AGA KHAN UNIVERSITY

Postgraduate Medical Education Programme
Medical College, East Africa

THE EFFECTIVENESS OF DIGITAL HEALTH INTERVENTIONS FOR WEIGHT LOSS IN POSTPARTUM WOMEN: A SYSTEMATIC REVIEW AND META-ANALYSIS

By

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A dissertation submitted in part fulfilment of the requirements for the degree of
Master of Medicine
In Family Medicine

Nairobi / Kenya

30th May, 2021

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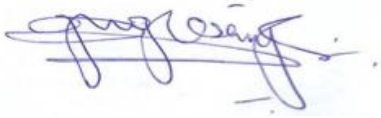

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Master of Medicine
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27th May, 2021
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ABSTRACT

Objectives: This systematic review and meta-analysis aimed (1) to determine the effectiveness of digital health intervention (DHI) components on weight loss in postpartum women, (2) to determine the effect of DHIs on body mass index and (3) to determine the attrition rates within DHIs.

Methods: Electronic searches were conducted on PubMed (MEDLINE), Cochrane Library, Google Scholar and Web of Science from inception to 22nd April 2020. Studies included were; (1) randomized controlled trials (RCT), quasi-experimental trials and controlled before-after studies (2) of weight loss interventions delivered by either website, Internet, email, computer, Apps, SMS, phone call or video player (3) for postpartum women. Interventions involving medicines or surgeries for weight loss were excluded. Primary outcome was weight mean difference (MD), while secondary outcomes were BMI MD and attrition rates. Cochrane Collaboration's tool for assessing risk of bias and the Quality Assessment Tool for Quantitative Studies were used to judge quality of the primary outcome. Narrative summary tables were generated for descriptive analysis. Random-effects model analysis was conducted to generate weight and BMI mean differences and 95% CIs.

Results: Twenty studies (19 RCTs and 1 Non-RCT) were included. A total of 3228 women were included for analysis of body weight change, while 458 women were included for BMI change. DHIs significantly reduced body weight (mean difference, -1.41 Kg; 95% CI: -2.04 to -0.77 Kg) and BMI (-0.94 Kg/m^2; 95% CI: -1.37 to -0.52 Kg/m^2). All classifications of DHIs were effective, but the biggest weight loss was with on-demand information services (-2.4 Kg, 95% CI: -3.4 to -1.41 Kg). Mixed-site interventions had more weight loss (-1.62 Kg; 95% CI: -2.99 to -0.25 Kg) compared to home-based interventions (-1.35 Kg; 95% CI: -2.13 to -0.57 Kg). Mixed-target interventions had more weight loss (-1.67 Kg; 95% CI: -2.89 to -0.46 Kg) compared to individual-only targeted interventions (-1.30 Kg; 95% CI: -2.11 to -0.49 Kg). Attrition within intervention groups ranged from 0% to 85%. Ten studies (out of 20) were judged to be of high risk of bias with 1 having "some concerns" mostly due to missing outcome data and attrition.

Conclusion: Digital health interventions lead to weight loss in postpartum women irrespective of type or mode of delivery and are a good recommendation as a scalable weight loss

promotion option. The most effective interventions had components catering to continuous support, group interaction and convenience.

LIST OF ABBREVIATIONS

AN	Anthony Ngugi
Apps	Applications
BMI	Body mass index
BW	Body weight
CG	Catherine Gathu
CI	Confidence interval
CWMO	Commercial weight management organisation
DHI	Digital health intervention
DM	Diabetes mellitus
DPP	Diabetes prevention program
FDD	Families defeating diabetes
GEM	Glycaemic load, Exercise and Monitoring glucose
GDM	Gestation diabetes mellitus
HCW	Healthcare worker
ICT	Information and communications technology
IERC	Institutional Ethics Review Committee
JS	Jacob Shabani
Kg	Kilogram
LR	Logan Rabuogi
MSIU	Mums Step It Up
PPWR	Postpartum weight retention
PRISMA	Preferred Reporting Items for Systematic Review and Meta-Analysis
RCT	Randomized controlled trial
RevMan	Review Manager
ROB	Risk of bias
SMS	Short message service
SPSS	Statistical Product and Service Solutions
TIDieR	Template for Intervention Description and Replication
WHO	World health organization
WIC	Women, Infants, and Children

ACKNOWLEDGEMENT

First of all, I am grateful to my supervisors, whose scholarly advice, help and constant encouragement have contributed significantly to the completion of this study.

I wish to thank my Dissertation Committee members for their critical input for my study.

I also wish to thank the management, staff, faculty members, and my fellow residents for their invaluable input and for being a great source of support to me during my study.

My gratitude to Nasra Gathoni for her support with the search strategy.

Thank you all

DECLARATION

I declare this dissertation does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university and that to the best of my knowledge it does not contain any material previously published or written by another person except where due reference have been made in the text.

The editorial assistance provided to me has in no way added to the substance of my dissertation which is the product of my own research endeavours.

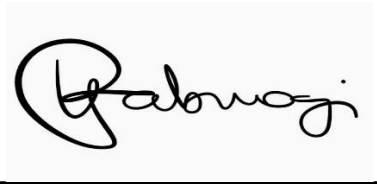

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TABLE OF CONTENTS

BACKGROUND 1

Obesity and Postpartum Weight Retention 1

Digital Health Interventions 1

Statement of the Problem 3

LITERATURE REVIEW 5

REVIEW QUESTION 9

Conceptual framework 9

Primary objective: 10

Secondary objectives: 10

METHODS 11

Criteria for considering studies for this review 11

Types of studies 11

Population 11

Types of interventions 11

Types of outcome measures 12

Search methods for identification of studies 13

Electronic searches 13

Searching other resources 13

Data collection and analysis 13

Selection of studies 13

Data extraction and management 13

Risk of bias assessment 14

Assessment of reporting biases 14

Data synthesis and statistical analysis 15

Descriptive analysis 15

Statistical analysis 15
Ethical considerations 15
RESULTS 16
Study identification 16
Inter-rater reliability between reviewers 17
Characteristics of included studies 19
Characteristics of participants 19
Characteristics of Interventions 19
Effect of DHIs on Body Weight Change 30
Effect of DHIs on BMI change 41
Summary of study conclusions 43
Risk of bias in included studies 43
DISCUSSION 47
Main results 47
Quality of the evidence 48
Strengths and limitations of the included studies 48
Strengths and limitations of the review process 49
Differences with other studies or reviews 50
CONCLUSIONS 51
Implications for clinical practice 51
Implications for research 51
ROLES OF REVIEWERS 53
REFERENCES 54
APPENDICES 60
Data Extraction Form 60
Search strategies 73
PubMed 73

Web of Science Core Collection 75
Cochrane CENTRAL.....76
Google Scholar 77

LIST OF TABLES

Table 1. Summary of related reviews 6
Table 2. Inclusion and exclusion criteria 12
Table 3. Summary of database search results 16
Table 4. Characteristics of included studies 20
Table 5. Characteristics of participants 22
Table 6. Description of digital health interventions 24
Table 7. Main DHI classifications per study 28
Table 8. Attrition within intervention groups per study 30
Table 9. Summary of conclusions 45
Table 10. Roles and contributions of reviewers 53

LIST OF FIGURES

Figure 1. WHO Classification of Digital Health Interventions 2
Figure 2. Tanahashi Model 3
Figure 3. Conceptual framework of review 9
Figure 4. Study Flow Diagram 18
Figure 5. Pooled weight loss 31
Figure 6. Weight loss excluding Non-RCTs 32
Figure 7. Targeted client communication 33
Figure 8. Client-to-client communication 34
Figure 9. Personal health tracking 35
Figure 10. On-demand information services 36
Figure 11. Telemedicine 37
Figure 12. Effect size by intervention site 38
Figure 13. Individual-only Vs mixed target interventions 39
Figure 14. Excluding pilot/feasibility studies 40
Figure 15. Excluding high risk of bias 40
Figure 16. Funnel plot 41
Figure 17. Pooled change in BMI 42

BACKGROUND

Obesity and Postpartum Weight Retention

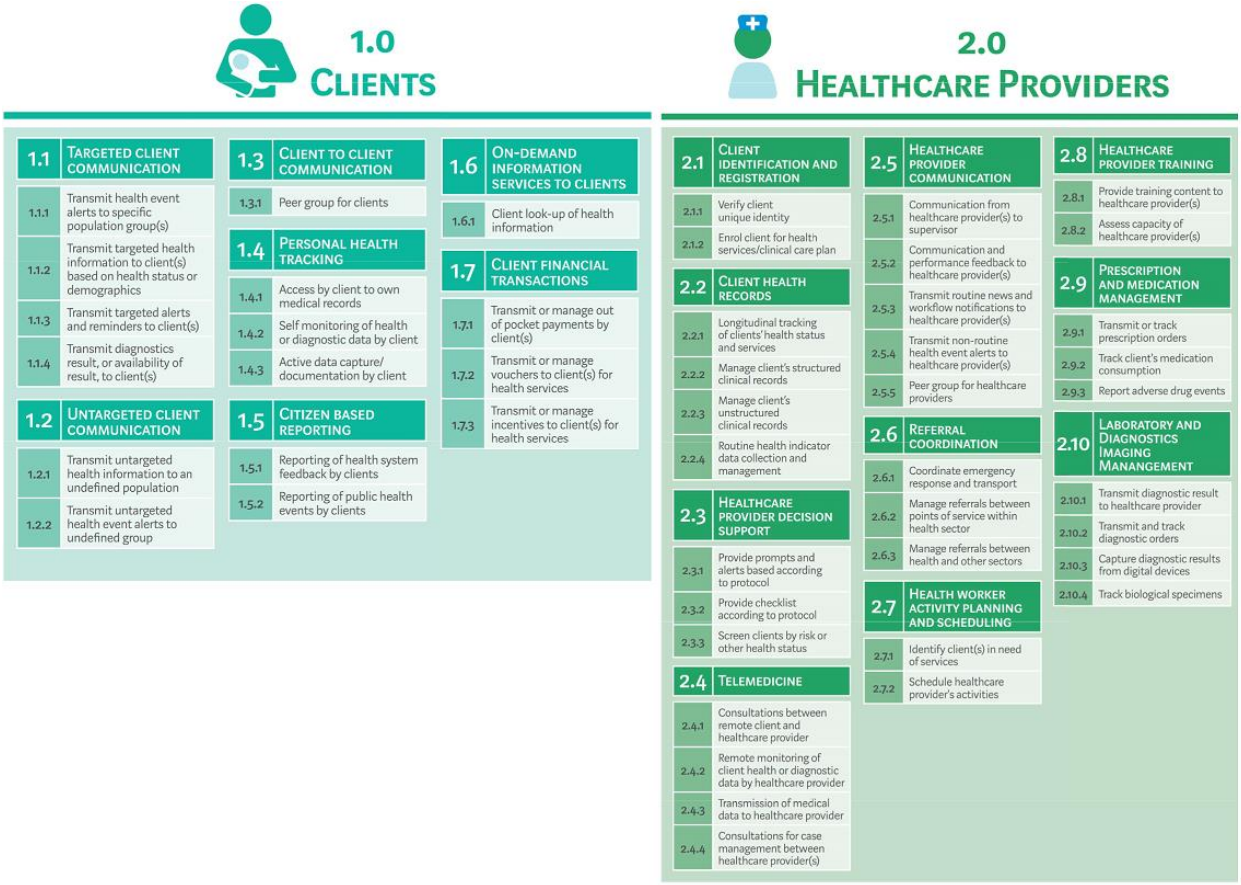
The prevalence of overweight and obesity has drastically increased worldwide. The proportions are highest among women, with 40% and 15% of women being either overweight or obese respectively (1). Women have an increased risk of weight gain during the reproductive years as excessive gestational weight gain predisposes these women to significant postpartum weight retention (PPWR) (2).

Major PPWR of more than 4.5 kilograms (Kg) is a risk factor for long-term obesity, type 2 diabetes, cardiovascular disease, depression, anxiety, problematic body image and socioeconomic deprivation (3-5). Weight control reduces these risks and complications in subsequent pregnancies (3).

Digital Health Interventions

A digital health intervention (DHI) is the use of technologies within Information and Communications Technology (ICT) to achieve health objectives (6). In an effort to synthesize evidence and research, the World Health Organization (WHO) developed a taxonomy of these interventions. Figure 1 shows an excerpt from the WHO Classification of Digital Health Interventions v1.0 with focus on classes potentially related to this review.

Figure 1. WHO Classification of Digital Health Interventions



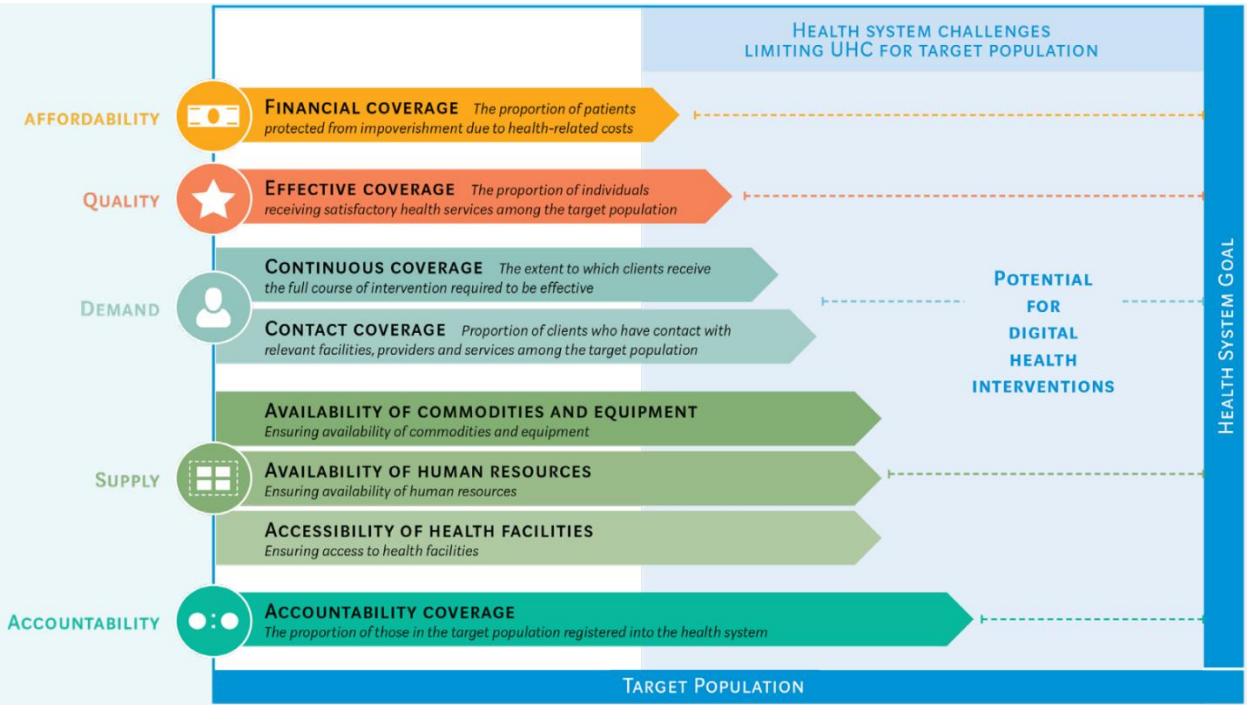
DHIs have been used in various contexts within the healthcare space. They have been used in improving clinical outcomes (such as short-term weight loss, glycosylated haemoglobin), lifestyle behaviour change, healthcare support and monitoring (7-13). Furthermore, DHIs have been shown to improve cost-effectiveness in cardiovascular disease care (14).

