Appendix 3. Study Characteristics of Individual Studies (Adapted from Hoffmann et al. [77]).

Author (Year); Country	Recipient	Why/ Study Short Name	Design/ Setting	Outcome	What (Materials/Procedures/ Dietary Changes/ Theory/Previous Health Wearable Use)	Who Provided/ How/ Where	Dose/Tailoring/ Intervention Modification	Fidelity Strategies/ Extent	Findings
Lyons et al.[44] (2017); USA	Adults at-risk for chronic disease with chronic overweight/obesity; n = 54	PA often decreases, and sedentary behavior increases in aging adults leading to increased risk of negative health outcomes. Aimed to examine the feasibility/acceptability of non-Fitbit wearables combined with telephone counseling among aging adults.	RCT; free-living	BW (kg)	Intervention participants underwent a multicomponent health wearable intervention and wore a Jawbone Up24 + tablet + 15-20-minute telephone PA counseling (provided weekly by PI and a postdoctoral fellow). Participants were encouraged to comment and like others′ activity, and there was an initial goal-setting session (steps/day, PA [short- and long-term] and sedentary behavior [longest bout length]) Participants excluded if used a health wearable at time of intervention Theory-driven (not specified) No dietary changes Control group; waitlist, received intervention after intervention group participants	PI, postdoctoral fellow, predoctoral fellow provided the intervention via telephone	12 weeks Tailoring: reevaluation of weekly step goals and action planning for the next week via phone counseling). Goals were negotiated between the counselors and participants No intervention modification throughout the trial	Fidelity procedures/extent not described	The intervention participants lost significantly more BW after 12 weeks compared to control
Hartman et al.[45]	Adults at-risk for	Reducing excess weight and	RCT; free-	BW (kg)	Intervention participants underwent a	Phone calls delivered by	24 weeks	A counseling call was considered	The intervention

(2016); USA	breast cancer with chronic overweigh t/obesity; n = 40	increasing PA in women with increased breast cancer risk are important approaches for reducing their risk. Employed a weight loss intervention combining commercially-available technology-based self-monitoring tools and individualized phone calls	living		multicomponent health wearable intervention and wore a Fitbit One + my fitness pal app + phone counseling (received 12 phone calls [30 minutes each] over the intervention period. Participants were given a weight loss goal (lose 10% of their starting BW) and were instructed to engage in ≥ 150 minutes/week of MVPA and to restrict calories (approximate deficit of 500 kcal/day) Previous health wearable use not specified Social Cognitive Theory-based phone calls Set dietary goals (increased intake of fruits, vegetables, and fiber, decreased intake of unhealthy fats and refined grains) and tracked via phone app (MyFitnessPal) Control group; usual care	trained lay coaches (Each participant was matched with a single coach)	Tailoring was based on reducing daily kcal intake based on participants′ current BW Participants received weekly calls for the first 8 weeks, bi-weekly calls for weeks 8-12, and then monthly calls for weeks 12-24	missed if a participant did not answer after three attempts. Intervention adherence was high (92% of intervention participants completed ≥ 10 of 12 counseling phone calls. Adherence to Fitbit use was high (77% reporting wearing it every day; 19% reporting wearing it 4–6 days/week throughout the intervention)	participants lost significantly more BW after 24 weeks compared to control
Zhang et al.[58] (2019); USA	Adults at-risk for chronic disease with chronic overweigh t/obesity;	Inadequate PA among young African American women remains a serious public health challenge and no available intervention has	RCT; free-living	BMI (kg/m^2)	Intervention participants underwent a multicomponent health wearable intervention and wore a Fitbit + group weight loss + app-based (PennFit) group chatting. Participants attended a two-hour training	A certified PA trainer led the in-person, two-hour training session in a research office	12 weeks No tailoring of the intervention was described No intervention modification	Intervention fidelity was tracked by average number of logins to the app per day The mean number	The intervention participants significantly decreased BMI after 12 weeks compared to

	n = 91	leveraged mobile technologies to promote PA in this population, even though African Americans are among the most avid users of mobile apps.			session on the health benefits of PA and covered the national aerobic and muscle-strengthening PA guidelines (emphasizing light PA). No specific instructions were given and participants wore the Fitbit and used the app for 12 weeks Previous health wearable use not specified Social Cognitive Theory-based application No dietary changes Control group; usual care/no group chatting		throughout the trial	of logins to the app per day during the 90-day study period was 2.4 in the intervention group and 1.1 in the control condition. Time did not affect the frequency of logins, indicating the number of daily logins did not significantly decline over the intervention	control
Kim et al.[46] (2019); Korea	Adults at-risk for chronic disease with chronic overweight/obesity and sleep apnea; n = 60	Although using technologies for a variety of chronic health conditions is reported as acceptable/useful, evidence is lacking on the associations between technology use and change of health outcomes and patients′ response to digital health apps	3-arm RCT; free-living	BW (kg)	Intervention participants underwent a multicomponent health wearable intervention and wore a Samsung Charm + fitness mobile application; comparison participants only used the mobile application. Participants were instructed to follow the instructions of the app and wearable for 4 weeks Previous health wearable use not specified No mention of theory-basis of intervention	All instructions were based on feedback from health wearable and associated app	4 weeks No tailoring of the intervention was described (everything was based on feedback from health wearable and app) No intervention modification throughout the trial	Health app usability was based on patients′ responses to automated lifestyle comments and clinician comment feedback on usage logs was analyzed. For daily diet recordings (breakfast, lunch, and dinner), if any of the 3 records were recorded, this was processed as 1 record for	The intervention and arm-3 comparison participants lost significantly more BW after 4 weeks compared to control. No significant differences between intervention and comparison groups

