



New technologies and dietary behavior change

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HISTORY OF TECHNOLOGY USED FOR BEHAVIORAL CHANGES



1998 Persuasive Technology (PT): “how people can be persuaded when interacting with the technology and adjusting itself according to the actions, inputs, and context of persuaded party”. Fogg et al

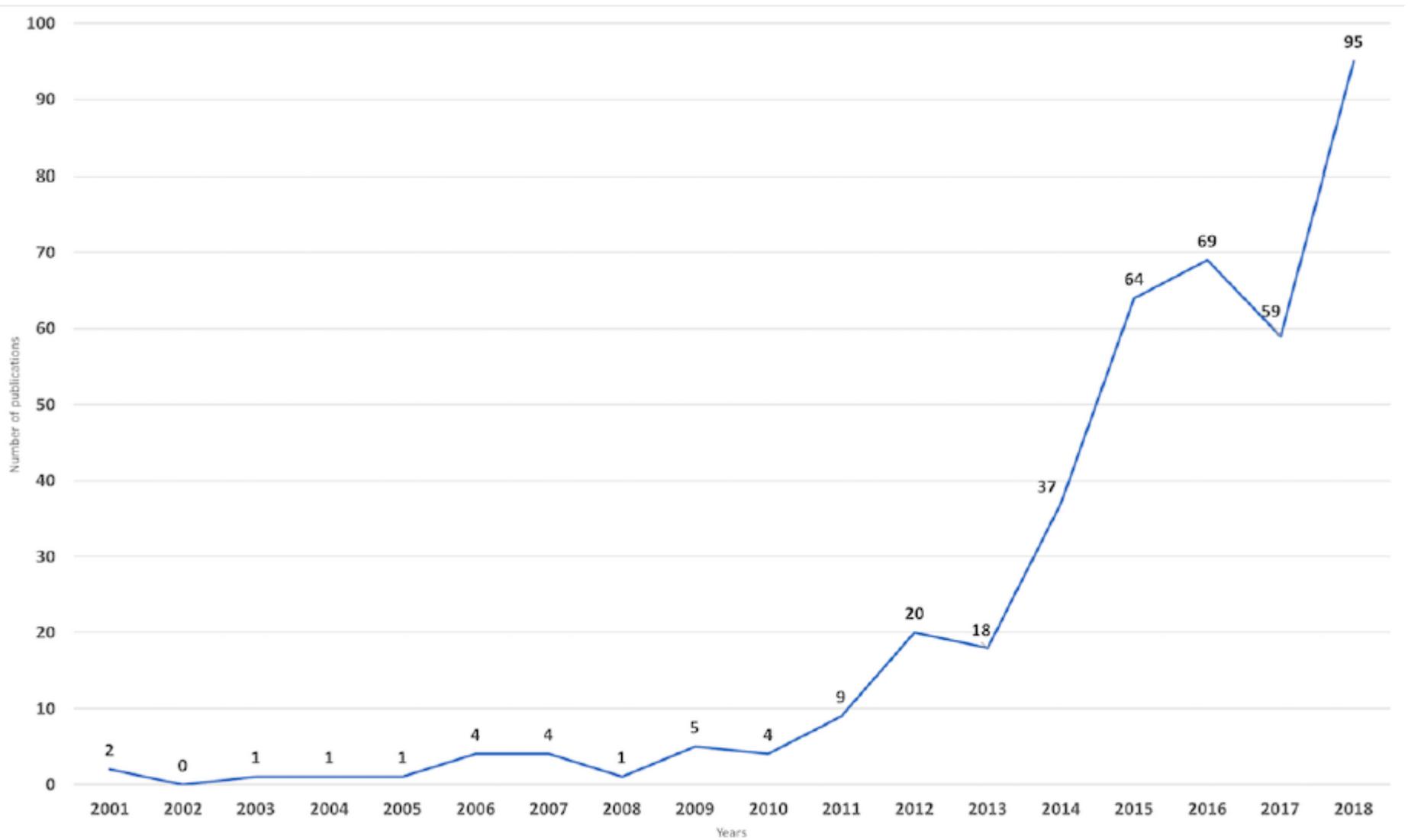


2008 Persuasive Systems (PS): “a computerized software or information system designed to reinforce, change, or shape attitude or behavior or both, without using coercion or deception” . Oinas-Kukkonen and Harjumaa



2012 Behavior Change Support Systems (BCSS): “a socio-technical information system with psychological and behavioral outcomes designed to form, alter, or reinforce attitudes, behaviors or an act of complying without using coercion or deception”. Oinas-Kukkonen