Statement of the Problem

Major guidelines have recommended research into effective and cost-effective ways to promote weight control/loss in pregnancy and postpartum (3). However, sustaining recommended lifestyle behaviour changes may need more than the traditional face-to-face sessions that have been shown to be effective. Time constraints may impact the healthcare professionals' ability to deliver and monitor these lifestyle behaviour changes within these sessions.

Other barriers unique to postpartum women include lack of time due to infant care, low motivation and prioritization of childcare (15, 16). DHIs have been suggested to improve recruitment into weight control programs as well as retention within weight loss programs (17). This could be due to their ability to address challenges such as demand generation, broadening of contact coverage and continuous care (6). To illustrate this, the adapted Tanahashi Model below identifies gaps digital health could address in providing quality universal coverage (Figure 2).

Figure 2. Tanahashi Model



There's evidence that support from healthcare professionals is associated with greater weight loss and the technology is merely a delivery media (18). With that said, the World Health Assembly Resolution on Digital Health urged ministries of health to assess the use of digital health technologies and to prioritize development, evaluation, implementation and scaling up the use of these technologies (19). This was echoed by the WHO Bellagio eHealth Evaluation Group recommending evaluations of DHIs for appropriate integration and use (20).

LITERATURE REVIEW

Weight loss interventions during the postpartum period has been systematically reviewed. Adegboye et al reviewed the role of diet or exercise or both in weight reduction after childbirth concluding that diet or diet plus exercise was significantly more effective and safer for breastfeeding and postpartum (21).

Adegboye's findings were echoed by Neville et al with the addition that lower attrition was observed when components of the interventions were more personal and including self-monitoring (22). Both of these reviews included DHI and Non-DHI studies.

Lim et al found health professional delivered interventions were more effective while also recommending future research into duration of intervention, delivery format and role of technology (17, 18).

Christiansen et al review looking at ICT-based interventions commented that the main features demonstrating significant weight change were personal coaching, feedback, frequent interaction and gaming (23). This was a narrative review that only looked at RCTs and excluded studies of women with gestational diabetes. Furthermore, it included interventions without contact with coaches or healthcare workers.

Previous related reviews are summarized in Table 1.

This systematic review and meta-analysis aimed to synthesize the evidence and evaluate the quantitative benefit of DHIs for weight loss in postpartum women thus far.

Table 1. Summary of related reviews

Author	Title	Gap/Difference/Comments	Conclusions
Adegboye 2013 (21)	Diet or exercise, or both, for weight reduction in women after childbirth	Searched 30 April 2013	1. Exercise did not produce significantly more weight loss than usual care. 2. Diet or diet plus exercise produced significantly more weight loss than usual care. 3. Weight loss between diet alone and diet plus exercise was not significantly different. 4. Breastfeeding was not adversely affected.
Lim 2015 (17)	Effective strategies for weight loss in post-partum women: a systematic review and meta-analysis	Searched July 2014	1. Self-monitoring and the combined diet and exercise were effective approaches. 2. Suggested research on duration, delivery format and the roles of technology in weight loss programmes.
Lim 2019 (18)	A systematic review and meta-analysis of intervention characteristics in postpartum weight management using		1. Interventions delivered by health professionals had significantly more weight loss. 2. Combined diet and physical activity produced more weight loss than physical activity- only. 3. Intervention intensity and setting did not influence weight loss.

	the TIDieR framework: A summary of evidence to inform implementation		
Christiansen 2019 (23)	Lifestyle interventions to maternal weight loss after birth: a systematic review	Only RCT Narrative review Exclude GDM Search Feb 2018 Old ROB Included studies without contact with coach/HCW	1. Most effective features: a. Feedback b. Personal coaching, c. Frequent interaction d. Gamification e. Financial reward
Dodd 2018 (24)	Targeting the postpartum period to promote weight loss: a systematic review and meta-analysis	Both DHI and non-DHI	1. Combined diet and lifestyle intervention produced modest weight loss.
Sherifali 2017 (25)	The Effectiveness of eHealth Technologies on Weight Management in	4 postpartum studies from 1990 >3 months intervention 1 reviewer extracted data.	1. eHealth technologies may enhance weight management during pregnancy and postpartum. 2. Adoption of eHealth interventions is dependent on more robust research.

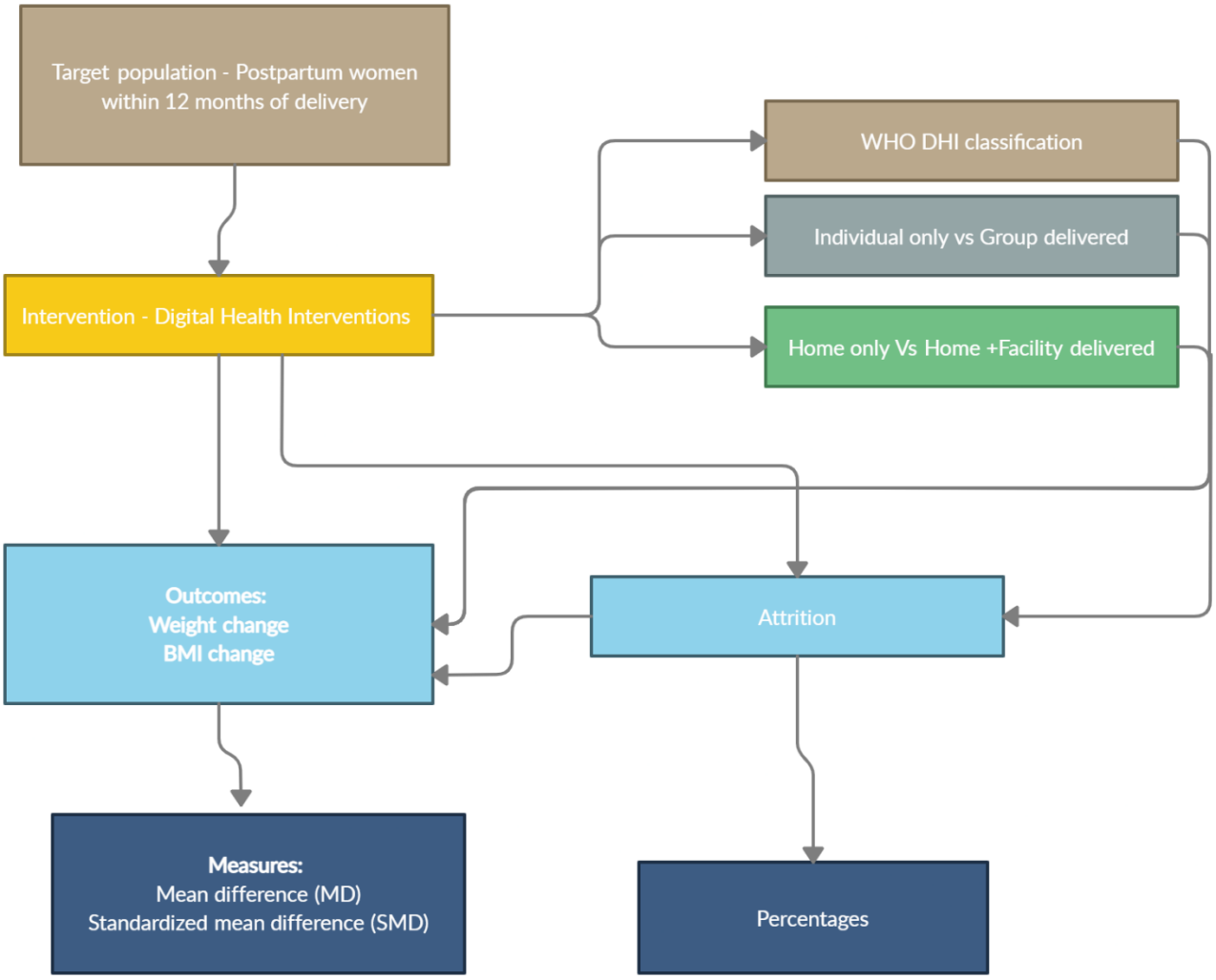
	Pregnant and Postpartum Women: Systematic Review and Meta-Analysis		
Neville 2014 (22)	The Effectiveness of Weight Management Interventions in Breastfeeding Women—A Systematic Review and Critical Evaluation	Searched June 2012 Exclusively breastfeeding mothers <2years postpartum Excluding pre-existing conditions (DM GDM)	1. Diet or combined diet and exercise may be effective in reducing weight in addition to improving body composition. 2. Exercise-only interventions did not produce significant difference in weight loss. 3. Exercise was compensated for with a higher energy intake. 4. Lower attrition observed with: a. health professional support b. face-to-face counselling c. home visits d. food provision e. childcare provision f. self-monitoring.

REVIEW QUESTION

In postpartum women, what is the effectiveness of digital health interventions for weight loss?

Conceptual framework

Figure 3. Conceptual framework of review



OBJECTIVES

Primary objective:

To determine the effectiveness of digital health intervention components on weight loss in postpartum women.

Secondary objectives:

1. To determine the effect of DHIs on body mass index in postpartum women.
2. To determine the attrition rates of the different digital health interventions.

METHODS

Following recommendations of the Cochrane Collaboration Handbook, the protocol for this systematic review and meta-analysis was prepared according to the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) format (26-28). The protocol was registered with the international Prospective Register of Systematic review, registration number CRD42020188550 (29). Changes to the protocol were made after an initial piloting period when the review began.

Systematic literature search was performed on PubMed (MEDLINE), Cochrane Library, Google Scholar and Web of Science from inception to 22nd April 2020.

Criteria for considering studies for this review

Types of studies

Studies of interest included randomized controlled trials (RCT), quasi experimental trials and controlled before-after studies.

Population

The review considered studies of postpartum women (less than 1 year postpartum at the start of the interventions). For studies referring to the same group of participants, the most detailed of these were selected for review. Interventions starting during pregnancy were included if there was a postpartum period that could be separately evaluated.

Types of interventions

Weight loss interventions of interest contained behavioural lifestyle aspects (e.g., diet, physical activity or monitoring) delivered by either website, Internet, email, computer, Apps, SMS, phone call or video player and combinations of these. Interventions involving surgery or medications specifically for weight loss were excluded.

Comparison intervention groups were either usual care, head-to-head DHI or no intervention (inactive controls).

Types of outcome measures

The primary outcome of interest was change in body weight in kilograms (Kg) or units convertible to Kg. This was defined as weight at the end of the intervention minus the weight at baseline (preferably a postpartum baseline).

The review included studies that reported change in body mass index (BMI in Kg/m^2) as an addition to body weight or surrogate to it.

Attrition within the intervention group was noted for studies that either reported it or could be imputed/calculated. It was defined as the percentage of participant drop outs at the end of the intervention.

A summary of inclusion and exclusion criteria is given in Table 2.

Table 2. Inclusion and exclusion criteria

Inclusion criteria	**Exclusion criteria**
Population: Postpartum women (< 1 year postpartum at the start of the interventions)	
Interventions: Delivered by either website, Internet, email, computer, Apps, SMS, phone call or video player	Medicines or surgical procedures for weight loss
Outcomes: Change in weight and/or BMI (as continuous variables)	
Study types: Randomized controlled trials (RCT), quasi experimental trials and controlled before-after studies	

Search methods for identification of studies

Electronic searches

Systematic literature search was performed on PubMed, Cochrane Library, Google Scholar and Web of Science from inception to 22nd April 2020.

Search strategies for the separate databases are provided in the appendix.

Searching other resources

Relevant references cited in the selected studies and previous systematic reviews were screened. Inquiry for additional data and grey literature was not done as the timeframe for completion of this review was limited.

Data collection and analysis

Selection of studies

Titles of articles obtained from the electronic searches were screened for duplicates using EndNote. Titles and abstracts of retrieved articles were independently screened by two reviewers (LR and CG) to identify eligible studies fitting the inclusion criteria. Discrepancies were resolved by consensus. Abstracts not providing enough data fitting the inclusion/exclusion criteria were selected for full-text evaluation. Full manuscripts of the identified studies were examined. Finally, the two reviewers verified the reasons for inclusion and exclusion. Disagreements were resolved by consensus. The agreement rate between reviewers was assessed by calculating kappa statistics.

Data extraction and management

An adapted predefined form was used to extract data from the included studies: study characteristics (author, publication year, study location, study design, sample size), participants characteristics (postpartum age, breastfeeding status, medical history, physical activity status

and diet history), intervention description (duration, location, individual or group setting), outcomes (body weight, and BMI) and attrition rate (30). For studies that reported outcomes at different time points, the outcome at the end of the intervention was chosen. LR extracted data from all the included studies while CG and JS split the extraction as the second reviewers. Disagreements were resolved by consensus or by the third reviewer (either JS or CG for the studies they did not extract data from). See appendix for adapted data extraction form.

Risk of bias assessment

LR and either CG or JS independently assessed the methodological quality of included studies according to the Cochrane Collaboration Handbook recommendations. RCTs were assessed using the Cochrane Collaboration's tool for assessing risk of bias while the Quality Assessment Tool for Quantitative Studies was used to assess the quality of quasi experimental trials and controlled before-after studies (31-33). In both quality assessment tools, overall risk of bias was reported as low, some concern or high risk. Disagreements were resolved by consensus or by JS or CG if consensus was not reached.

Assessment of reporting biases

Reporting bias for the primary outcome (body weight change) was evaluated visually by funnel plot asymmetry provided for in Review Manager.

Data synthesis and statistical analysis

Descriptive analysis

A descriptive review of the included studies was conducted with summary tables. Details of summaries included study characteristics, participants characteristics, DHI characteristics, outcomes of interest, and major conclusions.

Statistical analysis

Analyses were conducted using Microsoft Excel sheets, Review Manager and SPSS.

For body weight review, extracted and calculated data were tabulated as mean weight change, standard deviation for DHIs and controls of each study in SPSS. Review Manager was used to calculate pooled mean differences, 95% CI, heterogeneity and produce forest plots. This was similarly done for the BMI change.

Sub-group analyses were conducted on body weight outcome in terms of DHI characteristics; WHO classification, individual vs individual+group intervention and home vs home+facility-based intervention. Comparison forest plots were generated.

Sensitivity analyses were performed for weight change outcome. The review investigated whether excluding studies with overall high risk of bias would alter the findings. The effect of excluding pilot studies was also explored. Comparison forest plots were generated for each of the exclusions.

Ethical considerations

Data for this review was obtained from already published studies and there were no privacy concerns. An exemption of ethical approval was obtained from the Aga Khan University (Kenya) Institutional Ethics Review Committee (IERC).

RESULTS

Study identification

The electronic database search yielded 5607 articles. Google Scholar search retrieved 1800 articles but only the first 1000 records were viewable and only 970 were able to be saved.