					Dietary record was recorded. However, there was no specific dietary intervention described Control group; standard care			that day. The percentage of compliant patients was 63.6% (intervention group) and 36.4% in the comparison group	
Shuger et al.[47] (2011); USA	Adults at-risk for chronic disease with chronic overweight/obesity; n = 148	The real-time feedback of the SenseWear health wearable can improve individual self-monitoring and, thus, enhance weight loss in sedentary overweight or obese adults. The purpose was to determine the effectiveness of continuous self-monitoring and feedback from the SenseWear health wearable alone and in combination with group weight loss to enhance weight loss	3-arm RCT; free-living	BW (kg)	Intervention participants underwent a multicomponent health wearable intervention and wore a SenseWear Armband; comparison participants underwent group weight loss. Intervention group participants received a weight loss manual (14 chapters about healthy eating and active living and forms to record their daily meal and lifestyle activity), and mood. All participants were instructed to self-monitor their dietary intake and PA based on health wearable feedback. Participants received real-time feedback from the health wearable on several outcomes (e.g., energy expenditure, MVPA, and steps/day). Feedback for energy balance was received as participants uploaded their armband to the website and inputted daily energy intake and body weight.	The paper described the individual as a "facilitator." No information was available as to the facilitator's credentials.	36 weeks. No tailoring of the intervention was described (everything was based on feedback from health wearable and app) During the first 16 weeks of the intervention, participants received 14 general weight loss sessions from a facilitator. Further, intervention participants received six one-on-one telephone counseling sessions	A two-week pre-randomization run-in period was conducted, behavioral contracts were given, and consistent support from staff members was provided throughout the trial. Additionally, financial incentives were broken up so participants would be more likely to continue the study through its duration 70% and 62% of participants completed the 16 week and 36-week assessments, respectively	The intervention and arm-3 comparison participants lost significantly more BW after 36 weeks compared to control

					Previous health wearable use not specified No mention of theory-basis for intervention groups No dietary changes Control group; standard care				
Cadmus-Bertram et al.[23] (2015); USA	Adults at-risk for chronic disease with chronic overweight/obesity; n = 51	This trial examined the Fitbit wearable and website as a 'low-touch' PA intervention. The purpose was to evaluate the feasibility and efficacy of integrating a Fitbit wearable and website into a PA intervention among postmenopausal women	RCT; free-living	BW (kg)	Intervention participants wore a Fitbit one. Intervention participants (Web-Based Tracking Group) were asked to focus on self-monitoring/self-regulation skills and were instructed to engage in ≥ 150 minutes/week of MVPA and walk 10,000 steps/day Previous health wearable use not specified The intervention was based on the CALO-RE framework (identifies self-monitoring and other self-regulatory skills [e.g., goal setting, frequent behavioral feedback]) No dietary changes Control group; wore a pedometer	Not described	16 weeks Tailoring: Individualized goals were set for the intervention group for the first 4 weeks of the intervention using data observed from the baseline ActiGraph assessment and participants committed to a specific plan to achieve these goals Follow-up phone counseling calls at 4 weeks were used to evaluate progress and refine goals to modify the trial	Fidelity was tracked by Fitbit wear-time and associated website use 96% of participants reported wearing the tracker at least four days/week. Wear time was corroborated with Fitbit data (showed the median days of wear of at least 2,000 steps accrued) was 106 of 112 prescribed days. 88% used the website, with 52% logging in at least two days/week. 72% viewed the Fitbit data daily	The intervention participants lost significantly more BW after 16 weeks compared to control

Hartman et al.[59] (2018); US	Adult breast cancer survivors; n = 87	Increasing PA can improve cognition in cognitively impaired adults, yet the benefits for cancer survivors are unknown. The purpose was to examine a 12-week Fitbit-based PA intervention on objective and self-reported cognition among breast cancer survivors	RCT; free-living	BMI (kg/m^2)	Intervention participants wore a Fitbit one. Participants were instructed to gradually increase their aerobic exercise over time and aim to meet the study goal (≥150 minutes of MVPA/week) Previous health wearable use not specified No mention of theory-basis for intervention groups No dietary changes Control group; waitlist, received intervention after intervention group participants	The intervention was employed (in-person and via phone and email) by a clinical psychologist who had extensive training and experience in behavior change promotion and a staff member who was trained by said psychologist	12 weeks No information regarding tailoring was available Intervention modification took place as participants received two phone calls—one at two-weeks and one at six-weeks—and received emails every 3 days throughout the 12-week intervention	None described	The intervention participants significantly decreased BMI after 12 weeks compared to control compared to control
Polzien et al.[48] (2007); USA	Adults at-risk for chronic disease with chronic overweight/obesity; n = 57	The purpose was to examine the efficacy of adding a SenseWear wearable-based program to an in-person, behavioral weight loss intervention	RCT; free-living	BW (kg)	Intervention participants wore a SenseWear Armband. Participants received seven in-person individualized counseling sessions. Participants were instructed to use diaries to self-monitor exercise and eating behaviors. Feedback was provided by the health wearable (e.g., energy balance, energy expenditure) Previous health wearable use not specified	"Intervention personnel." In-person.	12 weeks Tailoring: Participants received seven in-person individualized counseling sessions Intervention modification took place as counseling sessions were held weekly during month	Wearable use was tracked as total wearable time on body and dietary behavior was tracked as number of meals reported No data were reported for the preceding fidelity procedures. Average in-person session attendance was 91.4% among all participants.	The intervention participants lost significantly more BW after 12 weeks compared to control

					Social Cognitive Theory-based intervention Participants were instructed to reduce energy intake to 1200 to 1500 kcalories/day and dietary fat to ≤20% of total energy intake Control group; standard care		one, twice during month two, and once during month three. Further, PA progressed from 20 to 40 minutes/day of MVPA, 5 days/week		
Shin et al.[49] (2017); Korea	Adults at-risk for chronic disease with chronic overweight/obesity; n = 105	The purpose was to assess the feasibility and effectiveness of a multicomponent SmartCare intervention (activity tracker + smartphone application) and financial incentives	3-arm RCT; free-living	BW (kg)	Intervention participants underwent a multicomponent health wearable intervention and wore a FitMeter; comparison participants engaged in PA + financial incentives. Participants′ set goals were to lose 3%, 5%, and 7% of baseline BW at weeks 4, 8, and 12, respectively. Intervention participants received one-on-one education regarding diet and exercise from a trained nurse for 5 minutes at four sessions. The contents included the clinical consequence of obesity and a PA recommendation (specifying frequency, intensity, time, and type). Feedback was provided by the associated application regarding progress for financial incentives for meeting weight loss goals	Delivered by a trained nurse at the study university.	12 weeks Tailoring was based on individual participants′ weight loss goals and progress throughout the intervention Intervention modification took place based on process incentives that were accumulated and paid out at 12 weeks and outcome incentives were given after meeting goals at each of the four visits (weeks 4, 8, 12)	Participants′ objective- and subjectively-measured PA levels and kcal intake served as the process/intervention fidelity measure. Objective and self-report measures were significantly higher in the health wearable intervention group. However, there were no significant between-group differences in total kcal intake	The comparison group lost significantly more BW than intervention and control participants. No significant differences between intervention and control groups.