Publication trends 2000-2018



TECHNOLOGICAL PLATFORMS USED FOR BEHAVIORAL CHANGE



MOBILE
APPS



SMS



WEB
SYSTEMS



WEARABLE
SENSORS



GAMES

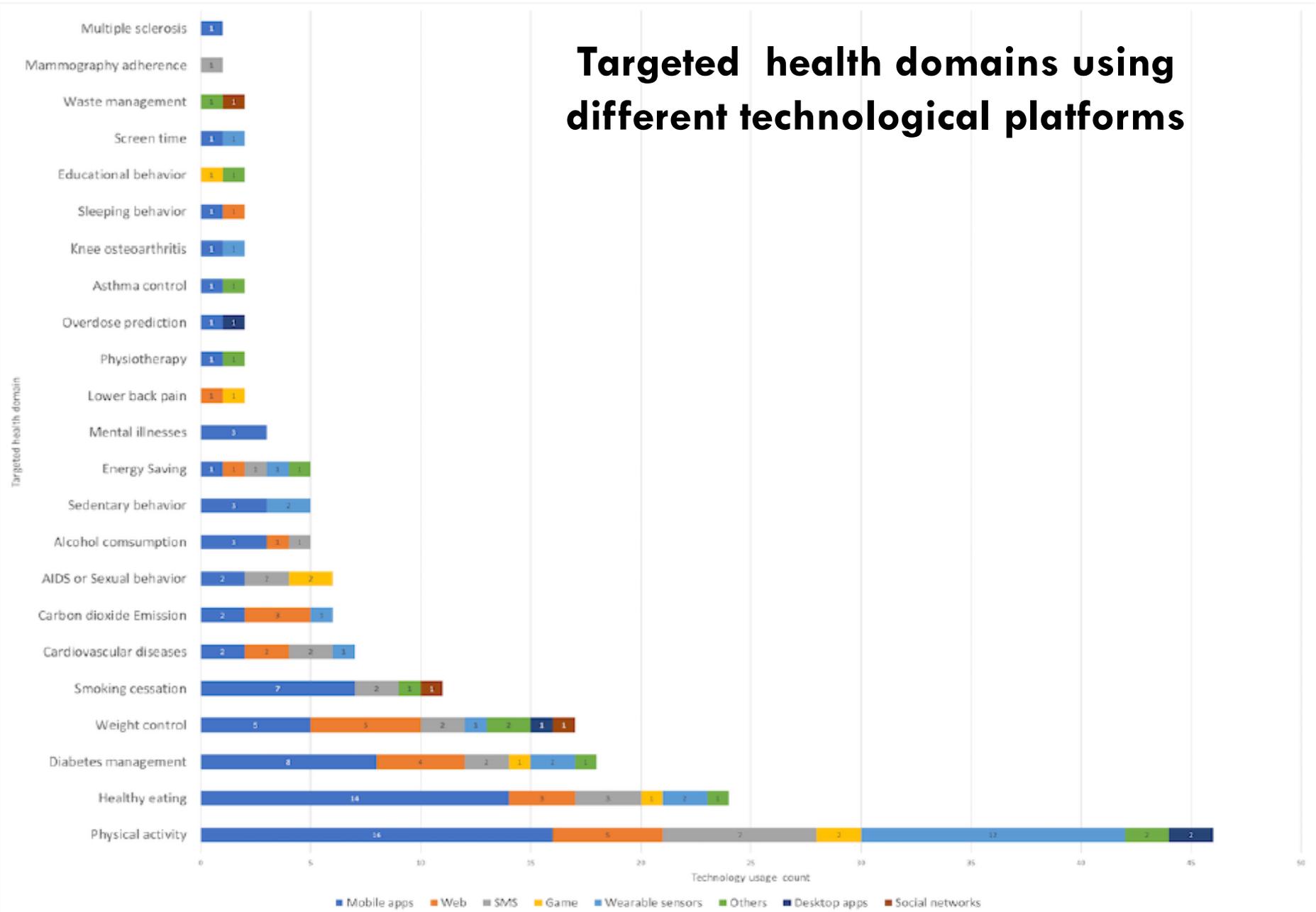


DESKTOP
APPS

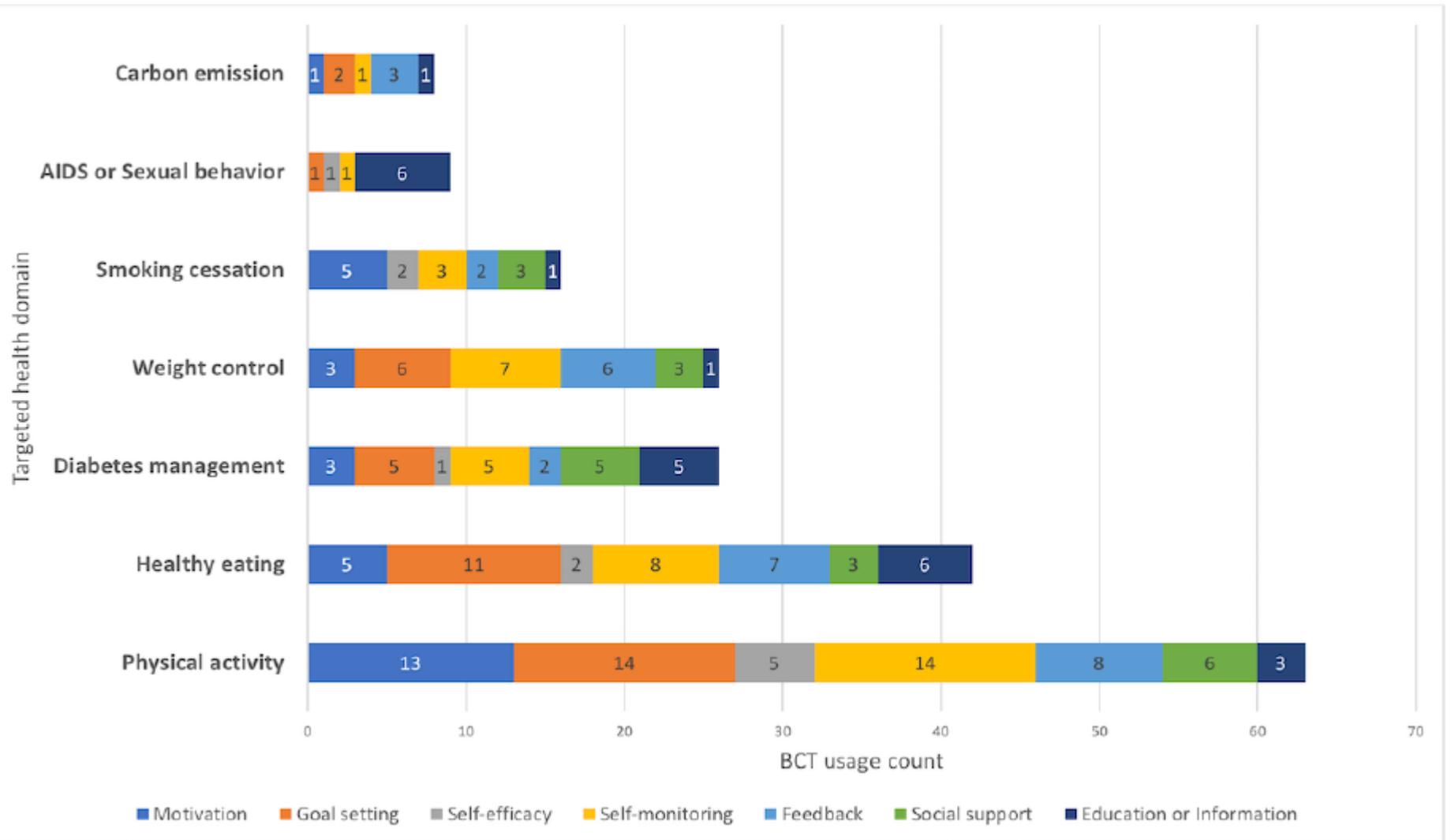


SOCIAL
MEDIA

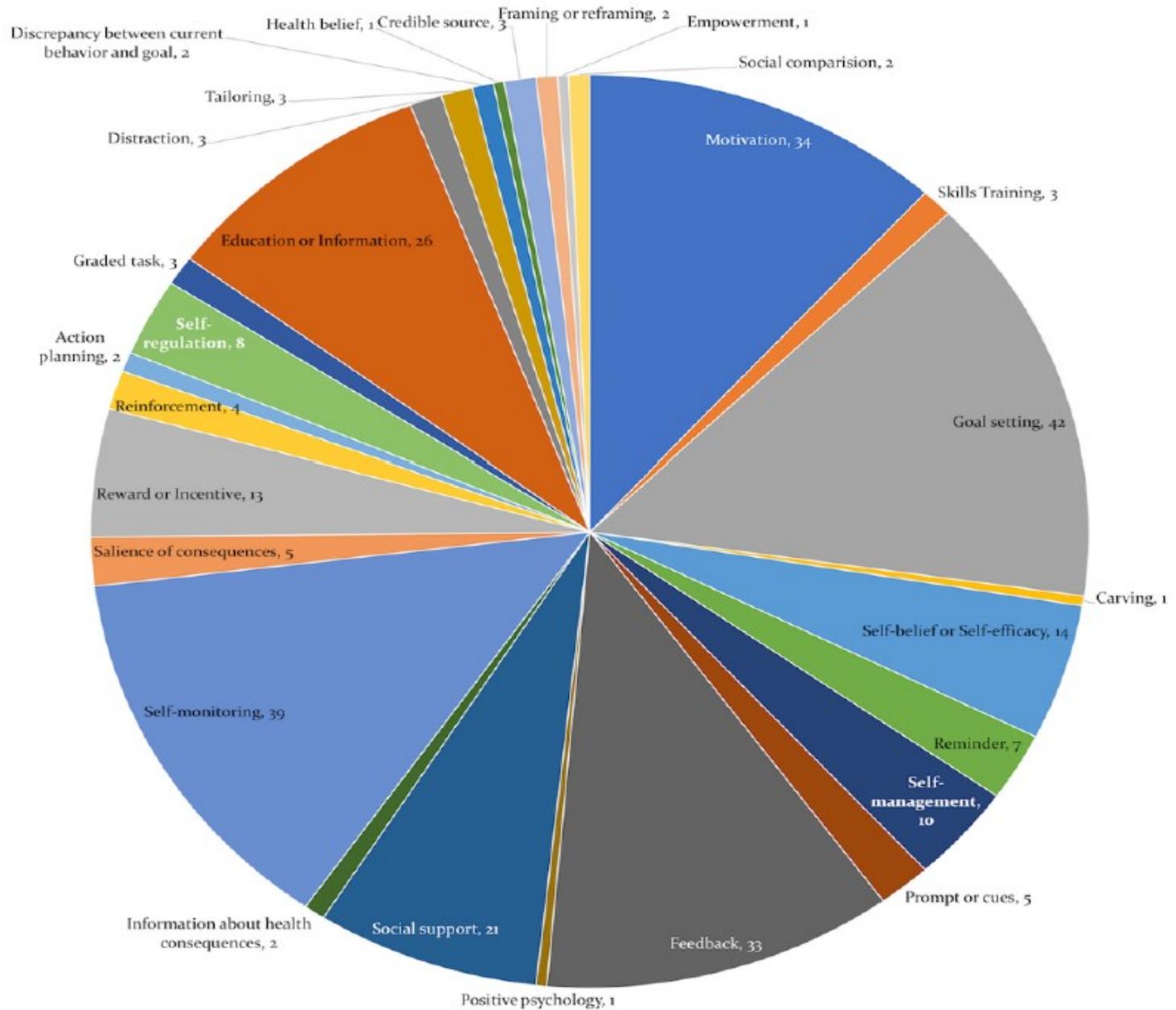
Targeted health domains using different technological platforms