Table 3. Summary of database search results

Database	**Last date searched**	**Articles found**	**Articles after cleaning***
Web of Science	17th March 2020	2348	
PubMed	15th April 2020	1691	
Google Scholar	17th April 2020	970	
Cochrane CENTRAL	22nd April 2020	598	
Total		5607	3557

*Removing duplicates, animal studies, protocols, systematic reviews and meta-analyses using EndNote.

Title and abstracts of these 3557 articles were screened and a further 3424 were excluded. One hundred and thirty-three articles were deemed eligible for full text review. Full text manuscripts for 8 articles could not be retrieved from searched libraries and were excluded from the review.

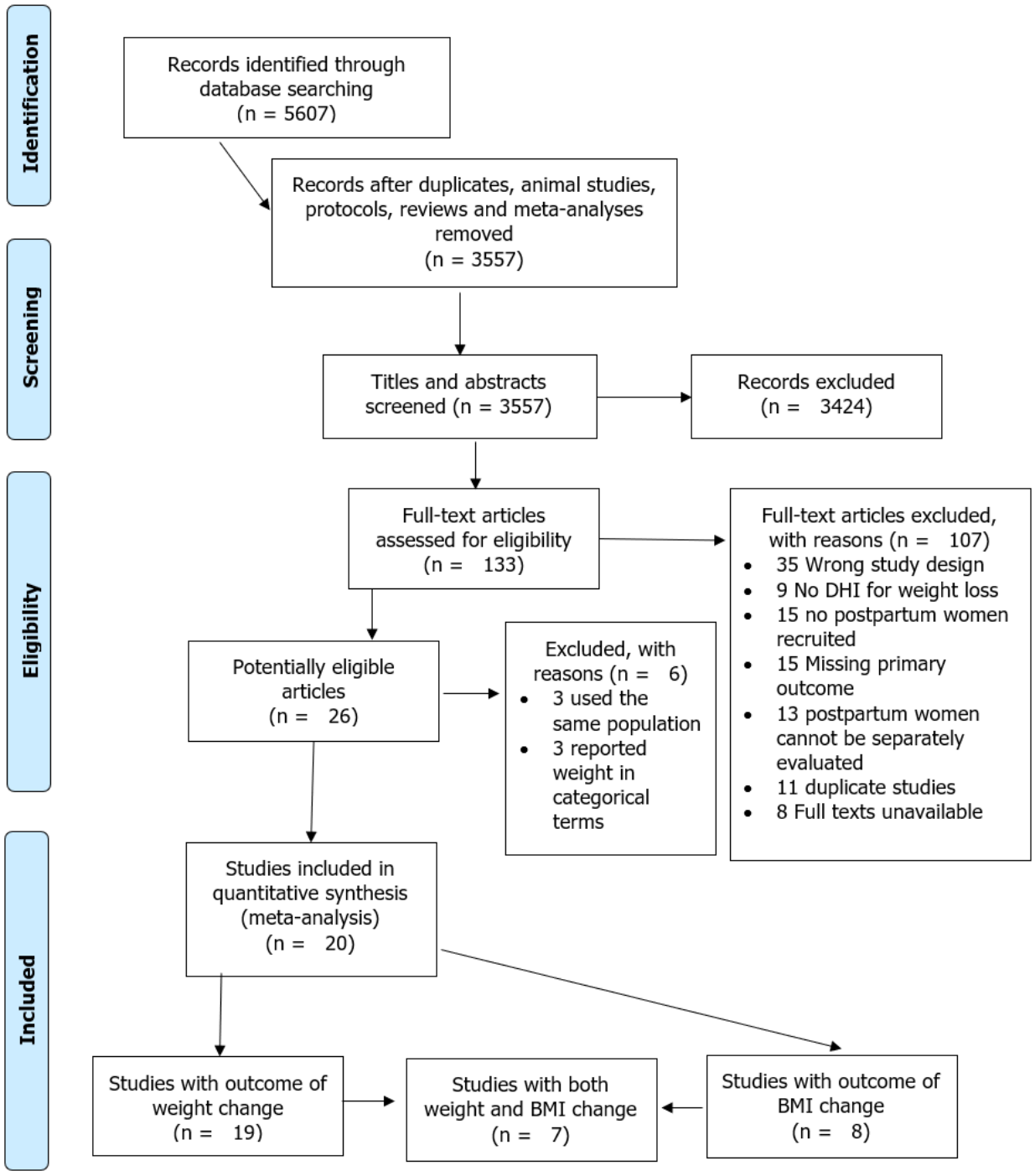
No additional studies from reference lists nor grey literature were added for the review. Six other potentially eligible studies were excluded as 3 had used the same population reported in other included studies and 3 reported weight change in categorical terms (e.g., proportion of women meeting weight goal). Twenty articles from the full text review met eligibility for inclusion into the final review.

Nineteen (out of 20) studies assessed weight change, 1 reported only BMI change, while 8 (out of 20) reported both weight change and BMI change.

Inter-rater reliability between reviewers

Screeners for titles and abstracts (LR and CG) had an agreement rate of 0.93. All disagreements were resolved by consensus.

Figure 4. Study Flow Diagram



Characteristics of included studies

Table 4 summarizes characteristics of the 20 included studies. Included studies were published between 1998 and 2019 from 6 different countries. A total of 3228 women were included for analysis of body weight change, while 458 women were included for BMI change. There were 19 RCTs and 1 quasi-experimental study. Eleven were pilot or feasibility studies.

Characteristics of participants

There was a varied target population for the included studies as summarized in **Table 5**. Major targets were women with gestational diabetes mellitus, overweight or obese, deprived communities and minorities. For those that reported postpartum gestational age at baseline, the range was from 4 weeks to 8 months. Several studies reported baseline comorbidities or risk factors that could affect or be affected by weight change i.e., smoking, hypertension and depression. One study excluded breastfeeding women while 2 required lactating/breastfeeding women.

Characteristics of Interventions

While several studies may have used a combination of in-person or conventional lifestyle intervention with DHIs, Table **6** summarizes the DHI components of these interventions. The most used classifications were telemedicine and targeted client communication.

All interventions were longer than 12 weeks (range 12 – 52 weeks; mean 25.45 weeks). Twelve interventions were targeted at individuals only with the remaining 8 targeting both the individual and a group. Sixteen interventions were delivered remotely versus 4 that combined both remote and facility-based components.

Attrition within the intervention groups ranged from 0% to 85%.

Table 4. Characteristics of included studies

First Author, Year of publication	Location/ Country	Study Design	Sample Size	Outcomes of interest reported
Cheung 2019 (34)	Sidney, Australia	RCT	60	BW
Colleran 2012 (35)	North Carolina, USA	RCT	31	BW, BMI
Craigie 2011 (36)	Scotland	RCT	52	BW, BMI
Ferrara 2015 (37)	California, USA	RCT	2280	BW
Gilmore 2017 (38)	Baton Rouge, USA	RCT	40	BW
Gross 2018 (39)	Baltimore, USA	RCT	53	BW
Herring 2014 (40)	Philadelphia, USA	RCT	18	BW
Herring 2017 (41)	Philadelphia, USA	RCT	66	BW
Holmes 2018 (42)	Northern Ireland	RCT	60	BW, BMI
Kernot 2018 (43)	Adelaide, Australia	RCT	120	BMI
Leermakers 1998 (44)	Pittsburgh, USA	RCT	90	BW
Maturi 2011 (45)	Abadan, Iran	RCT	70	BW, BMI
McIntyre 2012 (46)	Australia	RCT	28	BW
McManus 2017 (47)	Canada	RCT	170	BW, BMI
Nicklas 2014 (48)	Boston, USA	RCT	75	BW, BMI
Østbye 2009 (49)	Durham, USA	RCT	450	BW

Phelan 2017 (50)	California, USA	RCT	371	BW
Reinhardt 2012 (51)	New South Wales, Australia	RCT	38	BW, BMI
van der Pligt 2017 (52)	Melbourne, Australia	Quasi-Experimental	160	BW
Walker 2012 (53)	Texas, USA	RCT	71	BW

Table 5. Characteristics of participants

Study	Participants	Postpartum age	Medical History	Physical Activity	Breastfed
(34)	Women with GDM	10 weeks	Gestational DM	150 min Moderate Intensity: Intervention (50%) Controls (65%)	
(35)	Lactating overweight/obese postpartum women	4 weeks			100%
(36)	Postpartum women living in deprived communities		13% smokers		
(37)	Women with GDM	6 weeks	GDM (100%), Hypertension (7.1%), Depression (19.4%)	59.4% Moderate physical activity.	
(38)	Overweight and obese postpartum women				65%
(39)	Obese African-American women				
(40)	Overweight/obese, socioeconomically disadvantaged, ethnic minority women.	4 months	Depression 11%	83% walked at least 10 minutes at a time several days per week.	22%
(41)	Overweight/obese African-American women				

(42)	Overweight/obese pregnant women with a history of GDM in their recent pregnancy	9 weeks	GDM		35%
(43)	Postpartum women	26 weeks			68%
(44)	Postpartum women	8 months			0%
(45)	Postpartum women	12 weeks			100%
(46)	Women with recent GDM		GDM	0 min/week	
(47)	Overweight English-speaking women with recent GDM		GDM		
(48)	Women with recent GDM	7 weeks	Gestational DM. Depression (35%)		32%
(49)	Postpartum women		Depression 8%		35%
(50)	Postpartum women	5.2 weeks			62.4%
(51)	Women with GDM		GDM		
(52)	First-time parents				
(53)	White/Anglo, African American, and Hispanic low-income postpartum women	6 weeks			67.6%

Table 6. Description of digital health interventions

Study	Description of DHI	Weeks	Delivery	Site
(34)	**SMART MUMS WITH SMART PHONES**: Education and support via text messages (3 per week). Fitbit Flex® activity monitor and an accompanying mobile phone app that was integrated with the texting (1 text per week from 6wks postpartum). Diet counselling session by phone at 10 - 12 weeks postpartum. Yamax Digi-walker SW700® pedometers for 7 days at 36wks postpartum.	26	Individual	Home
(35)	Sixteen-week combined exercise and diet intervention from 4 weeks postpartum. Individual **MyPyramid Menu Planner for Moms** accounts were created for each participant. A 30-minute, face-to-face orientation counselling session. Encouraged to log in to MyPyramid 3 days per week. Research assistants provided home-based child care, exercise sessions and dietary counselling.	16	Individual	Home
(36)	Lifestyle counselling via 3 face-to-face sessions monthly and 3 structured calls. Pedometer provided for self monitoring.	12	Individual	Home
(37)	Optional print/telephone-based DPP-derived lifestyle program delivered by coaches from 6 weeks to 6 months postpartum. Mailed a guidebook and were reviewed via telephone.	20	Individual	Home
(38)	Personalized lifestyle intervention through the **SmartLoss** with: real-time activity and weight monitoring; interventionist feedback and health information (SmartTips) that were automatically sent weekly. BodyTrace scale with weights above or below the zone for 3	16	Individual	Home

	consecutive days triggering remote supportive personalized treatment advice. Fitbit Zip accelerometer.			
(39)	Standard WIC plus 5 healthy eating lessons each with brief video which summarized key messages. One telephone counselling session at 5 months. Weekly text messages to reinforce lessons.	26	Both	Both
(40)	Biweekly 15-minute calls with health coach. Text messaging and Facebook-delivered skills training and self-monitoring. Daily tailored strategy text messages, 3 to 4 self-monitoring texts weekly with immediate personalized automatic feedback. Facebook group support forums with links to web sites and videos. Self weighing with digital scales and tracking daily steps via pedometers.	14	Both	Home
(41)	Two components: Pregnancy (baseline to 36weeks) and postpartum. Postpartum: week 10 to 6 months. Behaviour change goals text messages. Skills training and support by: daily tailored skill building text messages, weekly posts on Facebook linking to other websites and videos, and scheduled 15-minute calls with a coach. 3–4 times weekly self-monitoring texts. Self weighing with digital scales and tracking daily steps via pedometers.	16	Individual	Home
(42)	Sixty-minute group educational session at 6-weeks postpartum. Free 3 months membership to a commercial weight management organization (CWMO). Sealed piezoelectric pedometer. Text weekly for 1 month then fortnightly by a health educator (HE). Structured telephone calls monthly by HE. Educational DVD (as usual care group).	26	Individual	Home
(43)	**MSIU Facebook app**. Pedometer: 50-day walking challenge with a target of half a million steps per person. Daily physical activity tip, automated e-mails, reminders and summaries of achievements. Facebook push notifications to the group when team members posted.	26	Both	Home

(44)	Two group sessions. Scheduled correspondence material with 16 lessons mailed over the duration of the intervention. Weekly or biweekly telephone calls on diet, physical activity, goals and troubleshooting.	26	Both	Both
(45)	Participants continuously wore a pedometer except when sleeping or bathing. 10,000 steps as a final target by the 12th week. Baseline individualized counselling session. Weekly reminders about physical activity via text messages and fortnightly phone calls. Weight loss pamphlet.	12	Individual	Home
(46)	Scheduled support by telephone after an initial face-to-face exercise consultation.	12	Individual	Home
(47)	Participants provided with a healthy living pamphlet and a face-to-face seminar with the coach. Access to a password-protected website and a 1-hour weekly walking group. Automatic e-mails with diabetes prevention tips twice month.	52	Both	Home
(48)	Private access to the **Balance after Baby** web site with scheduled animated videos of 12 core and 10 optional modules. Scheduled telephone or e-mail contact with the lifestyle coach. Online feedback/data forms. Pedometers.	46	Individual	Home
(49)	**Active Mothers Postpartum (AMP)**: 8 healthy-eating sessions 10 physical-activity group sessions and 6 20-minute telephone-counselling sessions. Study notebook. Pedometer. Sport stroller. Biweekly newsletters with general tips.	36	Both	Both
(50)	Twelve-month internet-based weight loss program: Text or video resources and lessons, automated feedback, online weight and activity tracking. Four text messages weekly and mmonthly physical group sessions. Pedometer.	52	Both	Both
(51)	Ten prearranged telephone-based sessions, 30-minutes, over the course of the intervention.	26	Individual	Home

(52)	Pedometer. **SMART** goal setting chart. Online behaviour therapy website **(CALORIEKING**). Optional iPhone app after 1 month. Three 30-minute motivational interviewing and health coaching strategies calls with dietician. Optional online group discussion page.	36	Both	Home
(53)	Weekly telephone counselling support on mailed materials containing nutrition, physical activity, and behavioural strategies.	13	Individual	Home

Table 7. Main DHI classifications per study

Study	WHO DHI Classification				
	Targeted client communication	Client-to-client communication	Personal health tracking	On-demand information services	Telemedicine
(34)	**+**	**-**	**+**	**-**	**+**
(35)	**-**	**-**	**+**	**-**	**+**
(36)	**-**	**-**	**+**	**-**	**+**
(37)	**-**	**-**	**-**	**-**	**+**
(38)	**+**	**-**	**+**	**-**	**+**
(39)	**+**	**-**	**-**	**-**	**+**
(40)	**+**	**+**	**+**	**+**	**+**
(41)	**+**	**-**	**+**	**+**	**+**
(42)	**+**	**-**	**+**	**-**	**+**
(43)	**+**	**+**	**+**	**+**	**-**
(44)	**-**	**-**	**-**	**-**	**+**
(45)	**+**	**-**	**+**	**-**	**+**
(46)	**-**	**-**	**-**	**-**	**+**
(47)	**+**	**-**	**-**	**+**	**-**
(48)	**+**	**-**	**+**	**+**	**+**
(49)	**+**	**-**	**+**	**-**	**+**

(50)	**+**	**+**	**+**	**+**	**+**
(51)	**+**	**-**	**-**	**-**	**+**
(52)	**+**	**+**	**+**	**-**	**+**
(53)	**+**	**-**	**-**	**-**	**+**

Table 8. Attrition within intervention groups per study

Study	Attrition
Ferrara 2015	85%
Cheung 2019	53%
Gross 2018	52%
McManus 2017	44%
van der Pligt 2017	30%
Holmes 2018	28%
Leermakers 1998	27%
Craigie 2011	24%
Walker 2012	24%
Kernot 2018	20%
Reinhardt 2012	17%
Herring 2014	11%
Phelan 2017	10%
Herring 2017	9%
Maturi 2011	8%
Nicklas 2014	8%
McIntyre 2012	7%
Gilmore 2017	5%
Colleran 2012	0%
Østbye 2009	0%

Effect of DHIs on Body Weight Change

Eighteen RCTs and 1 quasi-experimental study with 3228 women reported outcomes on body weight, with 7 showing significant weight loss for the DHIs. Pooled analysis showed DHIs were associated with significant weight loss of -1.41 Kg (95% CI: -2.04 to -0.77 Kg; Figure **5**). Omission of the non-RCT did not significantly change the trend (Figure **6**). Substantial heterogeneity was observed (I^2 = 50%).