					Participants excluded if used a health wearable at time of intervention No mention of theory-basis for intervention groups Intervention participants received one-on-one education regarding diet and exercise for 5 minutes at four separate sessions. A dietary recommendation for weight loss with an example of a 1,200 kcalorie diet menu was provided Control group; traditional health education				
Chen et al.[50] (2014); USA	Young adults at-risk for chronic disease with chronic overweigh t/obesity; n = 90	For effective weight control in adolescents, educating them about energy balance is crucial. This study utilized the SenseWear health wearable and a diet journal to promote adolescents' motivation and knowledge of energy balance	RCT; free-living	BW (kg)	Intervention participants underwent a multicomponent health wearable intervention and wore a SenseWear Armband + journaling. The experimental group was given the health wearable and a diet journal. Instructions on how to use these two tools in addition to their utility features were carefully delivered and questions were answered immediately Previous health wearable use not specified No mention of theory-basis	A trained data collector gave feedback and instructed participants at the study location	11 weeks Not described	Not described	There were no significant differences between groups in BW after 4 weeks

					for intervention groups Intervention participants were instructed to carry the diet journal wherever they went and to immediately document everything they ate or drank. At mid-intervention, the intervention group was given personalized informational feedback regarding the ongoing use of the health wearable and diet journal from a trained data collector Control group; standard care				
Ryu et al.[51] (2017); Korea	Adults at-risk for chronic disease with chronic overweight/obesity; n = 80	Health care management systems based on personal health records can improve patient engagement and medical diagnosis in clinical settings. This study′s purpose was to show the development of an electronic health record-tethered personal health record app (MyHealthKeeper) which was used to retrieve data from a health wearable	RCT; free-living	BW (kg)	Intervention participants underwent a multicomponent health wearable intervention and wore a Misfit Shine + mobile application (MyHealthKeeper). Clinicians could review these data on the PHR module interface and provide health-related lifestyle-management feedback on individual activity, sleep, and meal consumption Previous health wearable use not specified No mention of theory-basis for intervention groups	Feedback and intervention dissemination took place by a family physician as part of routine clinical care	4 weeks Tailoring: Participants′ goals for daily MVPA and dietary intake were based on their current weight status Modification of the intervention took place during the bi-weekly visits with the clinician who gave feedback based on goal progress	Not described	There were no significant differences between groups in BW after 4 weeks

		device and deliver these data to a hospital electronic health record system			During bi-weekly outpatient visits, individualized goals for participants′ diet and PA were prescribed. Intervention group participants could check their PA and dietary status at any time with a mobile phone and access the amount MVPA and food intake allowances remaining for the day to reach their daily goals Control group; standard care				
Pope et al.[52] (2018); USA	Breast cancer survivors; n = 30.	PA among breast cancer survivors can improve this population′s health and quality of living. This study′s purpose was to evaluate the effectiveness of a smartwatch + social media-based health education intervention on breast cancer survivors′ health outcomes	RCT; free-living	BW (kg)	Intervention participants underwent a multicomponent health wearable intervention and wore a Polar M400 + Facebook content. Intervention participants were instructed to track their daily PA using the health wearable and to view/participate in the twice weekly Social Cognitive Theory-related PA tips delivered via a private (study) Facebook group. Feedback related to PA participation was given by the health wearable tracker Previous health wearable use not specified Social Cognitive Theory-	The PI disseminated the PA tips and delivered the intervention	10 weeks Tailoring of the intervention was guided by Social Cognitive Theory Intervention not modified	Intervention and control groups were contacted bi-weekly throughout the intervention and the experimental group was encouraged to continue using the health wearable and both groups were encouraged to implement the Facebook health education tips 100% of experimental group participants reported wearing	There were no significant differences between groups in BW after 10 weeks

					based intervention (PA tips) No dietary changes Control group; Facebook content only			the health wearable 6–7 days/week. Participants in both groups Reported, on average, implementing the PA tips provided 1.2 times/week	
Peyer et al.[53] (2017);	Adults at-risk for chronic disease with chronic overweight/obesity; n = 89	Many health wearables are available, but it is unclear how to use them to most effectively promote weight loss. This study′s purpose was to compare the effectiveness of a personal health wearable, a guided weight loss program, and the combination of these approaches on weight loss with metabolic risk as a secondary outcome	3-arm RCT; free-living	BW (kg)	Intervention participants underwent a multicomponent health wearable intervention and wore a SenseWear Armband; comparison participants underwent a general weight loss program. Participants were instructed to use the health wearable daily and were provided with a wristwatch display that provided real-time estimates of kcal expenditure, MVPA time, and steps taken during the day Previous health wearable use not specified No mention of theory-basis for intervention groups Intervention participants were also instructed to enter their daily dietary intakes into the associated weight management system and view their reports of energy	Graduate student health coaches led the intervention at the study university who were trained/supervised by the PI and a Registered Dietician	8 weeks Intervention participants attended one-hour-long weekly meetings with the student health coaches (in combination with the health wearable) to assess and modify their daily PA and/or activity if needed Based on feedback from the wearables and coaches, intervention modification was in line with the instructions to make weekly self-directed modifications to	Weekly intervention compliance during the intervention was assessed using the subjective rating of a Compliance Score ranging from 0 to 2 (a score of 2 indicated full participation in the coaching sessions, good progress toward goals, and active communication with the health coaches Intervention compliance was added into the statistical model and those with greater compliance had significantly greater weight	The intervention and arm-3 comparison participants lost significantly more BW after 8 weeks compared to control. No significant differences between intervention and comparison groups