Different target behavior using different behavior change techniques



Frequency of different behavior change techniques adopted.



PROBLEMS REGARDING CONDUCTED STUDIES FOR DIETARY BEHAVIOR CHANGE

Not validated
assessment
tools

Length of
intervention
unknown

Intensity of
intervention
unknown

Unknown
effectiveness of
social influence

Not powered
sample size



Create a Soup



MyPlate, MyWins: Make it yours
Developed by the USDA's Center for Nutrition Policy and Promotion. Available at choosemyplate.gov.



Create a Pizza



Good Foods to Have on Hand



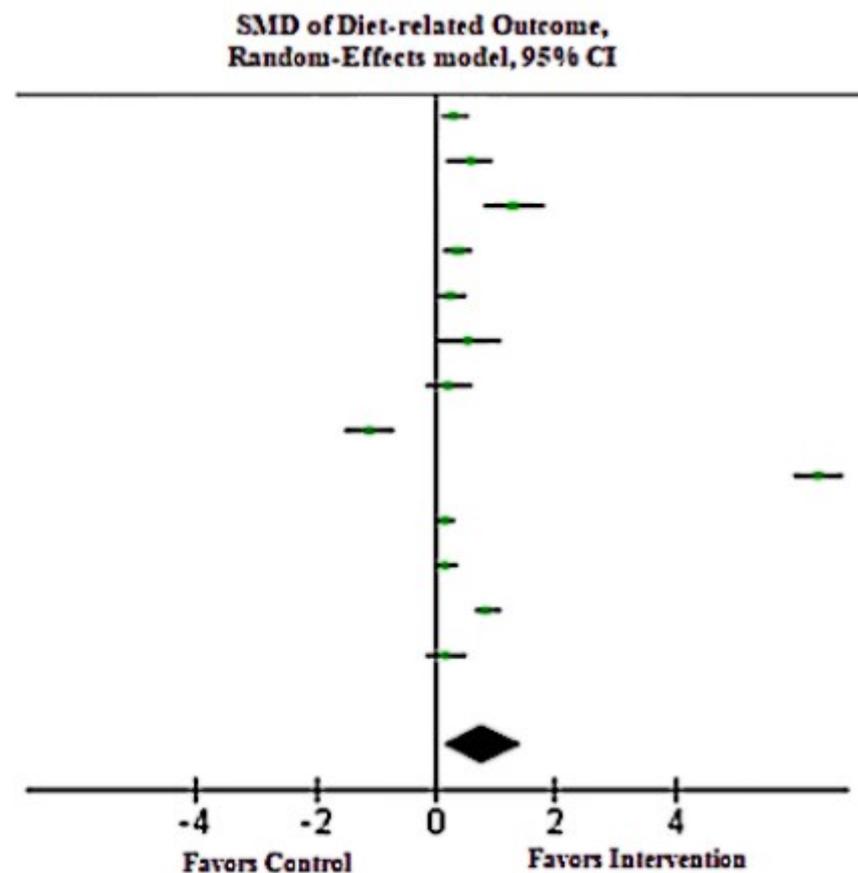
Diet related outcome from RCTS on NCD patients