Subgroup analysis showed interventions using on-demand information services had higher weight loss (-2.4 Kg, 95% CI: -3.4 to -1.41 Kg) while telemedicine had the least weight loss (-1.43 Kg, 95% CI: -2.06 to -0.08 Kg; Figure **7** to Figure **11**). Home-based interventions had a weight loss of -1.35 Kg (95% CI: -2.13 to -0.57 Kg) compared to mixed site interventions weight loss of -1.62 Kg (95% CI: -2.99 to -0.25 Kg; Figure **12**).

Interventions targeting individuals had a weight loss of -1.3 Kg (95% CI: -2.11 to -0.49 Kg). Interventions that targeted groups or both an individual plus the group had a weight loss of -1.67 Kg (95% CI: -2.89 to -0.46 Kg; Figure **13**)

Sensitivity analysis on removal of pilot/feasibility studies or those with overall high risk of bias did not change the overall effect significantly (Figure **14** and Figure **15**).

Funnel plot was symmetrical suggesting no evidence of significant reporting bias (**Figure 16**).

Figure 5. Pooled weight loss

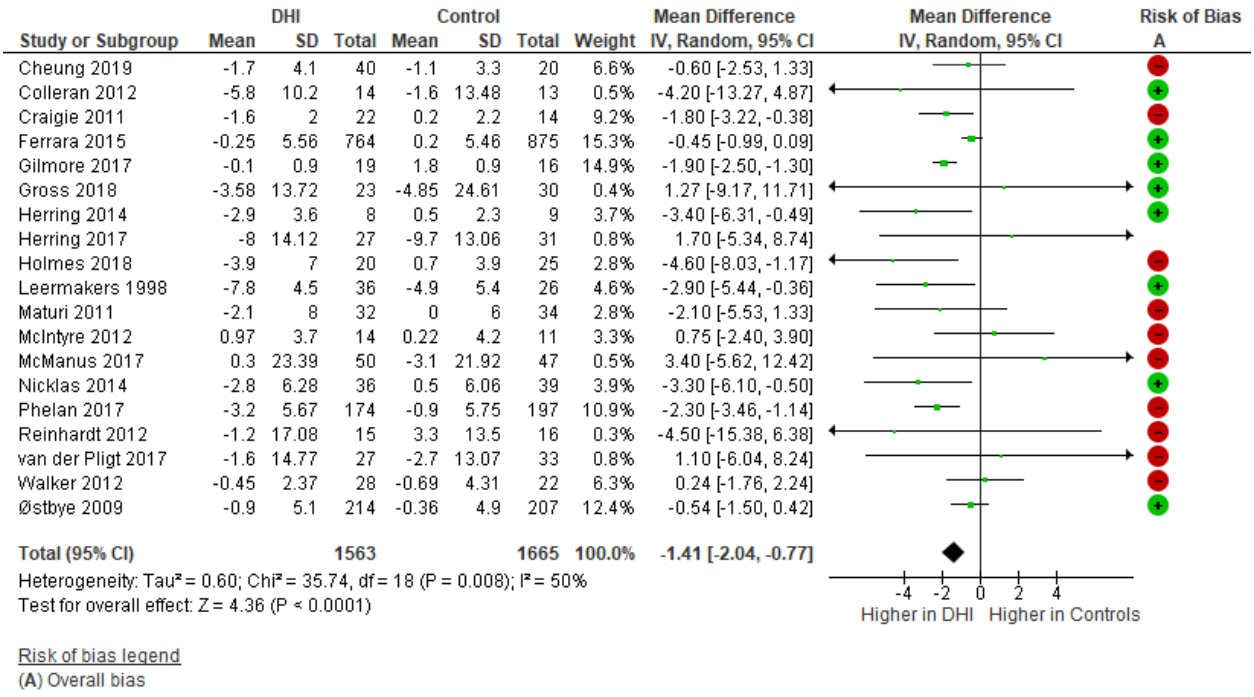
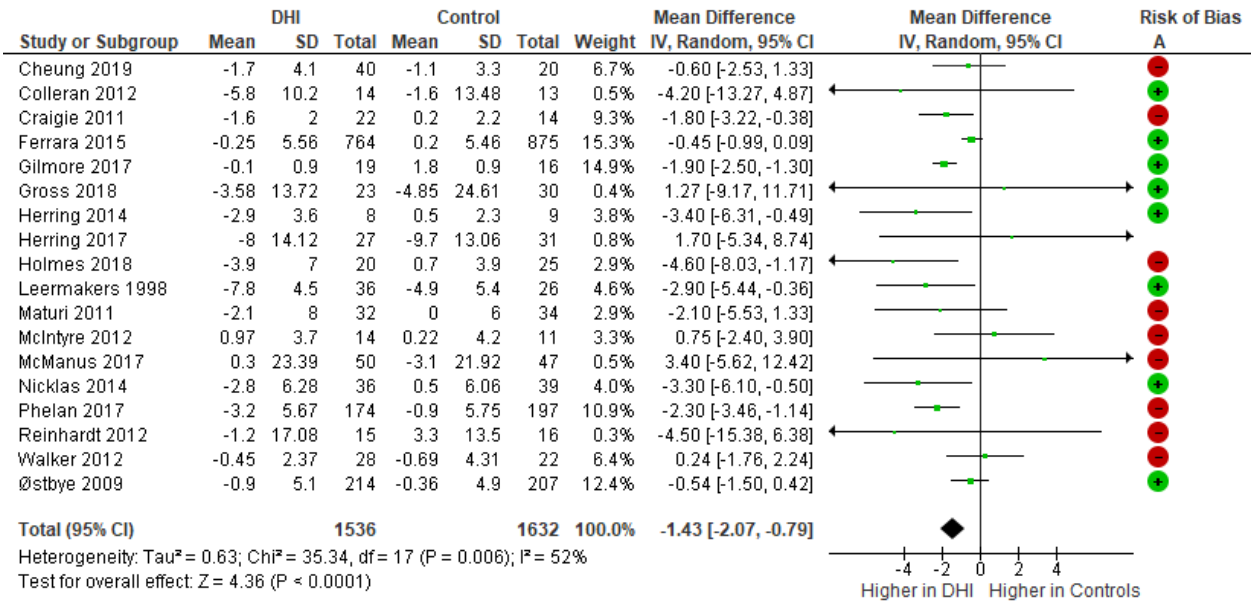