					balance, nutrition intake, and PA. Intervention participants were provided with a booklet teaching them about diet and weight loss strategies and were instructed to make weekly self-directed modifications to their lifestyle behaviors Control group; General Weight loss Program control		their lifestyle behaviors	loss	
Chen et al.[60] (2019); USA	Young adults at-risk for chronic disease with chronic overweight/obesity; n = 40	This study's purpose was to examine the short-term efficacy of a health wearable- and smartphone-based intervention among individuals with overweight or obesity and to explore factors associated with decreased BMI	RCT; free-living	BMI (kg/m^2)	Intervention participants underwent a multicomponent health wearable intervention and wore a Fitbit Flex + education + biweekly messages. Intervention participants were instructed to use the health wearable for throughout the intervention, review eight online educational modules, and receive tailored, biweekly text messages (after completing the modules). Intervention participants were also instructed to complete one module per week (covering lifestyle modification, weight management, etc.) Previous health wearable use not specified Social Cognitive Theory-based intervention	Not described	12 weeks Tailoring: received tailored, bi-weekly text messages during the intervention No intervention modification was described	Not described	There were no significant differences between groups in BMI after 12 weeks

					Dietary intake progress was tracked by the associated health wearable app (Fitbit Flex app) recording number of servings of fruits and vegetables eaten per day as well sugar-sweetened beverage consumption and glasses of water consumption per day Control group; pedometer + diary				
Ashton et al.[54] (2020); Australia	Adults at-risk for chronic disease with chronic overweight/obesity; n = 50	Unhealthy lifestyle behaviors in young men can be detrimental to their physical health and trajected into adulthood. This study aimed to assess the feasibility and efficacy of the 'HEYMAN' (Harnessing e-Health to enhance Young men's Mental health, Activity and Nutrition) healthy lifestyle program	RCT; free-living	BW (kg)	Intervention participants underwent a multicomponent health wearable intervention and wore a Jawbone + Facebook group + face-to-face counseling. Intervention participants were provided with all intervention materials (e.g., health wearable) at baseline and were instructed to use them throughout the 12-week intervention. Individual intervention sessions took place in week three of the program and personalized feedback provided from a food and nutrient report and from the health wearable's PA data. Previous health wearable use not specified	One-hour weekly face-to-face sessions at the study university were delivered by two male researchers of the same age demographic (one qualified P.E. teacher, undertaking a PhD in Education and one a PhD candidate in Nutrition and Dietetics)	12 weeks Tailoring: Personal tailored goals were set based on the one-hour weekly face-to-face PA and nutrition information sessions Intervention modification took place throughout (e.g., individual intervention sessions took place starting in week three of the intervention wherein personalized	Fidelity/compliance was tracked by number of times participants used/implemented the e-Health components of the program including the website and health wearable device, and associated app Participants demonstrated decent compliance and acceptability with most of the e-Health components of the program including the website and health wearable device, and associated app	There were no significant differences between groups in BW after 12 weeks

					Intervention guided by Social Cognitive Theory and Self Determination Theory Nutrition counseling and information was given at the face-to-face sessions. Nutrition tracking was to be utilized via the health wearable. A TEMPlate dinner disc to guide main meal portion size for main meal components Control group; waitlist, received intervention after intervention group participants		feedback provided		
Herzig et al.[61] (2014); Finland	Adults with chronic overweight/obesity and prediabetes; n = 68	The purpose of this study (PreDiabEx study) was to examine PA thresholds which affect lipid, glucose, and insulin concentrations and body composition in patients with overweight/obesity and high-risk for type 2 diabetes	RCT; free-living	BMI (kg/m^2)	Intervention participants underwent a multicomponent accelerometer intervention and wore an Accelerometer + walking intervention. Guided by the PA guidelines for MVPA, thrice-weekly walking sessions were held in an indoor sports hall wherein each 60-minute session included a five-minute warm-up + stretching, a 20-minute walk (participants were instructed to maintain a speed of ∼3–4 $km\,h^{-1}$) on plane area (depending on the participant′s physical condition). The health wearable was sealed to	An exercise instructor and a physician disseminated the thrice-weekly training sessions in an indoor sports hall over the 12-week intervention	12 weeks Tailoring: The intensity of the walking intervention was dependent on each participant′s physical condition (most participants were not able to walk at a speed required for moderate-intensity PA) Modification of the intervention too place after	Intervention fidelity was tracked as median session adherence 32 sessions were held with a median adherence of 22 times (67%; range 11–31 times)	There intervention group significantly decreased BMI compared to the control group after 12 weeks

					prevent PA feedback Previous health wearable use not specified No mention of theory-basis for intervention groups No dietary changes Control group; waitlist, received intervention after intervention group participants		six weeks wherein the five-minute stretching + balance training between the two 20-minute walks were eliminated, and walking session duration was increased to 45 minutes		
Shenoy et al.[62] (2010); India	Adults with chronic overweight/obesity and type 2 diabetes; n = 40	The purpose of this study was to assess the effects of eight weeks of aerobic walking with a heart rate monitor + pedometer for monitoring exercise intensity on participants′ (type 2 diabetes patients) glycemic outcomes, fasting blood glucose, cardiovascular fitness and well-being	RCT; free-living	BMI (kg/m^2)	Intervention participants underwent a pedometer intervention and wore a pedometer + heart rate monitor. Intervention participants were given a time schedule and were instructed to walk on regular basis of five days a week with the health wearable (pedometer) and associated heart rate monitor. Intervention participants kept a diary in which the researchers noted resting heart rate and step count for each session. The walking program started at a step count of approximately 3000 steps with a range of 50 and 60% of participants′ maximum heart rate. The goal was to progress to ≥ 4000 steps within 35-40 minutes, with ≥ 70% of	Research personnel gave the walking program at the indoor study location	8 weeks No tailoring described Intervention modification took place in that the walking program started at a step count of approximately 3000 steps with a range of 50 and 60% of participants′ maximum heart rate. The goal was to progress to ≥ 4000 steps within 35-40 minutes, with ≥ 70% of maximum heart	Not described	There were no significant differences between groups in BMI after 8 weeks