Methods used mobile sms, web pages, telephone counseling in adults

Study	Number of participants (IG / CG)	Effect size (SMD, 95% CI)
Banturn (2014)	156 / 147	0.32 [0.09, 0.55]
Dale (2015)	61 / 61	0.58 [0.21, 0.94]
Duan (2018)	44 / 44	1.30 [0.84, 1.76]
Glasgow (2010)	320 / 124	0.37 [0.21, 0.53]
Kanera (2016)	183 / 183	0.26 [0.05, 0.47]
Lee (2014)	29 / 29	0.53 [0.01, 1.06]
Lindsay (2008)	54 / 54	0.22 [-0.16, 0.60]
Liu (2018)	85 / 43	-1.11 [-1.51, -0.72]
Morey (2009)	319 / 322	6.40 [6.01, 6.79]
Nolan (2011)	413 / 267	0.15 [0.00, 0.30]
Ramachandran (2013)	271 / 266	0.17 [0.00, 0.34]
Shahid (2015)	220 / 220	0.85 [0.60, 1.09]
Shetty (2011)	78 / 66	0.17 [-0.20, 0.53]
Total	2233 / 1823	0.78 [0.13, 1.43]

Test of overall effect: $Z=2.34, P=.02$

Heterogeneity: $\chi^2(12)=25.69, P=.01, I^2=53\%$



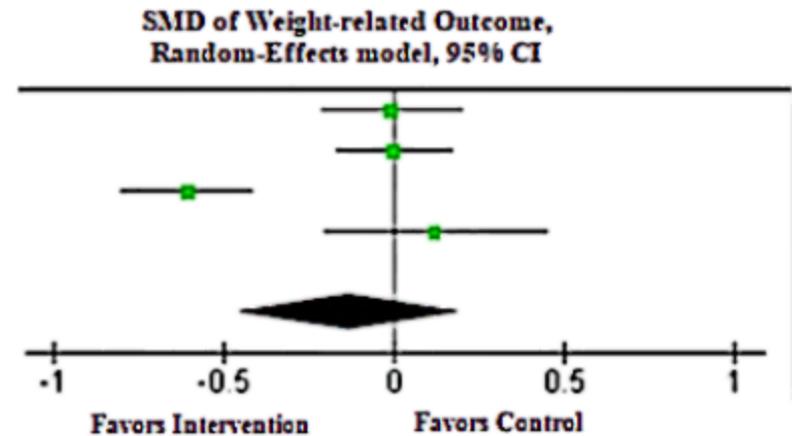
Interventions with SMS or telephone counselling (SMD 1.54, $Z=2.05$, 95% CI 0.07 to 3.01, $P=.04$) achieved better effectiveness than web-based interventions (SMD 0.30, $Z=1.70$, 95% CI -0.05 to 0.64, $P=.09$)

Weight related outcome from RCTS on NCD patients

Methods used mobile sms, web pages, telephone counseling in adults

Study	Number of participants (IG / CG)	Effect size (SMD, 95% CI)
Glasgow (2010)	320 / 124	-0.01 [-0.22, 0.20]
Ramachandran (2013)	271 / 266	0 [-0.17, 0.17]
Shahid (2015)	220 / 220	-0.61 [0.30, 0.92]
Shetty (2011)	78 / 66	-0.12 [-0.53, 0.28]
Total	889 / 676	-0.13 [-0.47, 0.20]