Figure 6. Weight loss excluding Non-RCTs



Risk of bias legend
(**A**) Overall bias

Figure 7. Targeted client communication

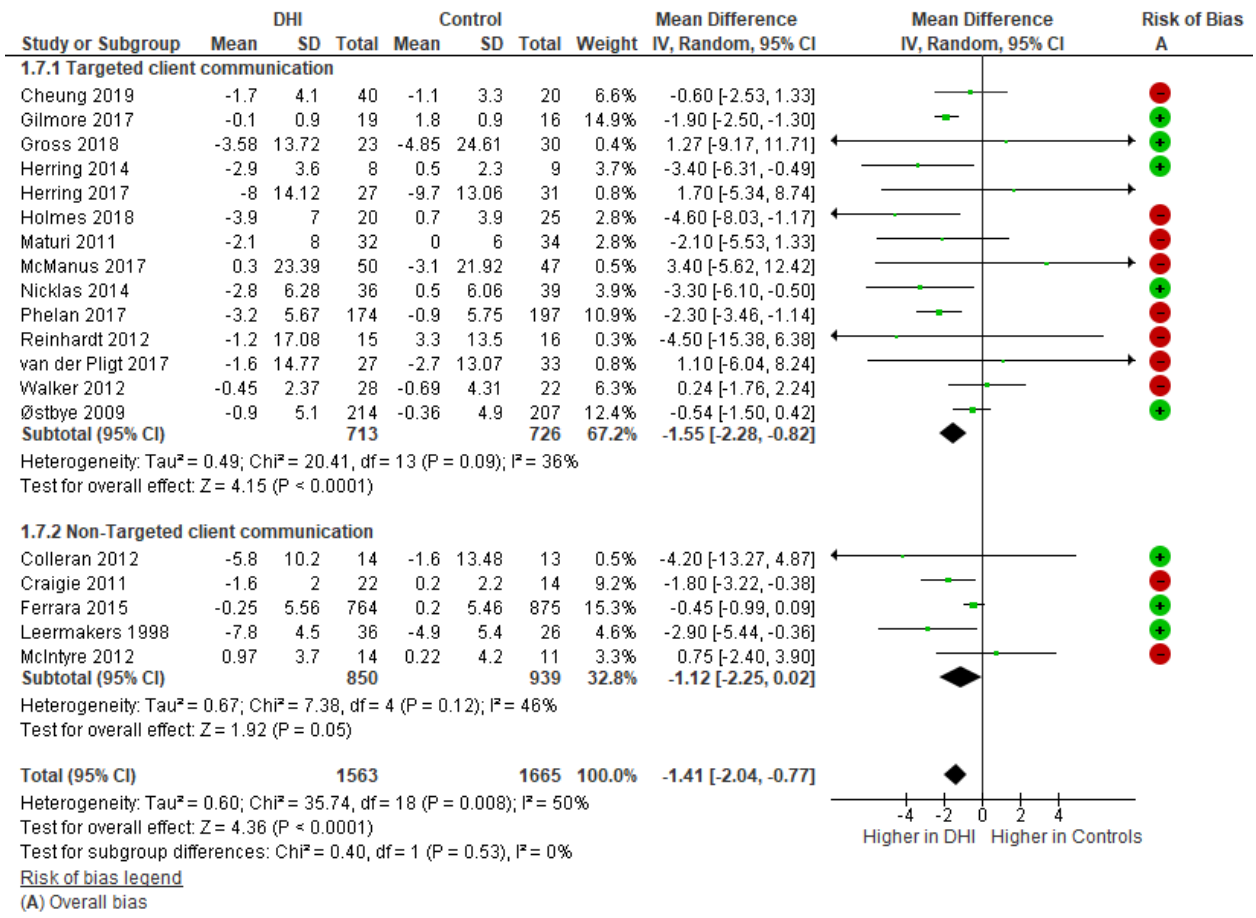


Figure 8. Client-to-client communication

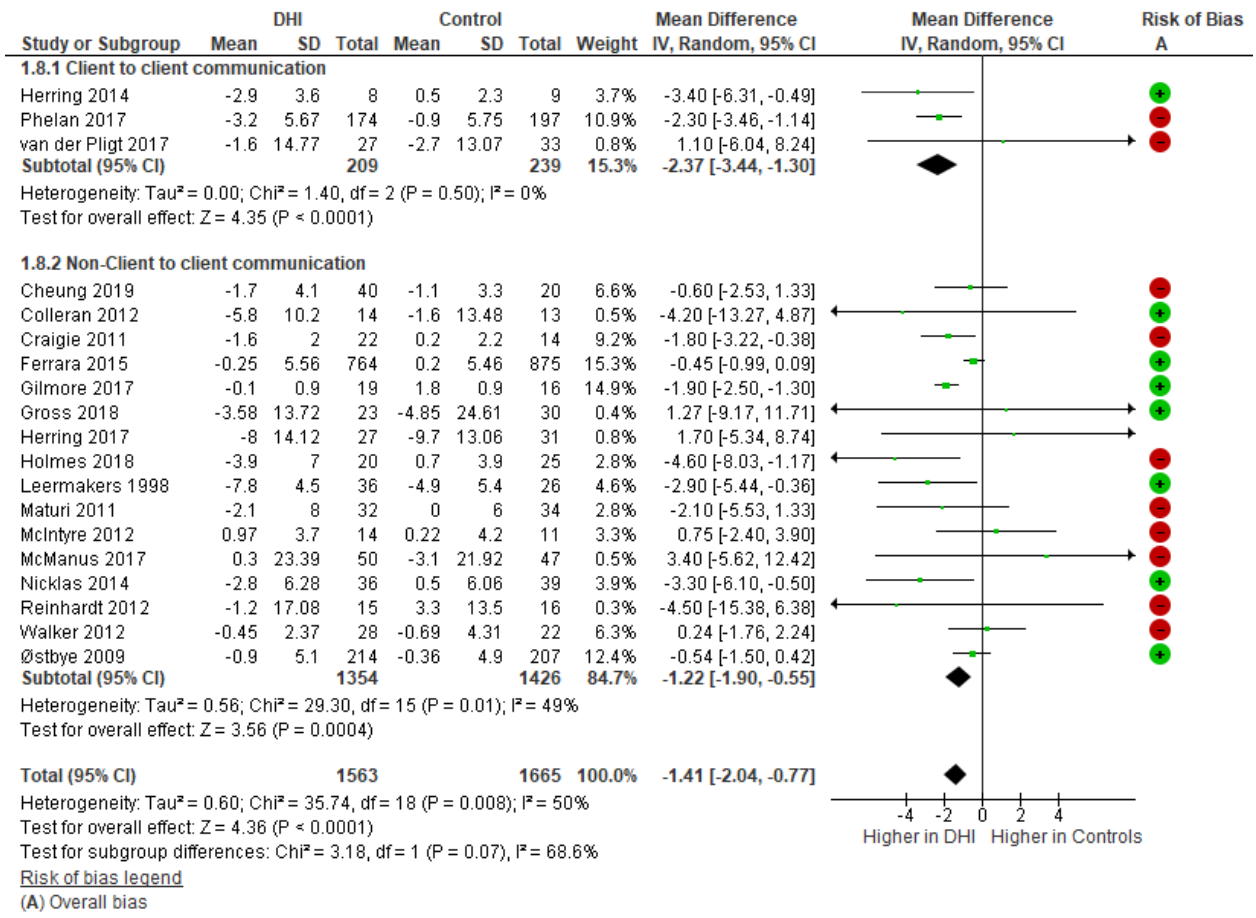


Figure 9. Personal health tracking

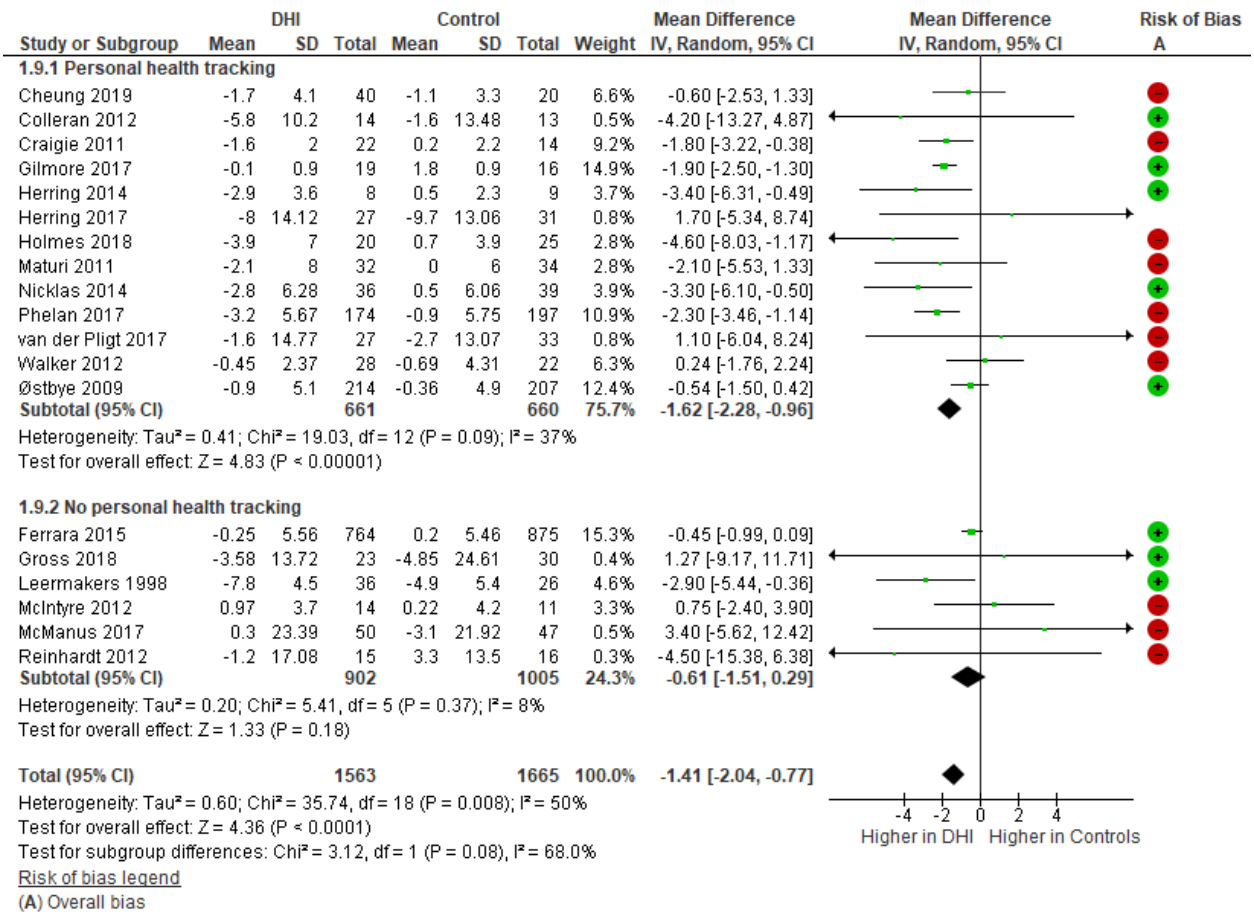


Figure 10. On-demand information services

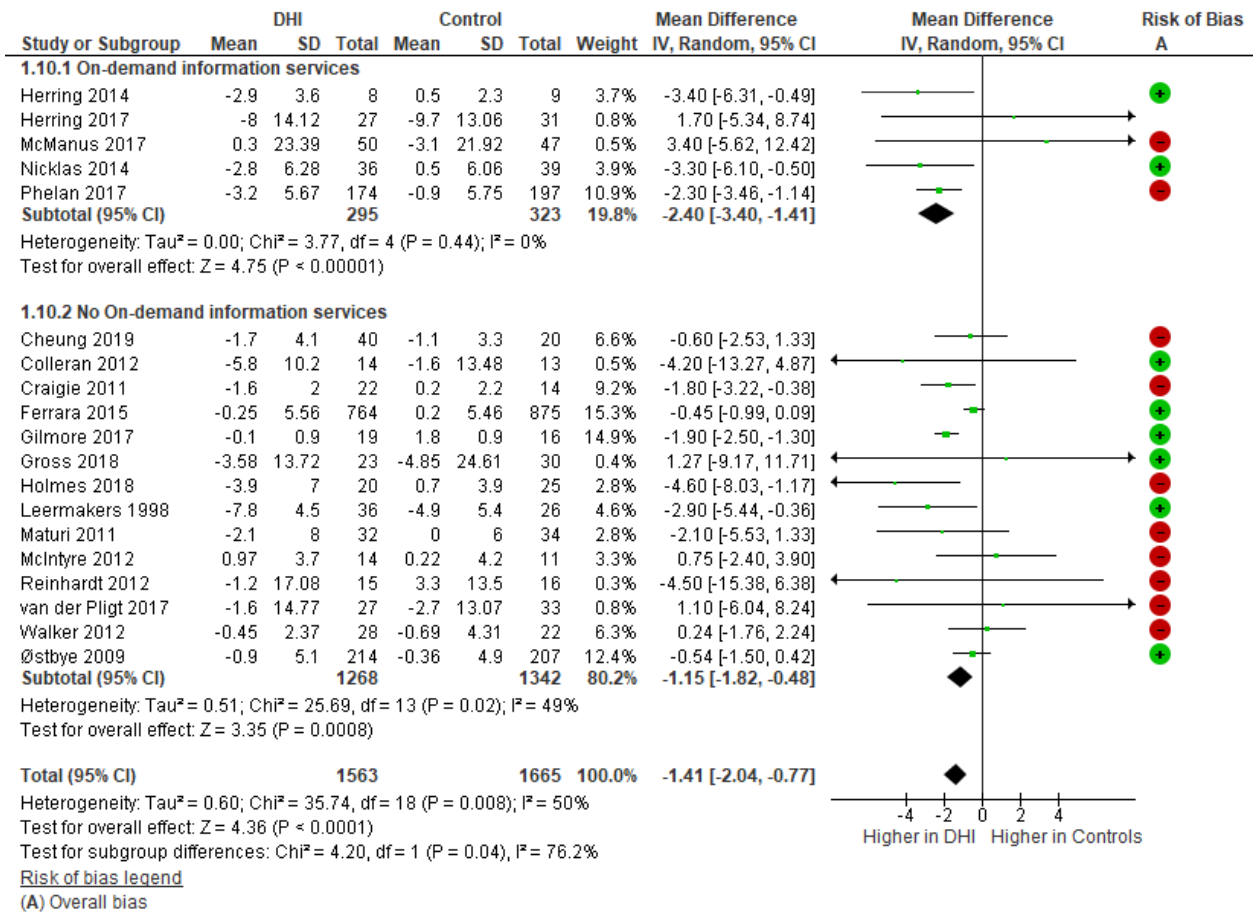


Figure 11. Telemedicine

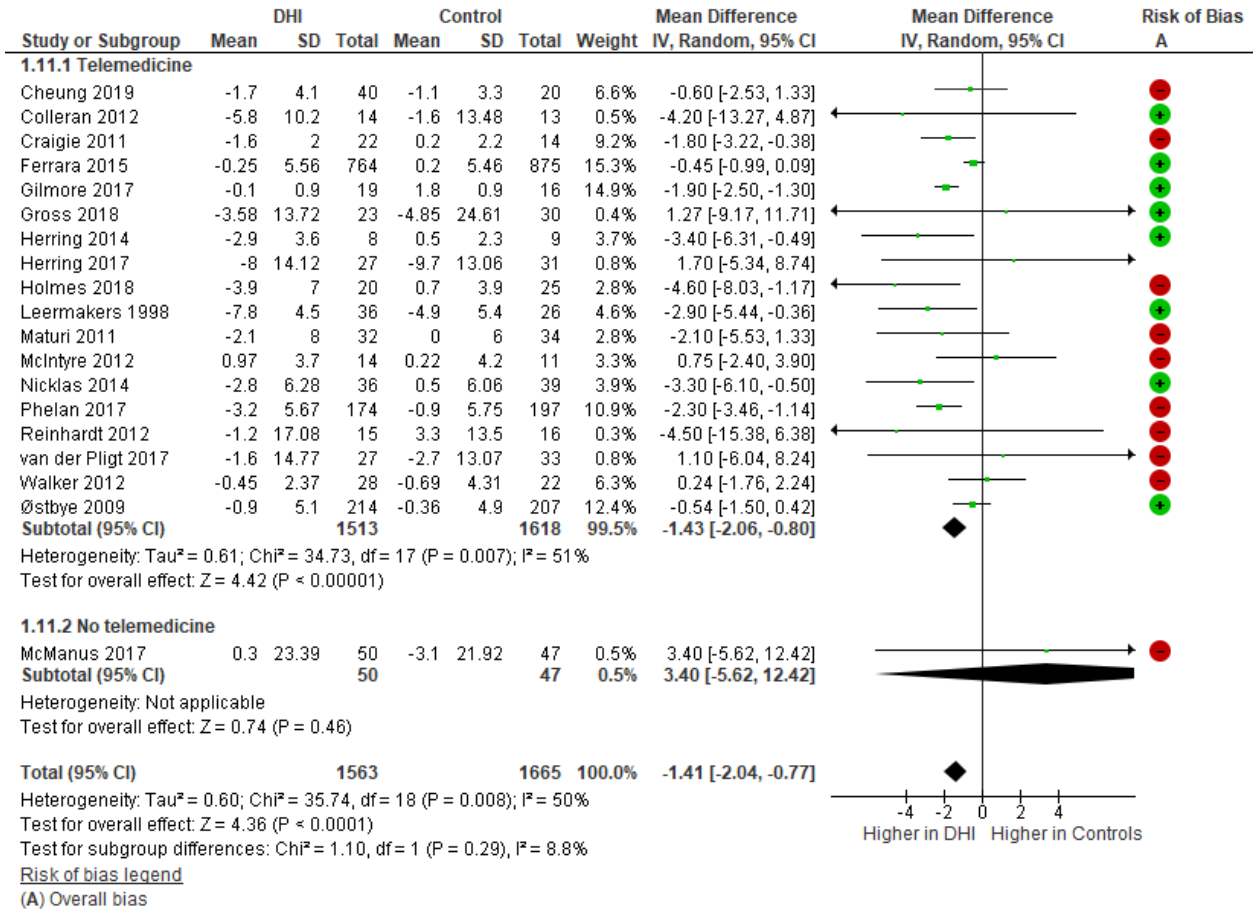


Figure 12. Effect size by intervention site

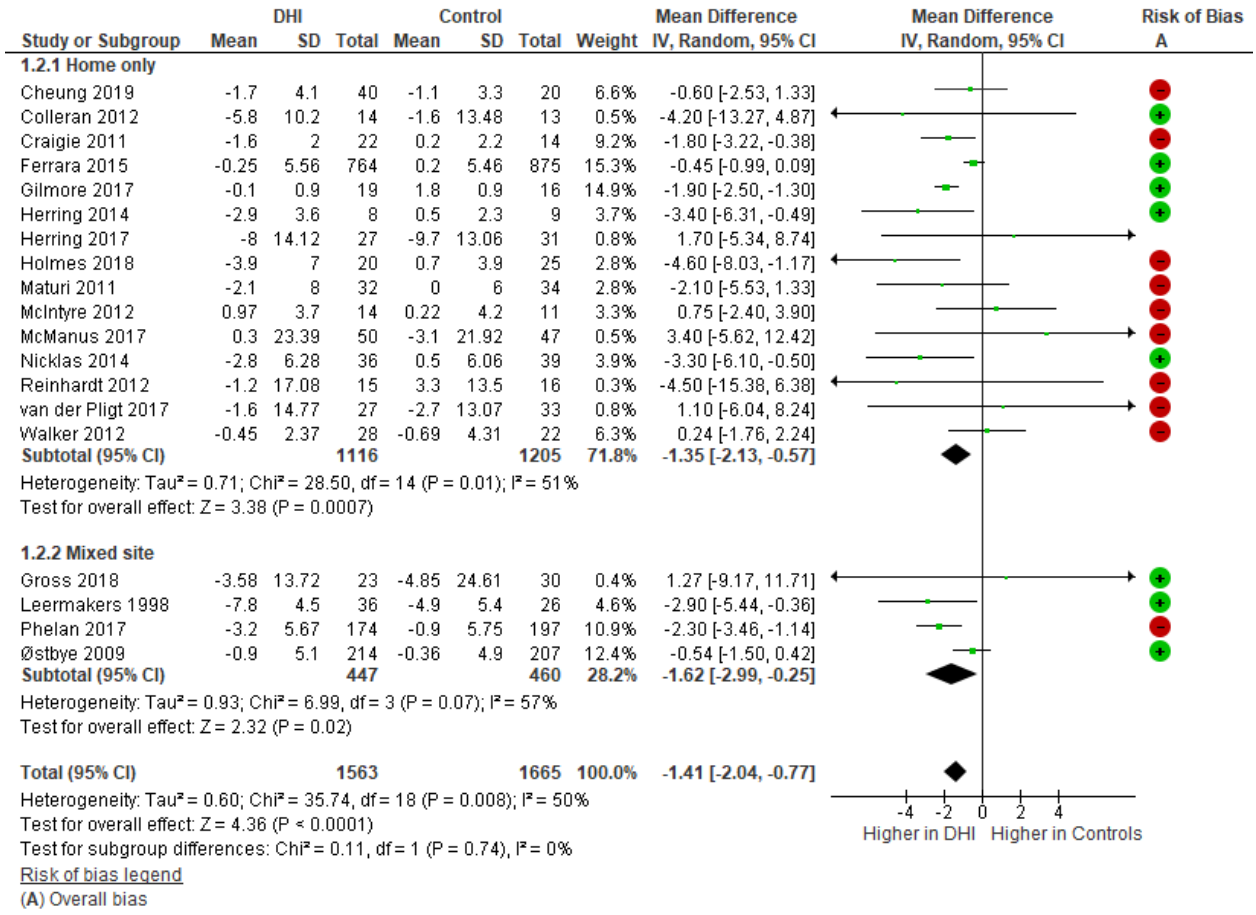


Figure 13. Individual-only Vs mixed target interventions

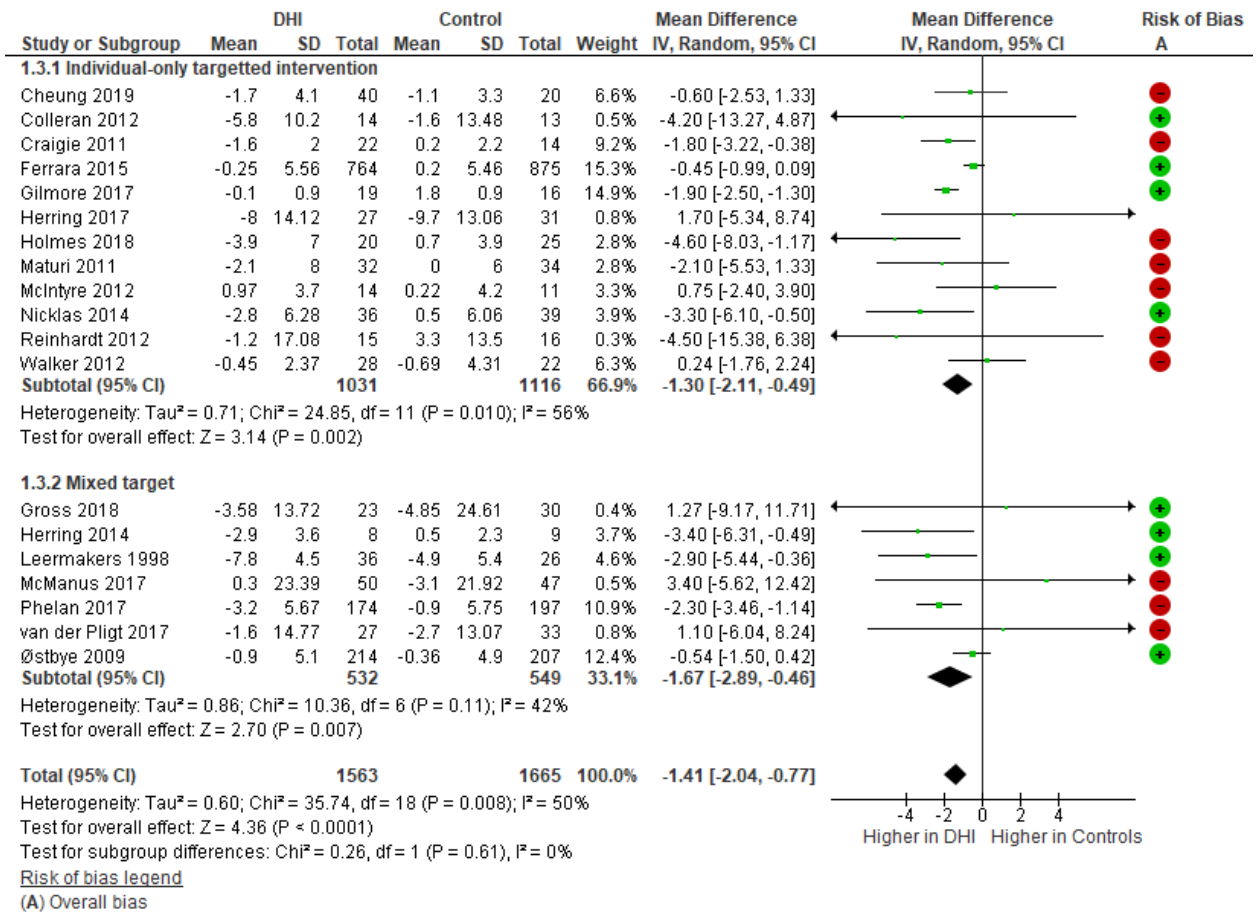


Figure 14. Excluding pilot/feasibility studies

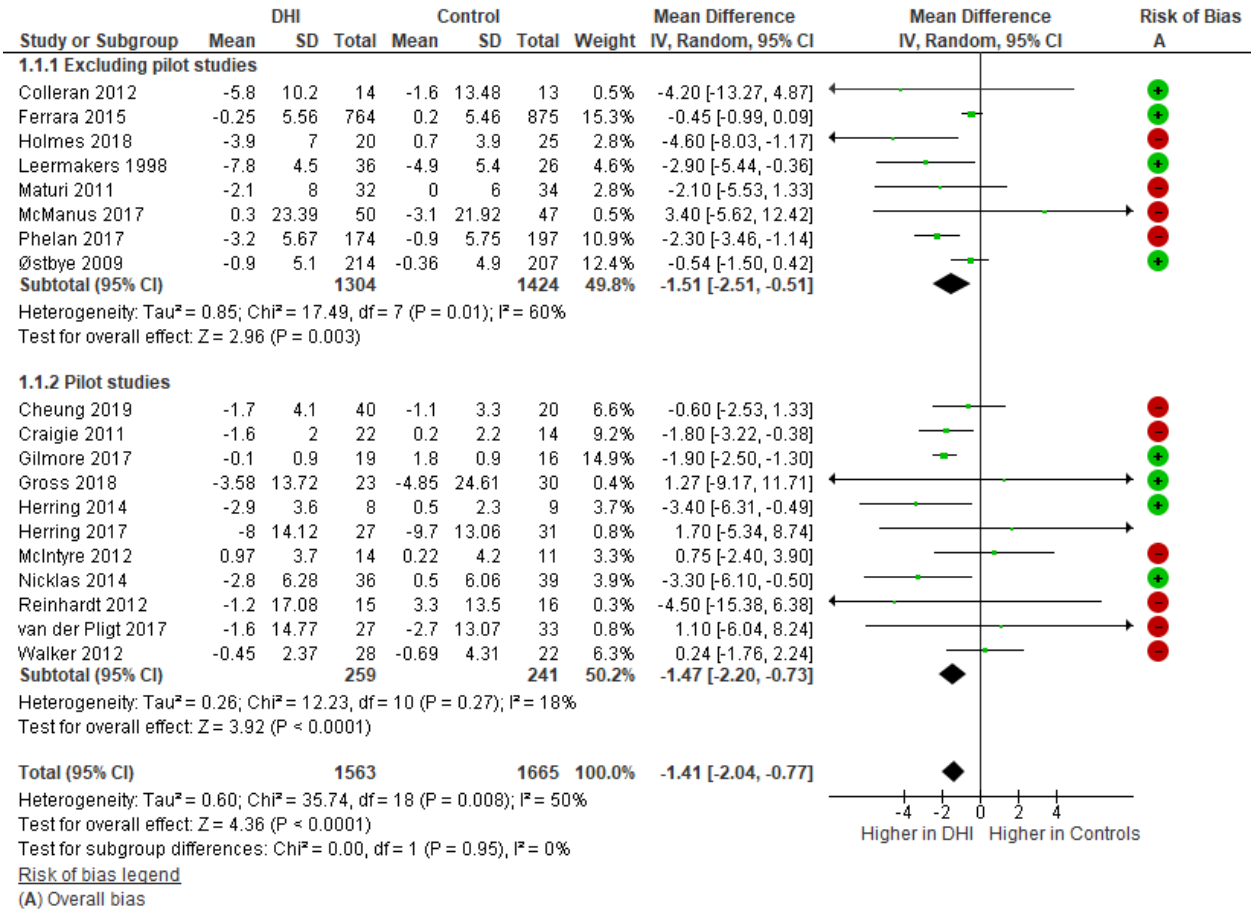


Figure 15. Excluding high risk of bias

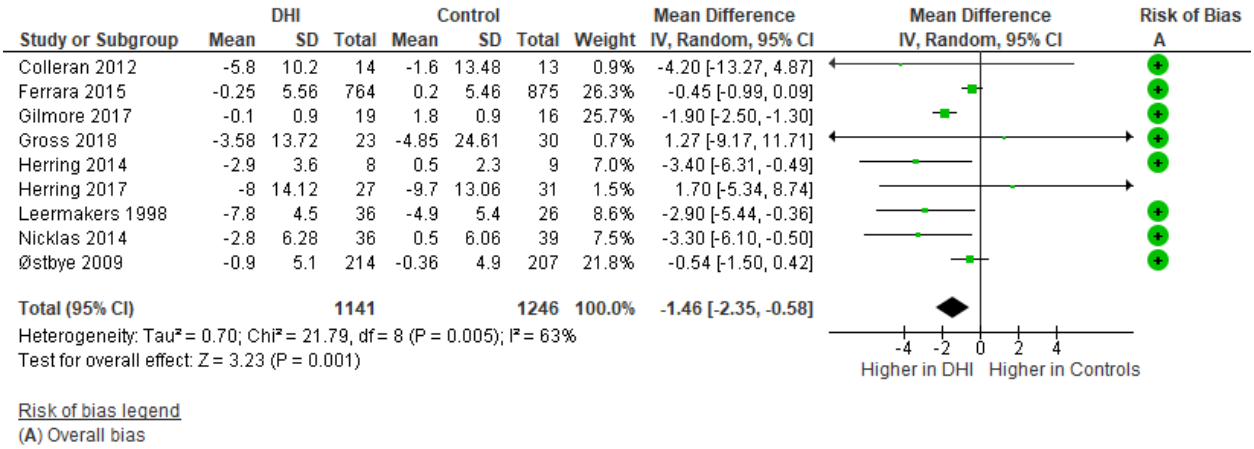
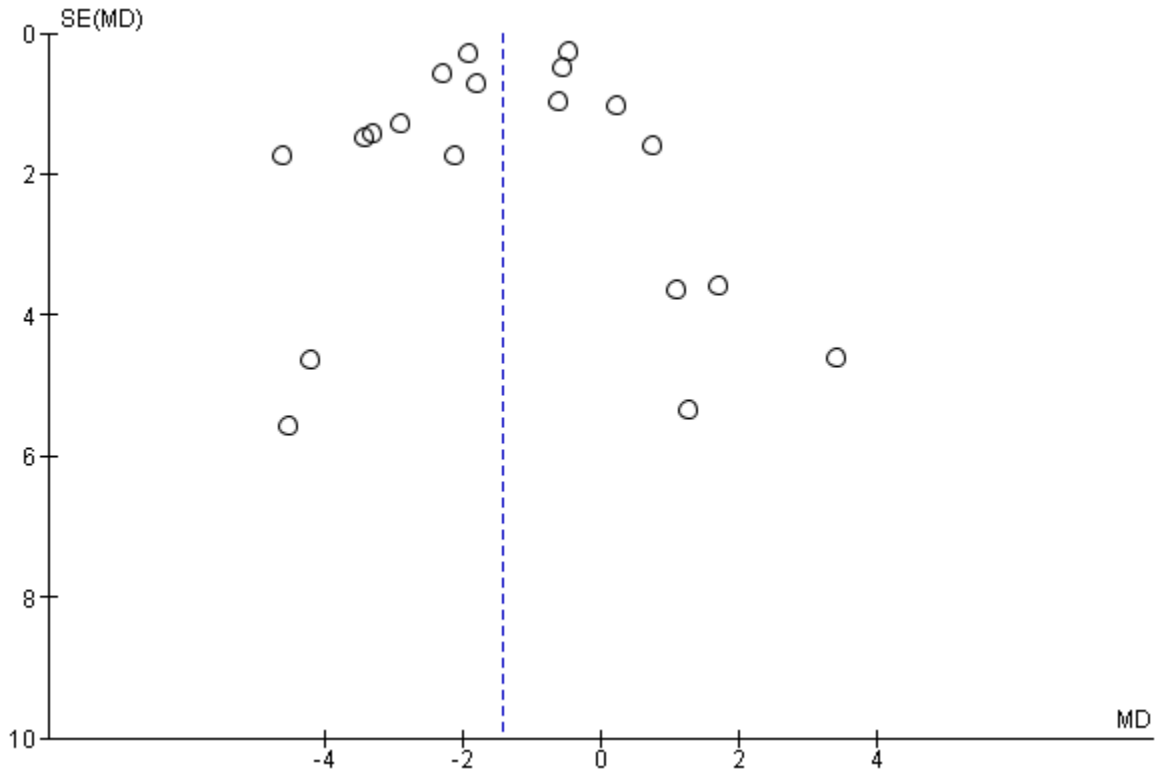


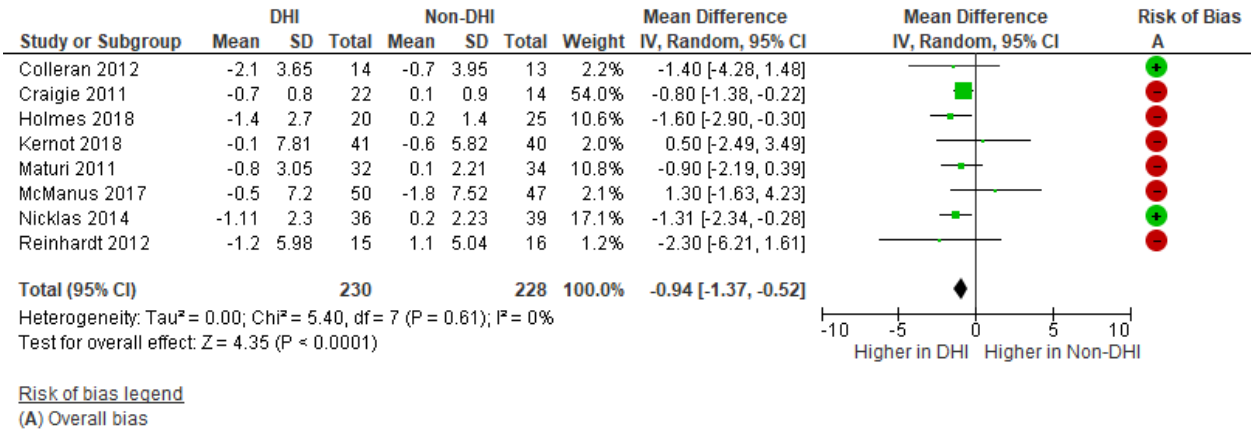
Figure 16. Funnel plot



Effect of DHIs on BMI change

Eight RCTs with 458 women reported on BMI, with 3 showing significant BMI reduction for DHIs. Pooled analysis showed DHIs were associated with significant BMI reduction of -0.94 Kg/m^2 (95% CI: -1.37 to -0.52 Kg/m^2). Subgroup and sensitivity analyses were not done for this outcome due to small number of studies.

Figure 17. Pooled change in BMI



Risk of bias legend
(A) Overall bias

Summary of study conclusions

A majority of studies concluded that DHIs had either greater weight loss or showed a trend towards this outcome. They also showed feasibility and potential for scalability of these interventions as a number of the included studies were pilot studies.

DHIs were shown to be a useful aid for behaviour change in aspects such as counselling, lifestyle skills acquisition and improving engagement within the programs.

Postpartum women's needs were catered for better with the DHIs as they preferred and were pleased with home interventions while showing low participation with face-to-face or communal activities. Furthermore, interventions outside the home were unlikely to affect weight loss.

Risk of bias in included studies

For RCTs assessing change in body weight, 9 of the 18 were judged to be of high risk of bias with the 1 quasi-experimental study judged to be of weak global rating. The overall bias was largely affected by the "missing outcome data" domain.

Only 1 RCT was judged to have "some concerns" with regards to the randomization process domain. For that study, even with randomization, the Caucasian intervention group had a baseline BMI significantly lower than the other ethnic groups.

One RCT was judged to have "high risk" in the deviations from intended interventions domain. This study did not apply an intention-to-treat approach in its analysis and excluded from it a significant proportion of participants post-randomization.

Eight RCTs were judged to have "high risk" in the missing outcome data domain. This was due to high attrition rates ranging 10.7% - 41%. Attrition from the number randomized at baseline was used as a proxy to judge amount of missing data. For one study, the amount of missing data could not be assessed. This domain heavily influenced the overall bias for these studies.

