGuide app

Family planning							
Gilliam ML[9] 2014 United States	RCT 8months N=60 women under 30yr old, median age of 22.5yr	Increasing women's interests in up taking long-acting reversible contraceptive (LARC)	App 1. based on the theory of planned behavior 2.general information 3. instruction on how to use	Standard care	1.Expressed interest in discussing a LARC method during the clinic visit. 2.Contraceptive knowledge and LARC selection	1.Intervention group: 90.3% (28/31) 2.Control group:77.4% (24/31)	App users had a significantly higher knowledge of contraceptive effectiveness and increased interest in the implant after the intervention
Pain management							
Irvine,A B[10] 2015 United States	RCT 8weeks 4months follow-up N=597 adults suffered low back pain in previous 3 months	1.Improving self-care for on-going pain 2.Adopting behaviors to reduce the chance of reoccurrence	Group 1: FitBack app 1. based on Theory of Planned Behavior 2. self-management intervention 3. self-monitoring 4. tailored information Group 2: Alternative Website Control	Usual care	Change in responses to the Modified Oswestry Low Back Pain Disability Questionnaire	1.App intervention group: 92.0% (183/199) 2.Alternative intervention group:97.5% (194/199) 3.Control group: 97.5% (194/199)	Users of the FitBack program showed significant improvement compared to the control group in every comparison of the critical physical, behavioral, and worksite outcome measures

ADHD: Attention Deficit Hyperactivity Disorder
BG: blood glucose
BP: blood press
BDI: Beck's Depression Inventory
BDI-II: Beck Depression Inventory-II
Depression Scale -PHQ-9: 9-item Patient Health Questionnaire
eBAC: individual's estimated blood alcohol concentration
EQ5D-3L: EuroQol Five Dimensional [EQ5D-3L] questionnaire

EBI: Eating Behaviors Inventory (EBI)
SPPB: Short Physical Performance Battery
SMS: Short Message Service
SSB: sugar sweetened beverages
SBP: Systolic blood pressure
TBP: theory-based podcast
PA: physical activity