Test of overall effect: $Z = 0.79, P = .43$



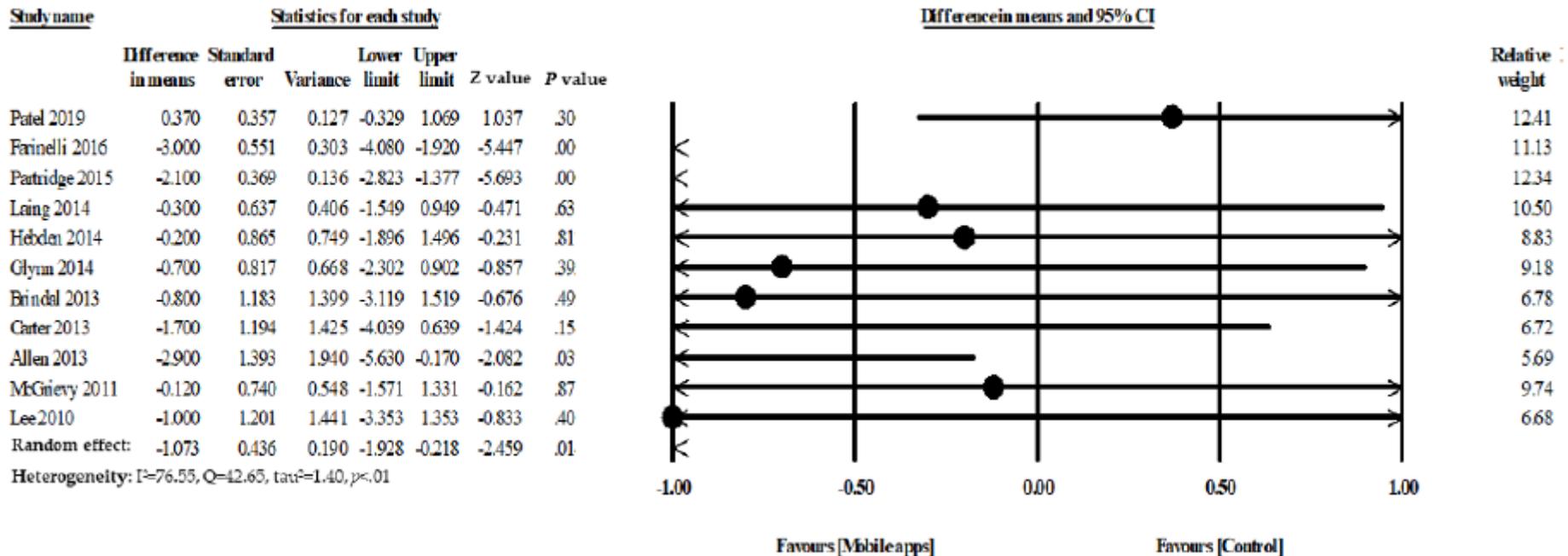


DIGITAL MEDIA AND ADOLESCENTS

- DIGITAL MEDIA ARE WIDELY ACCESSED BY ADOLESCENTS AND MAY REPRESENT A SCALABLE AND INEXPENSIVE OPPORTUNITY FOR ENGAGING THIS GROUP IN BEHAVIOR CHANGE.
- DIGITAL INTERVENTIONS THAT INCLUDE HEALTH EDUCATION, GOAL-SETTING, SELF-MONITORING, AND PARENT INVOLVEMENT CAN PRODUCE SIGNIFICANT IMPROVEMENTS IN THE DIETARY BEHAVIORS OF ADOLESCENTS.
- THERE IS LESS EVIDENCE FOR THE EFFECTIVENESS OF OTHER DIGITAL PLATFORMS SUCH AS APPS, TEXT MESSAGES AND SOCIAL MEDIA, DUE TO THE PAUCITY OF WELL-DESIGNED TRIALS OF THESE INTERVENTIONS.
- SMARTPHONE-BASED INTERVENTIONS ARE WIDELY ACCESSIBLE AND LOW-COST AND MAKE USE OF RESOURCES ALREADY USED BY MOST ADOLESCENTS.