One RCT was "high risk" and 1 had "some concerns" in the measurement of the outcome domain. In the former, self-reported weights from participants were used for analysis. For the latter there was concern on procedures used by clinic staff versus research staff for measuring weight.

The selection of reported results domain was judged as "low risk" for all studies.

The non-RCT was rated weak in the selection bias and blinding domains. Major contributors to these weak ratings were less than 60% of selected individuals agreed to participate and no clarity if outcome assessors were aware of the participants' assignments.

Table 9. Summary of conclusions

Study	Conclusions
Cheung 2019	Text messages and physical activity monitor are feasible and scalable population health interventions through improving diet, physical activity, and weight loss.
Colleran 2012	MyPyramid Menu Planner was a helpful postpartum counselling tool for weight loss through change of dietary habits.
Craigie 2011	The program showed promising effectiveness for postpartum weight loss. Pregnancy rates during intervention suggests that it may be best offered within the year postpartum. Home visits were the preferred mode of intervention delivery.
Ferrara 2015	The DHI for women with GDM was better in reducing PPWR and increasing physical activity with relatively modest cost per woman.
Gilmore 2017	Overall, the intervention did not decrease PPWR although it was effective in those who adhered to the program.
Gross 2018	Potentially feasible and effective DHI.
Herring 2014	Greater weight loss with the DHI compared to usual care especially when participants completed more coaching calls. Dietary behaviours, more than physical activity, influenced the effect. All participants found the program extremely successful while 80% found the skills and resources useful.
Herring 2017	Weight loss intervention during pregnancy and postpartum improved anthropometric outcomes at 6 and 12 months. Late postpartum weight increase may be countered by longer intervention duration.
Holmes 2018	Intervention produced significant reduction in anthropometric measures without improvements in plasma glucose levels.
Kernot 2018	No significant effects for anthropometric nor secondary physical activity outcomes.

	High participant engagement suggests good feasibility for social network interventions.
Leermakers 1998	Correspondence intervention was effective in reducing excess postpartum weight especially via self-monitoring and feedback. Drop-outs may have been the best targets for the intervention. PPWR was the strongest predictor for return to pre-pregnancy weights.
Maturi 2011	Intervention significantly increased energy expenditure and anthropometric measures.
McIntyre 2012	The DHI is feasible but no significant differences in physical activity nor weight were observed.
McManus 2017	DHI did not result in more weight loss, healthier anthropometric measures nor glycated haemoglobin levels. There were low engagement levels with group activities and high relapse rates to unhealthy lifestyles.
Nicklas 2014	The DHI was feasible and effective in reducing PPWR and caloric intake even up to 12 months.
Østbye 2009	DHI did not show significant difference in dietary, physical activity, nor weight measure. Non-home-based group interventions are unlikely to influence weight loss.
Phelan 2017	The DHI was effective in producing significant weight loss across all demographic characteristics and could be cheaper than traditional in-person methods. No significant difference in diet nor physical activity outcomes.
Reinhardt 2012	DHI produced significant reductions in body weight, BMI, total fat intake, carbohydrate intake while increasing time physical activity.
van der Pligt 2017	DHI could only show positive trend in reducing waist circumference.
Walker 2012	No significant differences in weight change although the DHI participants were more pleased with their assignment.

DISCUSSION

Main results

The review on the effect of DHIs on body weight included 19 studies reporting on 3228 postpartum women mainly with diabetes, obesity or minorities. The pooled effect was a significant weight loss of -1.41 Kg (95% CI: -2.04 to -0.77 Kg) associated with the DHIs. Lifestyle and behaviour change strategies within these interventions were key to producing weight loss. In some interventions both the intervention groups and the controls were given similar lifestyle advice with some controls losing weight. However, the delivery through the DHIs ensured continuous support that gave a significant advantage over the controls. There are few reviews looking at DHIs for postpartum weight loss. Sherifali and Christiansen strictly reviewed ICT-based interventions (23, 25). Both reviews found similar significant effectiveness of DHIs on weight loss in postpartum women.

The importance of continuous or regular support is highlighted when looking at the attrition rates. Attrition rates within the intervention groups ranged from 0 – 85%. Lowest attrition was noted in studies such as Østbye et al, where regular contact sessions were common. This points to DHIs being an effective and scalable option for weight loss especially when a program requires regular/continuous support.

Interventions delivered both at home and a facility had greater weight loss of -1.62 Kg (95% CI: -2.99 to -0.25 Kg) compared to home-only interventions' weight loss of -1.35 Kg (95% CI: -2.13 to -0.57 Kg). This was in keeping with greater weight loss for interventions that targeted both the individual and a group (-1.67 Kg) compared to those that only tarted the individual (-1.3). Group interactions seem to be more effective which could also explain interventions with client-to-client communication producing the second-best weight loss. Similar observations were made by Christiansen et al as interventions that produced significant weight change had elements of feedback and frequent interaction (23).

On the other hand, intervention components outside of the home e.g., group physical activity sessions had low engagements. This may still be due to the traditional barriers of lack of time due to infant care, low motivation and prioritization of childcare. Convenient home-only

interventions or out-of-home components thus were preferred. Additionally, with regards to WHO classifications, interventions with on-demand information services had the most weight loss of -2.40 Kg (95% CI: -3.40 to -1.41 Kg). Catering to this convenience improved participant satisfaction and retention while still being effective.

The pooled effect of DHIs on BMI showed significant reduction of BMI of -0.94 Kg/m^2 (95% CI: -1.37 to -0.52 Kg/m^2). As weight is the component of BMI that can change, then BMI can be used as a surrogate for weight change. Therefore, this result for the BMI corroborates the previous pooled effect of weight loss.

Overall, the quality of included studies was rated poor as a slight majority of studies (10/19) were judged to be of high risk of bias. However, exclusion of high risk of bias studies still gave a similar trend on the pooled effect. It is reasonable to assume that the missing data that contributed heavily to this judgement would not have significantly affected the outcome.

Quality of the evidence

Strengths and limitations of both the included studies and the review process have been considered for the quality of the evidence.

Strengths and limitations of the included studies

There was a decent number of studies included in the review with varying sample sizes. Even though a majority of them were pilot studies, this did not seem to affect patient selection, randomization nor the overall effect when excluding pilot studies.

The high attrition rates and missing outcome data could have heavily influenced the positive or negative effect of DHIs within individual studies as drop-outs may not have lost weight as completers. With that said, sensitivity analyses excluding studies with high risk of bias did not change the overall trend.

Substantial heterogeneity noted for the pooled effect on weight loss even with exclusion of non-RCTs. It is likely that the source could have been from clinical factors such as population characteristics. Further exploration for this heterogeneity was not done.

Approximately half of included RCTs were judged to be of poor quality largely due to the missing outcome data domain. This could have been a flaw in the review process as we did not seek additional data due to time limitations of the dissertation.

Strengths and limitations of the review process

Guidelines and recommendations of the Cochrane Collaboration Handbook were used in developing the protocol for this review. There were minimal variations from the registered protocol due to challenges noted during the data extraction pilot phase. Follow up of grey literature and additional data from authors was not done due to time limitations for completion of the dissertation. This could have had a major effect on the assessment of risk of bias as the missing outcome data domain contributed heavily to the overall judgement of included studies.

The review used a broad search strategy and did not limit by year of publication enabling identification of a large number of articles for screening. Google Scholar search retrieved 1800 articles but only the first 1000 records were viewable and only 970 were able to be saved. It is possible that the yield of potentially eligible articles from those missing 830 articles would be low owing to high number of excluded titles and abstracts (3424 out of 3557) at the screening stage.

Despite extensive search, full texts of 8 potentially eligible articles could not be found. For the studies that were included, there was no evidence of significant publication bias and this may suggest the missing studies may not have altered the overall effect.

Two reviewers were used at several stages with relatively high rates of agreements with decisions. At the time of writing, this is the first review of DHIs to use Version 2 of the Cochrane risk-of-bias tool for randomized trials (RoB 2).

Differences with other studies or reviews

Unlike the reviews by Sherifali and Christiansen, this review used the revised ROB2 therefore it would be inappropriate to compare the quality of the evidence.

Sherifali et al had only 4 postpartum studies, excluded interventions less than 3 months and used 1 reviewer to extract the data.

Christiansen et al was only a narrative review that used only RCTs, excluded GDM studies, included interventions without contact with coach/HCW, only 1 author screened articles and used a different classification for the DHIs. Many of these differences would explain our review identifying more studies.

CONCLUSIONS

Implications for clinical practice

This review set out to evaluate the effectiveness of DHIs for weight loss among a cohort that is most burdened with overweight and obesity complications yet have the greatest challenge with adherence to conventional interventions. Despite high attrition rates, the pooled weight loss with or without poor quality studies, and the varied options/delivery formats available would make DHIs a good recommendation for these women. This would also be a general recommendation to all postpartum women regardless of comorbidity or socio-economic status.

Even though most classifications were effective, many interventions utilized a combination of these classifications and it was not possible to tell which was more effective on its own. As a result, it would only be possible to recommend the programs as opposed to individual WHO DHI classifications. The most successful of programs would have elements catering to continuous support, group interaction and convenience.

These interventions would be first-line recommendations especially after the COVID-19 pandemic of 2020. The public health recommendations of social distancing or minimal physical gatherings would make these DHIs for weight loss the most appropriate and safe approach.

Implications for research

Majority of the included studies were pilot/feasibility studies and it would be important to evaluate the subsequent stages of those feasible and effective programs.

The preference for purely home-based interventions would need to be evaluated for quantitative effectiveness in an RCT against alternatives.

The WHO classification of DHIs may not be appropriate in evaluating effective components within a trial. Many DHIs had multiple classes within them. Future studies may need to evaluate the individual classes separately or combinations of the most effective classes. Alternatively,

other categories appropriate for clinical trials will need to be developed to find the most effective weight loss program.

ROLES OF REVIEWERS

Logan Rabuogi (LR), Catherine Gathu (CG), Anthony Ngugi (AN) and Jacob Shabani (JS) developed the protocol for the review process. The electronic search strategy was developed by the University Librarian, Nasra Gathoni, and LR.

Supervisors CG, AN and JS played the roles outlined below.

Table 10. Roles and contributions of reviewers

Reviewer	Electronic search	Screening articles	Data Extraction	Risk of bias assessment	Analysis	Report write-up
LR	×	×	×	×	×	×
CG		×	×	×		×
AN					×	×
JS		×	×	×		×

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APPENDICES

Data Extraction Form

Intervention review –
Randomised trials and non-randomised trials

This form can be used as a guide for developing your own data extraction form. Sections can be expanded and added, and irrelevant sections can be removed. It is difficult to design a single form that meets the needs of all reviews, so it is important to consider carefully the information you need to collect, and design your form accordingly. Information included on this form should be comprehensive, and may be used in the text of your review, 'Characteristics of included studies' table, risk of bias assessment, and statistical analysis.

Notes on using a data extraction form:
Be consistent in the order and style you use to describe the information for each included study.
Record any missing information as unclear or not described, to make it clear that the information was not found in the study report(s), not that you forgot to extract it.
Include any instructions and decision rules on the data collection form, or in an accompanying document. It is important to practice using the form and give training to any other authors using the form.
You will need to protect the document in order to use the form fields (Tools / Protect document)

Review title or ID

Study ID *(surname of first author and year first full report of study was published e.g., Smith*

Report IDs of other reports of this study *(e.g., duplicate publications, follow-up studies)*

Notes:

General Information

Date form completed *(dd/mm/yyyy)*	
Name/ID of person extracting data	
Report title *(title of paper/ abstract/ report that data are extracted from)*	
Report ID *(if there are multiple reports of this study)*	
Reference details	
Report author contact details	
Publication type *(e.g., full report, abstract, letter)*	
Study funding source *(including role of funders)*	
Possible conflicts of interest *(for study authors)*	
Notes:	

Eligibility

Study Characteristics	**Review Inclusion Criteria** *(Insert inclusion criteria for each characteristic as defined in the Protocol)*	**Yes/ No / Unclear**	**Location in text** *(pg & ¶/fig/table)*
Type of study	Randomised trial	…	
	Quasi-experimental trial		

Study Characteristics	**Review Inclusion Criteria** *(Insert inclusion criteria for each characteristic as defined in the Protocol)*	**Yes/ No / Unclear**	**Location in text** *(pg & ¶/fig/table)*
	Controlled before-after study	…	
Participants	Women <12 months postpartum		
Types of intervention	Digital health intervention with a weight loss component (e.g. diet, physical activity or weight monitoring delivered by either website, Internet, email, computer, Apps, SMS, phone call or video player)		
Types of outcome measures	Primary: Change in body weight		
Decision:			
Reason for exclusion			
Notes:			

DO NOT PROCEED IF STUDY EXCLUDED FROM REVIEW

Population and setting

	Description *Include comparative information for each group (i.e., intervention and controls) if available*	**Location in text** *(pg. & ¶/fig/table)*
Population description *(from which study participants are drawn)*		
Setting *(including location and social context)*		
Inclusion criteria		
Exclusion criteria		
Method/s of recruitment of participants		
Notes:		

Methods

	Descriptions as stated in report/paper	**Location in text** *(pg. & ¶/fig/table)*
Aim of study		
Design *(e.g., parallel, crossover, non-RCT)*		
Unit of allocation *(by individuals, cluster/ groups or body parts)*		

Start date		
End date		
Duration of participation *(from recruitment to last follow-up)*		
Notes:		

Risk of Bias assessment

See attached ROB-2/QAT forms.

Participants

Provide overall data and, if available, comparative data for each intervention or comparison group.

	Description as stated in report/paper	**Location in text** (pg & ¶/fig/table)
Total no. randomised *(or total pop. at start of study for NRCTs)*		
Clusters *(if applicable, no., type, no. people per cluster)*		
Withdrawals and exclusions *(if not provided below by outcome)*		
Age		
Average postpartum age at start		
Breastfeeding status		

	Description as stated in report/paper	**Location in text** (pg & ¶/fig/table)
Physical activity status at start		
Race/Ethnicity		
Co-morbidities		
Other treatment received *(additional to study intervention)*		
Other relevant sociodemographics		
Subgroups measured		
Subgroups reported		
Notes:		

Intervention groups

Copy and paste table for each intervention and comparison group

Intervention Group 1

	Description as stated in report/paper	**Location in text** *(pg & ¶/fig/table)*
Group name		
No. randomised to group *(specify whether no. people or clusters)*		

	Description as stated in report/paper	**Location in text** *(pg & ¶/fig/table)*
Description *(include sufficient detail for replication, e.g., content, dose, components; classification(s))*		
Duration of treatment period		
Delivery *(e.g., Individual Vs Group)*		
Intervention site *(e.g., Home Vs Facility or both)*		
Providers *(if relevant)*		
Co-interventions		
Notes:		

Outcomes

Copy and paste table for each outcome.