					maximum heart rate within the intervention period Previous health wearable use not specified No mention of theory-basis for intervention groups No dietary changes. Participants were instructed to not make any dietary changes Control group; standard care		rate within the intervention period		
De Greef et al.[63] (2010); Belgium	Adults with chronic overweight/obesity and type 2 diabetes; n = 41	This study's purpose was to assess the benefits of a pedometer + cognitive-behavioral group intervention for promoting PA in patients with type 2 diabetes	RCT; free-living	BMI (kg/m^2)	Intervention participants underwent a multicomponent pedometer intervention and wore a pedometer + PA instruction. This lifestyle intervention lasted 12-weeks and consisted of five cognitive-behavioral group sessions (90 minutes each). The first three group meetings were hosted every two weeks (to provide intense initial guidance). The final two sessions were hosted over an interval of 3 and 4 weeks between sessions (to allow participants to autonomously adopt the learned principles in their daily lives). Participants were instructed to wear the pedometer and record their PA (both type and duration)	The intervention took place at the study's Endocrinology Department and were hosted by two coaches (both possessing a master's degree—one in Physical Education/ Movement Sciences—the other in Clinical Psychology	12 weeks Tailoring: The pedometer and diary were both used to track PA progress and to prompt discussion during the group sessions. Results of baseline pedometer measurements were used to motivate the patients to increase their PA. Further, during each session, participants and coaches	Intervention compliance/ fidelity was tracked as attendance of ≥ three of the five sessions Approximately 75% of intervention participants achieved acceptable compliance to the intervention. There were no differences in outcome variables between those with adequate compliance and the remaining 25% of	There were significant differences between groups in BMI after 12 weeks favoring the intervention group

					and step count at the end of each day (to allow participants to set their own step goals in the context of their daily routine). Feedback was provided by the health wearable (pedometer) Previous health wearable use not specified Intervention guided by Cognitive-Behavioral therapy No dietary changes Control group; usual care		reviewed PA-related progress to set new goals together Intervention modification took place as the first three group meetings were hosted every two weeks (to provide intense initial guidance). The final two sessions were hosted over an interval of 3 and 4 weeks between sessions (to allow participants to autonomously adopt the learned principles in their daily lives)	participants	
Frederix et al.[64] (2015); Belgium	Adults with coronary artery disease who completed phase II cardiac rehabilitat	This study's purpose was to evaluate the effect of a PA telemonitoring intervention on daily PA, oxygen uptake capacity, and cardiovascular risk profile in	RCT; free-living	BMI (kg/m^2)	Intervention participants underwent a multicomponent accelerometer intervention and wore an accelerometer + brisk walking program at home. Intervention participants wore the motion sensor during the entire day (including when exercising	Medical staff at the study hospital's rehabilitatio n center conducted the intervention	18 weeks Tailoring: Each patient received weekly personalized automated feed-back on their PA via email or SMS to	Not described	The intervention group significantly decreased BMI compared to control participants after 18

	ion; n = 80	patients with coronary artery disease who completed phase II cardiac rehabilitation			in the study hospital's rehabilitation center) during the 18 weeks study period. All modalities of exercise training were acceptable, and the motion sensors registered PA data during all exercise sessions. The participants were instructed to upload their weekly PA data to their online patient account. Each patient received weekly personalized automated PA feedback by email or SMS. The program was designed to encourage the patient to increase their daily steps by 10% each week from baseline. Thus, the participants were encouraged to gradually increase their PA to reach the recommended daily step count for the secondary prevention of cardiovascular disease (6500–8500 steps) Previous health wearable use not specified Intervention not grounded in theory No dietary changes Control group; usual care		encourage participants to increase their steps by 10% each week from baseline and therefore, their daily PA outputs Modification of the intervention as based on tailored feedback and encouragement of gradual PA increases		weeks
Coghill et	Adults	Hypercholesterole	RCT;	BMI	Intervention participants	A study	12 weeks	Participants were	The

al.[65] (2008); UK	with hypercholesterolemia and chronic overweight/obesity; n = 67	mia and PA significantly contribute to risk of coronary heart disease. Increased PA may therefore be a method of improving lipid profiles in individuals with hypercholesterolemia. This study's aim was to investigate whether a home-based PA program meeting current PA guidelines improved the lipid profile of men with hypercholesterolemia	free-living/home-based	(kg/m^2)	underwent a multicomponent accelerometer intervention and wore an accelerometer + telemonitoring. Intervention participants were instructed to briskly walk for ≥ 30 minutes on ≥ five days out of every seven for a period over the 12-week study duration. Intervention participants were trained and instructed to walk at an intensity between a perceived exertion of 12-14 (on a modified 6-12 Borg scale) which is equivalent to an energy expenditure of 5-7.5 kcals/minute Previous health wearable use not specified Intervention not grounded in theory No dietary changes Control group; usual care	researcher led the investigation by telephone		reviewed by a study researcher at four-week intervals to confirm compliance/fidelity Fidelity outcomes not described	intervention group significantly decreased BMI compared to control participants after 12 weeks
Luley et al.[66] (2014); Greece	Adults with metabolic syndrome and overweight/obesity; n = 122	Mobile technology can enhance lifestyle programs, but the monitoring techniques and feedback from the care person needs optimization. This study investigated	RCT; free-living	BMI (kg/m^2)	Intervention participants underwent a multicomponent accelerometer intervention and wore an accelerometer + telemonitoring. Participants were instructed to increase their usual daily PA (e.g., walking or cycling)	Study care providers (from Magdeburg University Hospital) provided the intervention via	52 weeks Tailoring: Participants received monthly feedback of their PA and diet intake	Not described	The intervention group significantly decreased BMI compared to control participants