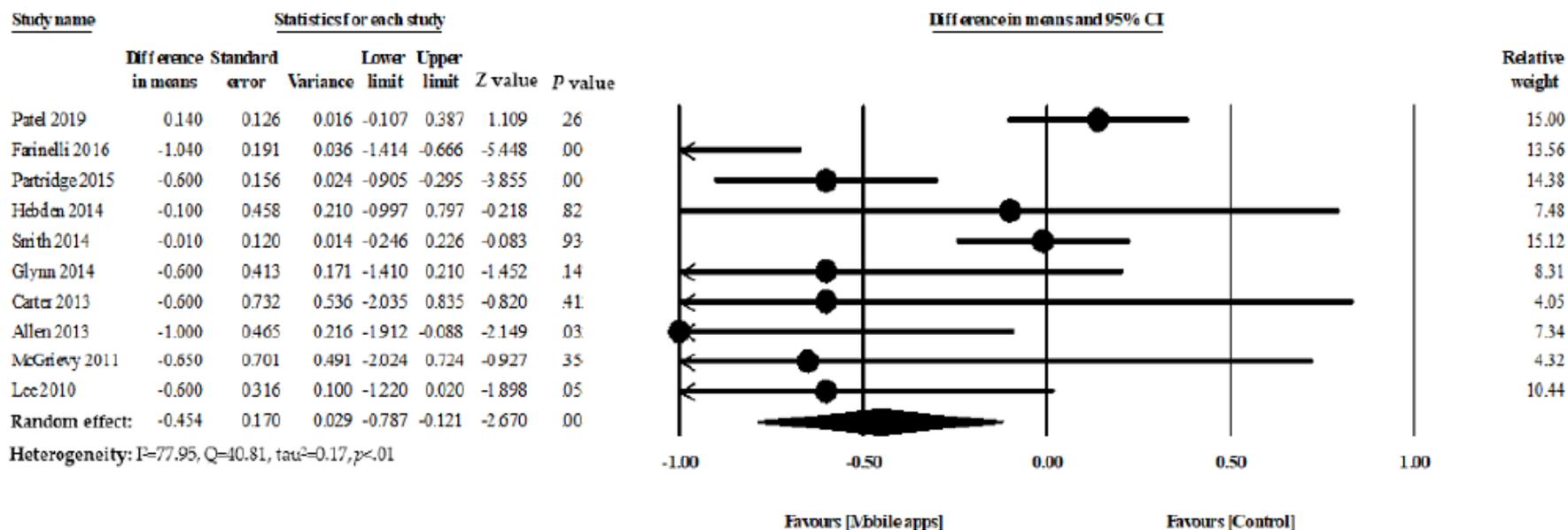
Meta-analysis of mobile apps used for weight loss

11 randomized controlled trials and 1 case-control study in children and adults with a follow-up period of 6 weeks to 9 months



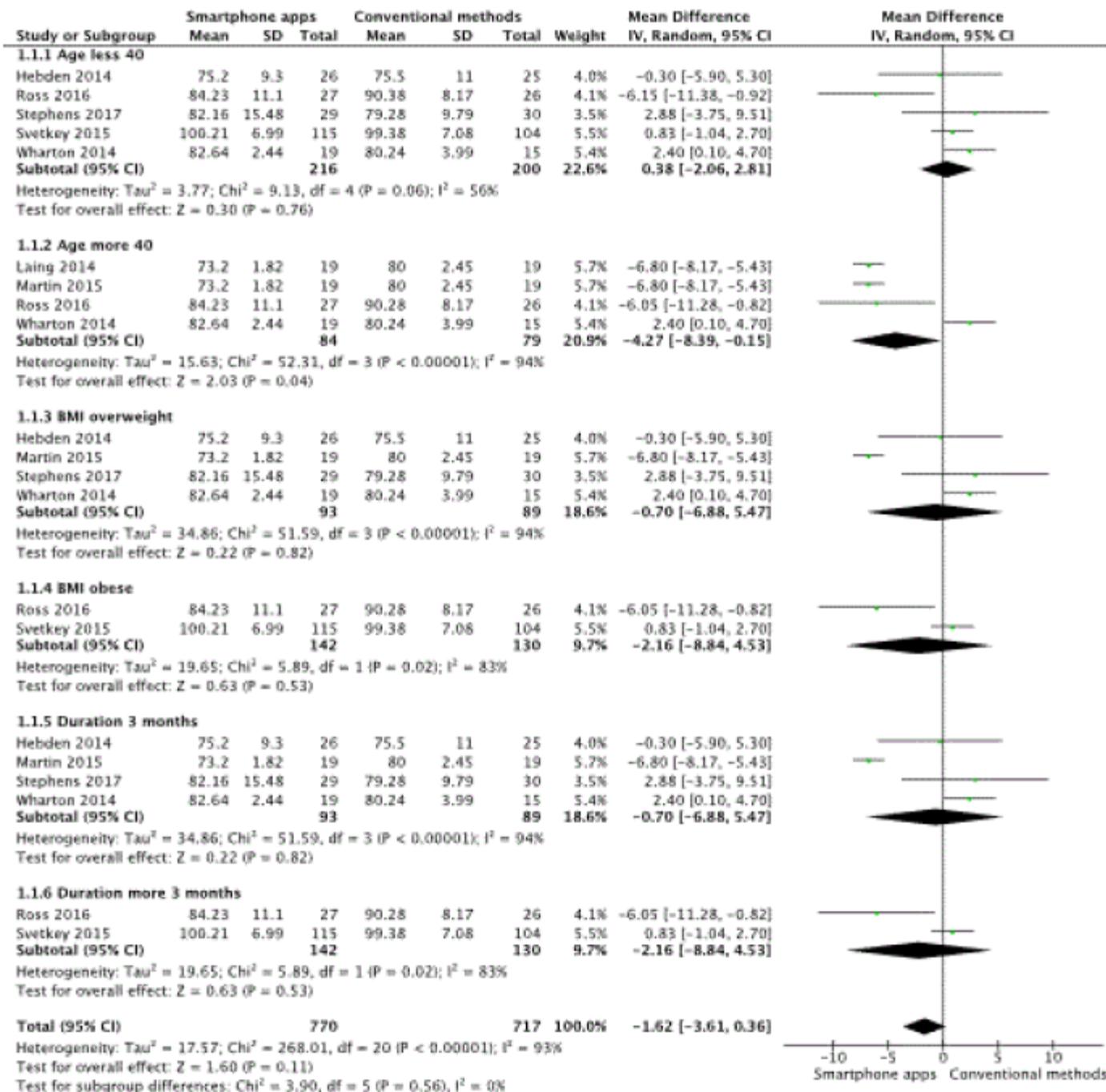
Meta-analysis of mobile apps used for BMI change