Outcome 1

	Description as stated in report/paper	**Location in text** *(pg & ¶/fig/table)*
Outcome name		

	Description as stated in report/paper	**Location in text** *(pg & ¶/fig/table)*
Time points measured *(specify whether from start or end of intervention)*		
Time points reported		
Outcome definition *(with diagnostic criteria if relevant and note whether the outcome is desirable or undesirable if this is not obvious)*		
Person measuring/ reporting		
Unit of measurement *(if relevant)*		
Imputation of missing data *(e.g., assumptions made for ITT analysis)*		
Notes:		

Results

Copy and paste the appropriate table for each outcome, including additional tables for each time point and subgroup as required.

For randomised or non-randomised trial - Continuous outcome

	Description as stated in report/paper	Location in text *(pg & ¶/fig/table)*
Comparison		
Outcome		
Subgroup		
Time point *(specify whether from start or end of intervention)*		
Post-intervention or change from baseline?		

Results *Note whether:* **…** *post-intervention OR* **…** *change from baseline And whether* **…** *Adjusted OR* **…***Unadjusted*	**Intervention**			**Comparison**			
	Mean	SD (or other variance)	No. participants	Mean	SD (or other variance)	No. participants	

Baseline data	**Intervention**			**Comparison**			
	Mean	SD (or other variance)	No. participants	Mean	SD (or other variance)	No. participants	

	Description as stated in report/paper		**Location in text** *(pg & ¶/fig/table)*
No. missing participants and reasons			
No. participants moved from other group and reasons			
Any other results reported			
Unit of analysis *(e.g. by individuals, health professional, practice, hospital, community)*			
Statistical methods used and appropriateness of these methods *(e.g. adjustment for correlation)*			
Reanalysis required? *(if yes, specify why)*	... *Yes/No/Unclear*		
Reanalysis possible?	... *Yes/No/Unclear*		
Reanalysed results			
Notes:			

For controlled before-after study

	Description as stated in report/paper				**Location in text** *(pg & ¶/fig/table)*
Comparison					
Outcome					
Subgroup					
Timepoint *(specify whether from start or end of intervention)*					
Post-intervention or change from baseline?					
Results	Intervention result	SD (or other variance)	Control result	SD (or other variance)	
	Overall results		SE (or other variance)		
No. participants	Intervention		Control		
No. missing participants and reasons					
No. participants moved from other group and reasons					
Any other results reported					
Unit of analysis *(individuals, cluster/ groups or body parts)*					

	Description as stated in report/paper		**Location in text** *(pg & ¶/fig/table)*
Statistical methods used and appropriateness of these methods			
Reanalysis required? *(specify)*	... *Yes/No/Unclear*		
Reanalysis possible?	... *Yes/No/Unclear*		
Reanalysed results			
Notes:			

Applicability

Have important populations been excluded from the study? *(consider disadvantaged populations, and possible differences in the intervention effect)*	... *Yes/No/Unclear*	
Is the intervention likely to be aimed at disadvantaged groups? *(e.g. lower socioeconomic groups)*	... *Yes/No/Unclear*	
Does the study directly address the review question? *(any issues of partial or indirect applicability)*	... *Yes/No/Unclear*	

Notes:

Other information

	Description as stated in report/paper	**Location in text** *(pg & ¶/fig/table)*
Key conclusions of study authors		
References to other relevant studies		
Correspondence required for further study information *(what and from whom)*		
Further study information requested *(from whom, what and when)*		
Correspondence received *(from whom, what and when)*		
Notes:		

Search strategies

PubMed

	as at 15 April 2020	
#1	"Therapy, Computer-Assisted"[Mesh] OR "Internet"[Mesh] OR "Computers"[Mesh] OR "text messaging"[MeSH] OR "Feedback"[Mesh] OR "Smartphone"[Mesh] OR (phone* OR computer-assisted OR "Programmable Calculator" OR "Programmable Calculators" OR "Computer Hardware" OR "Digital Computer*" OR "computer-based" OR "web-based" OR Telemedicine OR "communication network" OR "remote consultation" OR "electronic health" OR "mobile health" OR telehealth OR e-health OR ehealth OR mhealth OR m-health OR hypermedia OR multimedia OR computer* OR internet OR online OR on-line OR "world wide web" OR website* OR Cyberspace OR "Cyber-Space" OR telecare OR telemonitoring OR interactive OR wireless OR mobile OR "personal digital assistant" OR pda OR "interactive voice response" OR ivr OR "text message" OR "text messaging" OR SMS OR iOTA OR Bluetooth OR chat OR "chat room" OR "instant message" OR IM OR twitter OR tweet OR blog OR "social network" OR tailored OR automated OR individualized OR programmed OR remote OR self-monitoring OR feedback OR prompt OR reminder OR facebook OR "Computer-Assisted Therap*" OR "Computer Assisted Therap*" OR "Computer-Assisted Protocol-Directed Therap*" OR "Computer Assisted Protocol Directed Therapy" OR Smartphone* OR Smart phone* OR "Cellular Phone*" OR "Cellular Telephone*" OR "Cell Phones" OR "Portable Cellular Phone*" OR "Transportable Cellular Phone*" OR "Mobile Phone*" OR "Mobile Telephone*"	3,700,485
#2	"Weight Gain"[Mesh] OR "Weight Loss"[Mesh] OR "Weight Reduction Programs"[Mesh] OR "Diet, Reducing"[Mesh] OR "Body Weight"[Mesh] OR "Overweight"[Mesh] OR "Obesity"[Mesh] OR "Gestational Weight Gain"[Mesh] OR "Obesity, Maternal"[Mesh] OR "Body Mass Index"[Mesh] OR "Exercise"[Mesh] OR "Physical Exertion"[Mesh] OR "Physical Fitness"[Mesh] OR "Sports"[Mesh] OR "Exercise Movement Techniques"[Mesh] OR "Weight Gains" OR "Weight Losses" OR "Weight Reduction" OR "Weight Reductions" OR "Weight Reduction Program" OR "Weight Loss Programs" OR "Weight	1,152,273

	Loss Program" OR "Reducing Diet" OR "Reducing Diets" OR "Weight Reduction Diet" OR "Weight Reduction Diets" OR "Weight Loss Diet" OR "Weight Loss Diets" OR "Body Weights" OR "Pregnancy Weight Gain" OR "Maternal Weight Gain" OR "Postpartum Weight Retention" OR "Maternal Obesity" OR "Obesity in Pregnancy" OR "Quetelet Index" OR "Quetelet's Index" OR "Quetelets Index" OR Exercises OR "Physical Activity" OR "Physical Activities" OR "Physical Exercise" OR "Physical Exercises" OR "Acute Exercise" OR "Acute Exercises" OR "Isometric Exercises" OR "Isometric Exercise" OR "Aerobic Exercise" OR "Aerobic Exercises" OR "Exercise Training" OR "Exercise Trainings" OR "Physical Exertions" OR "Physical Effort" OR "Physical Efforts" OR "Fitness, Physical" OR Sport OR Athletics OR Athletic OR "Exercise Movement Technics" OR "Pilates-Based Exercises" OR "Pilates Based Exercises" OR "Pilates Training"	
#3	"Postpartum Period"[Mesh] OR "Postnatal Care"[Mesh] OR "Perinatal Care"[Mesh] OR "Pregnancy"[Mesh] OR "Pregnant Women"[Mesh] OR "Delivery, Obstetric"[Mesh] OR Postpartum OR Puerperium OR Pregnancies OR Gestation OR "Pregnant Woman" OR "Obstetric Deliveries" OR "Obstetric Delivery"	1,044,414
#4	"Randomized Controlled Trials as Topic"[Mesh] OR "Randomized Controlled Trial" [Publication Type] OR "Non-Randomized Controlled Trials as Topic"[Mesh] OR "Controlled Before-After Studies"[Mesh] OR "Randomized Clinical Trials" OR "Trials, Randomized Clinical" OR "Randomized Controlled Clinical Trials" OR "Non Randomized Controlled Trials" OR "Non-Randomized Controlled Clinical Trials" OR "Non Randomized Controlled Clinical Trials" OR "Quasi-Experimental Studies" OR "Quasi Experimental Studies" OR "Quasi-Experimental Study" OR "Nonrandomized Clinical Trial" OR "Nonrandomized Clinical Trials" OR "Controlled Clinical Trials, Nonrandomized" OR "Non-Randomized Clinical Trial" OR "Non-Randomized Clinical Trials" OR "Trial, Non-Randomized Clinical" OR "Trials, Non-Randomized Clinical" OR "Nonrandomized Controlled Trials" OR "Controlled Before After Studies" OR "Controlled Before-After Study" OR "CBA Studies" OR "Controlled Before and After Studies" OR Placebo OR "Drug Therapy" OR Randomly OR Trial OR Groups	5,056,393

#5	#1 AND #2 AND #3 AND #4	1,691

Web of Science Core Collection

Data of search: 2020-March-17

#1	TS=(phone* OR "Programmable Calculator" OR "Programmable Calculator*" OR "web-based" OR Telemedicine OR "communication network" OR "electronic health" OR telehealth OR e-health OR ehealth OR mhealth OR m-health OR hypermedia OR multimedia OR computer* OR internet OR online OR on-line OR "world wide web" OR website* OR Cyberspace OR "Cyber-Space" OR telecare OR telemonitoring OR interactive OR wireless OR mobile OR "personal digital assistant" OR pda OR "interactive voice response" OR ivr OR "text messag*" OR SMS OR iOTA OR Bluetooth OR chat OR "instant messag*" OR IM OR twitter OR tweet OR blog OR "social network" OR tailored OR automated OR individualized OR individualized OR programmed OR remote OR self-monitoring OR feedback OR prompt OR reminder OR facebook OR Smartphone* OR cellphone OR "Cellular Telephone*" OR "Mobile Telephone*")	5,183,059
#2	TS=(weight NEAR/3 (gain* OR loss* OR reduc* OR postpartum OR pregnan*))	268,633
#3	TS=("Reducing Diet*" OR "Body Weight*" OR "Maternal Obesity" OR "Obesity in Pregnancy" OR "Quetelet Index" OR "Quetelet's Index" OR "Quetelets Index" OR Exercise* OR "Physical Activit*" OR "Physical Exertions" OR "Physical Effort*" OR Sport* OR Athletic* OR Pilates)	898,715
#4	#2 OR #3	1,090,284
#5	TS=(Postpartum OR Puerperium OR Pregnan* OR Gestation OR Obstetric*)	631,034
#6	TS=(randomized OR randomised OR placebo OR "drug therapy" OR randomly OR trial OR groups OR "Quasi-Experimental" OR Nonrandomized OR "Non-Randomized" OR Nonrandomised OR "Non-randomised" OR "Controlled Before After" OR "Controlled Before-After" OR "CBA Stud*" OR "Controlled Before and After")	6,279,450

#7	#1 AND #4 AND #5 AND #6	2,348

Cochrane CENTRAL

Search Name:

Date Run: 23/04/2020 07:11:35

Comment:

ID Search Hits

#1 [mh "Therapy, Computer-Assisted"] OR [mh Internet] OR [mh Computers] OR [mh "text messaging"] OR [mh Feedback] OR [mh Smartphone] OR phone* OR computer-assisted OR "Programmable Calculator" OR "Computer Hardware" OR "Digital Computer" OR "computer-based" OR "web-based" OR Telemedicine OR "communication network" OR "remote consultation" OR "electronic health" OR "mobile health" OR telehealth OR e-health OR ehealth OR mhealth OR m-health OR hypermedia OR multimedia OR computer OR internet OR online OR on-line OR "world wide web" OR website OR Cyberspace OR "Cyber- Space" OR telecare OR telemonitoring OR interactive OR wireless OR mobile OR "personal digital assistant" OR pda OR "interactive voice response" OR ivr OR "text message" OR "text messaging" OR SMS OR iOTA OR Bluetooth OR chat OR "chat room" OR "instant message" OR IM OR twitter OR tweet OR blog OR "social network" OR tailored OR automated OR individualized OR programmed OR remote OR self-monitoring OR feedback OR prompt OR reminder OR facebook OR "Computer-Assisted Therapy" OR "Computer Assisted Therapy" OR "Computer-Assisted Protocol-Directed Therapy" OR "Computer Assisted Protocol Directed Therapy" OR Smartphone* OR Smart phone* OR "Cellular Phone" OR "Cellular Telephone" OR "Cell Phones" OR "Portable Cellular Phone" OR "Transportable Cellular Phone" OR "Mobile Phone" OR "Mobile Telephone"

152364

#2 [mh "Weight Gain"] OR [mh "Weight Loss"] OR [mh "Weight Reduction Programs"] OR [mh "Diet, Reducing"] OR [mh "Body Weight"] OR [mh "Overweight"] OR [mh "Obesity"] OR [mh "Gestational Weight Gain"] OR [mh "Obesity, Maternal"] OR [mh "Body Mass Index"] OR [mh "Exercise"] OR [mh "Physical Exertion"] OR [mh "Physical Fitness"] OR [mh "Sports"] OR [mh "Exercise Movement Techniques"] OR "Weight Gains" OR "Weight Losses" OR "Weight Reduction" OR "Weight Reduction Program" OR "Weight Loss Programs" OR "Weight Loss Program" OR "Reducing Diet" OR "Reducing Diets" OR "Weight Reduction Diet" OR "Weight Reduction Diets" OR "Weight Loss Diet" OR "Weight Loss Diets" OR "Body Weights" OR "Pregnancy Weight Gain" OR "Maternal Weight Gain" OR "Postpartum Weight Retention" OR

"Maternal Obesity" OR "Obesity in Pregnancy" OR "Quetelet Index" OR "Quetelet's Index" OR "Quetelets Index" OR Exercises OR "Physical Activity" OR "Physical Activities" OR "Physical Exercise" OR "Physical Exercises" OR "Acute Exercise" OR "Acute Exercises" OR "Isometric Exercises" OR "Isometric Exercise" OR "Aerobic Exercise" OR "Aerobic Exercises" OR "Exercise Training" OR "Exercise Trainings" OR "Physical Exertions" OR "Physical Effort" OR "Physical Efforts" OR "Fitness, Physical" OR Sport OR Athletics OR Athletic OR "Exercise Movement Technics" OR "Pilates-Based Exercises" OR "Pilates Based Exercises" OR "Pilates Training" 112524

#3 [mh "Postpartum Period"] OR [mh "Postnatal Care"] OR [mh "Perinatal Care"] OR [mh "Pregnancy"] OR [mh "Pregnant Women"] OR [mh "Delivery, Obstetric"] OR Postpartum OR Puerperium OR Pregnancies OR Gestation OR "Pregnant Woman" OR "Obstetric Deliveries" OR "Obstetric Delivery" 39514

#4 #1 AND #2 AND #3 in Trials 598

Google Scholar

Google Scholar search as at 16 April 2020

"digital|mobile|computer|web|internet health", "weight loss|gain", postpartum = 1800 results

I was however unable to **view** beyond 980 results. Secondly when **saving** the results, Google Scholar did not allow me to **save** beyond 970 results. Apparently "only the first 1,000 citations of any search in GS are viewable" *(this is documented)*

Therefore, as agreed I applied the above search (=1800 results) and was able to save 970 results. I believe this is something you may need to report in your study…something like

The search retrieved 1800 but only the first 970 were ….

This is the "error message from Google Scholar

Google Sorry...

We're sorry...

... but your computer or network may be sending automated queries. To protect our users, we can't process your request right now.
See Google Help for more information.

Google Home

Please find attached endnote library with the 970 results.