		the efficacy of telemonitoring PA and nutrition over 52 weeks in patients with metabolic syndrome			rather than to participate in sports. Further, Participants were instructed to perform these PAs moderately but steadily, and slowly enough to be able to talk at the same time and to keep their pulse below 120 beats/min. Telemonitoring feedback was provided by the study care people who contacted the intervention participants monthly Previous health wearable use not specified Intervention not grounded in theory Participants were taught and instructed to adhere to the Magdeburg Dual Diet (low-carbohydrate and progressive kcalorie restriction) Control group; usual care	telephone	metrics, but tailoring based on this feedback was not adequately described Intervention modification not described		after 52 weeks
Karstoft et al.[67] (2013); Denmark	Adults with chronic overweight/obesity and type 2 diabetes; n = 32	This study evaluated the feasibility of a free-living walking intervention in patients with type 2 diabetes and the effects of interval-walking training versus continuous-walking training on	3-arm RCT; free-living	BMI (kg/m^2)	Intervention participants underwent a multicomponent accelerometer intervention and wore an accelerometer + heart rate monitor + walking program. Participants in the continuous-walking training group had a target energy-expenditure rate of 55% of	Study personnel conducted the intervention remotely	16 weeks Tailoring: Based on participants' monthly changes in aerobic fitness (as determined by monthly VO_2 peak tests)	Fidelity/compliance was tracked as adherence to the training sessions Training adherence was high (89%)	The intervention group significantly decreased BMI compared to control participants after 16 weeks

		participants' physical fitness, body composition, and glycemic control			peak energy-expenditure rate and were instructed to perform continuous-walking training above that target. Participants in the interval-walking training group had a target energy-expenditure rate of 70% of peak energy-expenditure rate and were instructed to perform interval-walking training which consisted of cycles of 3 minutes of fast walking (above the target) and 3 minutes of slow walking (below the target). Participants n both intervention groups were prescribed five training sessions/week (60 minutes/session) for 16 weeks with training effort monitored by data upload every other week. At these sessions, feedback of the training achievements was provided by research staff Previous health wearable use not specified Intervention not grounded in theory No dietary changes. A diet record was kept Control group; usual care		Intervention modification was done by a monthly VO_2 peak test which was repeated to ensure that relative workload of the intervention was consistent with changes in participants' aerobic fitness		
Fukuoka et	Adults	Mobile phone	RCT;	BMI	Intervention participants	Two trained,	20 weeks	Compliance/fielit	The

al.[68] (2015); USA	with chronic overweight/obesity and prediabetes; n = 61	technology can be a convenient and cost-effective way to deliver weight loss interventions and delay or prevent type 2 diabetes. This study′s (Mobile Phone–Based Diabetes Prevention Program) purpose was to examine the feasibility and efficacy of a diabetes prevention program in addition to a pedometer and mobile app in adults with overweight/obesity and at risk for type 2 diabetes	free-living	(kg/m^2)	underwent a multicomponent pedometer intervention and wore a pedometer + mobile application + PA intervention. Intervention participants′ long-term PA goal was to increase and maintain their steps to ≥ 12,000 steps/day Previous health wearable use not specified Intervention not grounded in theory The study′s mobile app utilized electronic diaries for self-monitoring of BW, PA, and kcal intake and sent daily reminders to enter this information. Intervention participants also had the goals of healthy daily reductions in total kcal and fat intake and were instructed to reduce consumption of sugar-sweetened beverages by replacing them with non-sweetened alternatives Control group; usual care	non-medical research staff members delivered the intervention either in-person or via the study app	Tailoring: Only intervention participants received the tailored diabetes prevention program. Diet and PA assessments were conducted at baseline and during the run-in period and these data were used to tailor the intervention to each participant in the intervention group by providing individualized short- and long-term goals Modification of the intervention was achieved by the study mobile app which automatically displayed individualized short-term goals with 20% increases in step counts each	y was measured by study app compliance Results of fidelity not adequately described	intervention group significantly decreased BMI compared to control participants after 20 weeks

							week (based on app PA data and feedback) and encouragement for MVPAs (e.g., brisk walking)		
Alonso-Dominguez et al.[69] (2019); Spain	Adults with chronic overweight/obesity and type 2 diabetes; n = 204	Regular PA is essential for metabolic control in patients with type 2 diabetes mellitus. This study′s (EMID Study) aim was to assess the short- and long-term effects of a multicomponent intervention on PA and clinical biochemical parameters in patients with overweight/obesity and type 2 diabetes mellitus	RCT; free-living	BMI (kg/m^2)	Intervention participants underwent a pedometer intervention and wore a pedometer + PA intervention. Intervention participants received 10 minutes of standardized counseling on PA (compliance with the international recommendations to walk ≥ 10,000 steps/day and avoid a sedentary behavior) and to maintain a healthy diet (focused on the use of the plate method and to adhere to the Mediterranean diet). The intervention consisted of five heart-healthy walks (4 km on level ground; 50–70% of participants′ maximum heart rate) and the use of a health wearable and associated smartphone app. Participants were instructed to use the study app (EVIDENT II) to track daily PA and received feedback from the app if PA levels were too low Previous health wearable	The intervention and counseling sessions were performed by three nurses at study the health center	52 weeks Tailoring: The study app was configured to tailor the diet-based information based on participants′ age, sex, and PA data with the aim of encouraging healthy eating and PA choices Modification of the intervention was based on feedback from the health wearable and associated app which tailored based on participants′ current PA levels and adherence to the study′s diet recommendatio	Study fidelity/compliance was based on post-intervention data regarding the use of the study app Fidelity results not explicitly described	The intervention group significantly decreased BMI compared to control participants after 52 weeks

					use not specified Intervention not grounded in theory Intervention participants received diet counseling to maintain a healthy diet (focused on the use of the plate method and to adhere to the Mediterranean diet) Control group; usual care		ns		
Spring et al.[55] (2017); USA	Adults with chronic obesity; n = 64	The purpose of this study (The ENGAGED RCT) was to examine the effects an abbreviated behavioral weight loss intervention with and without coaching and mobile technology on weight loss in individuals with overweight/obesity	RCT; free-living	BW (kg)	Intervention participants underwent a multicomponent accelerometer intervention and wore an accelerometer + in-person workouts. Intervention participants had a weight loss goal of 7% and were encouraged to lose approximately 0.5-1.0 kg/week of BW. MVPA goals progressed from 45 to 175 minutes/week throughout the intervention. For the first 8 weeks, intervention participants attended 90-minute weekly group sessions led by a psychologist or exercise physiologist which focused on MVPA, nutrition, and other behavior change strategies. MVPA data were transmitted by the health wearable and automatically showed up in an app display	A psychologist or exercise physiologist led the intervention group sessions and individual coaches with bachelor′s degrees led the phone sessions and provided feedback at the study location	24 weeks Tailoring: Dietary tailoring was based on participants′ initial BW and progressive BW Intervention modification took place as MVPA goals progressed from 45 to 175 minutes/week throughout the intervention. Additionally, check-in calls regressed from weekly to monthly as the intervention progressed. If	Fidelity was assessed bi-weekly from weeks 1 to 8 and then monthly after that through the remainder of the intervention	The intervention participants lost significantly more BW after 24 weeks compared to control

					which showed the remaining MVPA needed to reach the set weekly goal Previous health wearable use not specified Intervention not grounded in theory Daily allowances for kcal and fat grams ranged from 1,200- 2,000 kcal and 32-55 fat grams/day, respectively, based on intervention participants′ initial body weight. Intervention participants were instructed to use the study app (ENGAGED app) to self-monitor daily dietary intake Control group; standard care		fidelity ever fell below 90%, the coach was retrained by a doctoral-level staff member The overall intervention fidelity was 95.0%; three coach re-trainings were held		
Hurling et al.[70] (2007); UK	Adults at-risk for chronic disease with chronic overweight/obesity; n = 77	The Internet may be an effective medium for health behavior change interventions but no RCTs have evaluated the effectiveness of a fully automated PA intervention over several months with objective, real-time feedback from a health wearable	RCT; free-living	BMI (kg/m^2)	Intervention participants underwent a multicomponent accelerometer intervention and wore an accelerometer + Internet + phone counseling. A series of weekly screens asked participants to report their PA levels during the last week prior to providing feedback on performance relative to their own PA targets. This system included a weekly schedule which allowed for planning	Study researchers disseminated the intervention from the study center	9 weeks Not described	Not described	The intervention group significantly decreased BMI compared to control participants after 9 weeks

					PA sessions over the next week in which participants were able to choose to receive mobile phone and/or email reminders. Participants were instructed to wear the health wearable continuously for 12 weeks. The intervention group then had full access to the web-based behavior change system. An automated "assessor" was provided with the schedule which provided feedback on the amount and type of planned PA and advising a reduction in PA in case participants planned to make overly ambitious increases compared with previous weeks Previous health wearable use not specified Intervention not grounded in theory No dietary changes Control group; usual care				
McNeil et al.[71] (2019); Canada	Adult breast cancer survivors, n = 45	This study's purpose was to prescribe different PA intensities using health wearables to increase PA, reduce sedentary behavior,	3-arm RCT; free-living/home-based	BMI (kg/m^2)	Intervention participants underwent a health wearable intervention and wore a Polar A360 + lower or higher intensity PA intervention. Intervention participants randomized to	A study exercise physiologist monitored all PA data and provided	24 weeks Tailoring: Target PA intensity for each participant was	Not described	There were no significant differences between groups in BMI after

	and improve health outcomes among survivors of breast cancer. The maintenance effect of the interventions on study outcomes was also assessed	the lower- and higher-intensity PA interventions were instructed to complete ≥ 300 minutes/week of PA (at ~3-5 METs) or 150 minutes/week of PA at an intensity ~6-9 METs, respectively. The total PA volume was similar across groups (~15-25 METs/hour/week). Target PA intensity for each participant was tailored for each participant based on calculated heart rate reserve. This target PA intensity was programmed under the health wearable's associated app (Polar Flow). The health wearable also provided immediate feedback on PA intensity and duration participants were instructed to use to modify their unsupervised, home-based PA participation. Participants were also instructed to upload their PA data to the study app ≥ once per week to minimize the risk of missing data and to allow the study exercise physiologist to track their progress Previous health wearable use not specified Intervention not grounded in theory	physiological- and PA-related feedback The health wearable also provided immediate feedback on PA intensity and duration participants were instructed to use to modify their unsupervised, home-based PA participation	individualized for each participant based on calculated heart rate reserve	24 weeks

					No dietary changes Control group; usual care				
Maxwell - Smith et al.[72] (2019); Australia	Adult cancer survivors with cardiovascular risk factors; n = 68	This study's objective was to examine if health wearables + action planning was effective for increasing PA in colorectal and endometrial cancer survivors at cardiovascular risk	RCT; free-living	BMI (kg/m^2)	Intervention participants underwent a multicomponent health wearable intervention and wore a Fitbit Alta + two group sessions + telephone support call. Intervention participants attended two-hour group sessions (11 sessions per group) in weeks one and four which covered health wearable setup and PA messaging, instructions for PA performance, goal setting, action planning, coping planning, and self-monitoring of PA and sedentary behavior. Emphasis was given to reducing bouts of sedentary behavior and responding to the automatic prompts to take steps, in addition to encouraging planned bouts of MVPA. During week 8, participants received a 20-minute phone call to pro-vide goal support and feedback for PA progress, to review goals, update action plans, and to provide coping-planning strategies Previous health wearable use not specified	A 'behavior change specialist' ran the intervention via phone	12 weeks Not described	Not described	There were no significant differences between groups in BMI after 12 weeks

					Intervention not grounded in theory No dietary changes Control group; waitlist, received intervention after intervention group participants				
Polgreen et al.[73] (2018); USA	Adults with chronic obesity with prediabetes or diabetes; n = 138	Health wearables may increase PA, but their effectiveness in sedentary, diseased, and less-motivated populations is unknown	3-arm RCT; free-living	BMI (kg/m^2)	Intervention participants underwent a multicomponent health wearable intervention and wore a Fitbit Zip + reminders or a Fitbit + reminders + goal setting. The Fitbit-only group was the control group (not given any extra information or sent any text messages). Participants in the reminders group were sent a daily text message which served to remind them to wear and sync their health wearable (if they did not wear their health wearable the previous day). The goal-setting group received daily text messages for goal setting. All goal-setting participants were delivered a morning text message regarding the last day′s PA and were asked to set a step goal for the current day. If the participant did not wear their health wearable, the	Research staff engaged with intervention participants via text message reminders	24 weeks Tailoring: Achieved by the health wearable (e.g., participants who wore their health wearable the previous day, the automated system sent personalized feedback: ““Yesterday you achieved 5,934 steps; your goal was 6,000 steps. What is your goal for today?””)	Fidelity was tracked by daily wearing of the health wearable (Non-wear was defined as zero steps recorded for the entire day) The health wearable-only group was the least compliant and the health wearables + reminders group was most compliant	There were no significant differences between groups in BMI after 12 weeks

					following text message was sent: "Remember to wear your Fitbit! What is your goal for today?" Participants responded with the number of steps they planned to take for that day Previous health wearable use not specified Intervention not grounded in theory No dietary changes Control group; Fitbit-only				
Kooiman et al.[56] (2018); Netherlands	Adults with chronic overweight/obesity and breast cancer survivors; n = 72	This study's purpose was to assess the efficacy of an online self-tracking program on PA and other health measures in patients with overweight/obesity and type 2 diabetes	RCT; free-living	BW (kg)	Intervention participants underwent a multicomponent health wearable intervention and wore a Fitbit Zip + online lifestyle program. Intervention participants were instructed to set small goals at the start (e.g., increasing steps/day by 500 or 1000 and, if physically able, continuing increasing steps/day to the norm of a ≥ 7500 steps/d and/or 150 Further, based on the number of steps taken in the past week, weekly tailored feedback messages were provided through the program. These feedback messages were based on whether the participants had	The study diabetes nurse disseminated the intervention and the e-Health program provided feedback for PA	12 weeks Based on intervention participants' number of steps taken in the previous week, weekly tailored feedback messages were disseminated through the program. These feedback messages were based on whether the participants had increased their steps per day with an average	Intervention adherence was tacked as having worn the health wearable on ≥ 75% of intervention days + having read ≥ 50% of the program content. The latter was tracked digitally using the telephonic evaluation 82.5% of the intervention participants were defined as being compliant to the intervention	The intervention participants lost significantly more BW after 12 weeks compared to control

					increased their steps per day with an average minimum of ≥ 500 steps/day, did not change, or decreased their steps per day compared with the previous week Previous health wearable use not specified Theory mentioned but no theoretical grounding of intervention No dietary changes but the intervention provided weekly information regarding a healthy diet with sample recipes appropriate for those with type 2 diabetes Control group; usual care		minimum of ≥ 500 steps/day, did not change, or decreased their steps per day compared with the previous week Intervention modification was based on the PA feedback from the program and participants were to increase PA levels to the established norms if they were under for the week		
Valle et al.[57] (2017); USA	Adults with chronic overweight/obesity and breast cancer survivors; n = 35	The purpose of this study was to evaluate the feasibility and efficacy of two 24-week, self-regulation interventions that investigated daily self-weighing and used tailored, health wearable-based feedback regarding BW (±PA), to prevent	3-arm RCT; free-living	BW (kg)	Intervention participants underwent a multicomponent health wearable intervention and wore a Withings Pulse-only + or with multiple interventions components. Intervention participants were instructed to identify one minor change in their diet that would reduce their intake by approximately 100 kcals/day (e.g., drink one less sugar sweetened beverage/day) and received an exercise plan in which	An interventionist with PhD-level training in nutrition intervention conducted the one-hour face-to-face sessions and research assistants provided the PA feedback	24 weeks Research assistants retrieved objective weight-related data for each participant on a weekly basis to drive content for tailored feedback messages and collect process data on	Intervention fidelity/adherence was tracked as weekly objective weight-related data for each participant to collect process data on adherence (total days weighed [of 168 possible program days]; average days weighed/week [number of	The multicomponent intervention participants lost significantly more BW after 24 weeks compared to intervention-only control groups. No significant differences

	weight gain in African American participants with overweight/obesity and who were survivors of breast cancer	they were instructed to gradually increase their weekly aerobic PA during the intervention until they achieved 150-225 minutes/week of MVPA (i.e., 3-5 METs, 30-45 min on five days/week, consistent with current guidelines for cancer survivors). Further, intervention participants were instructed to practice reinforcing themselves or taking the recommended actions to bring their BW back to their BW at the beginning of the program Previous health wearable use not specified Intervention based on Self-Regulation Theory No dietary changes. However, an overview of energy balance through diet and behaviors and the importance of self-weighing as an indicator of energy balance was provided at baseline and the research team emphasized daily use of the wireless scale as a tool or indicator of progress with diet and PA behaviors Control group; usual care	at the study location	adherence Intervention modification was based on the PA feedback from the preceding program	days weighed/24 program weeks]; and a measure of average weighing frequency of 5 or more days per week) On average, > 80 % of intervention participants weighed ≥ five days/week and this proportion differed significantly between groups. Within the intervention group, 73% of participants wore health wearables ≥ five days/week and median total days worn was 162 of 168 days (96% of prescribed days)	between intervention-only and control groups

Abbreviations. BMI = body mass index; BW = bodyweight; RCT = Randomized controlled trial; PA = physical activity; PI = principal investigator; MVPA = moderate-to-vigorous physical activity; METs = metabolic equivalents; app = application.