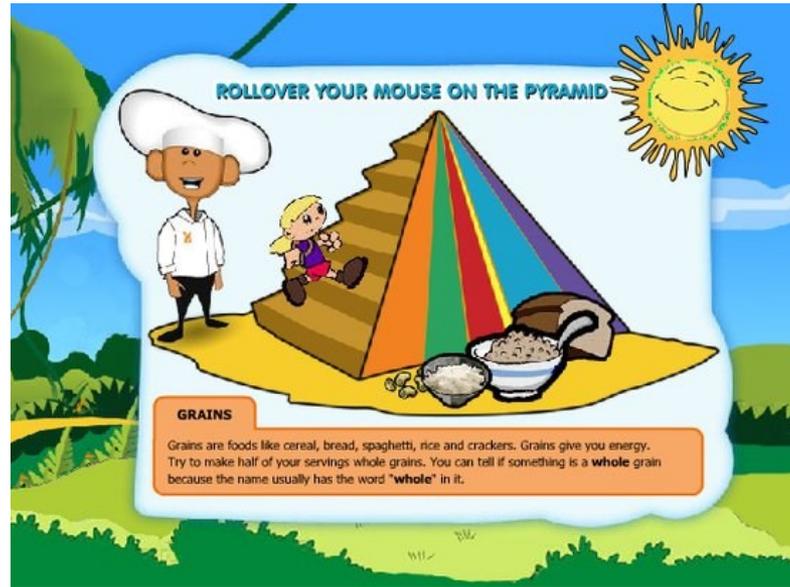
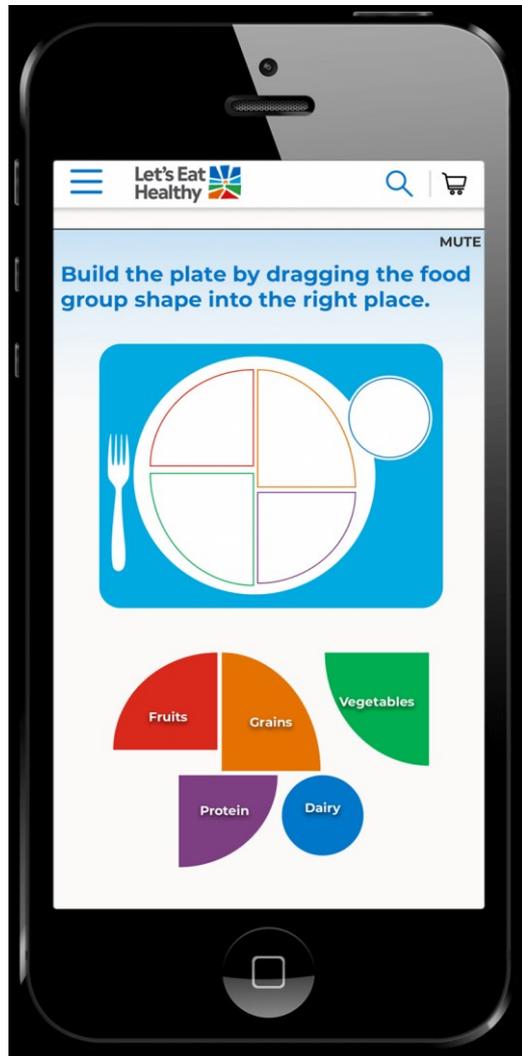
11 randomized controlled trials and 1 case-control study in children and adults with a follow-up period of 6 weeks to 9 months



Meta-analysis of smartphone apps intervention for changes in body weight

Nawi et al.
International
Journal of Public
Health Research ,
2021





The use of gaming in changing dietary behavior

They are designed primarily for children and adolescents

Games can be attractive behavioral change media

Fun

Enjoyment

Engagement (intrinsic motivation to play)

A multisensory experience to facilitate different learning styles

Safe opportunities for practice with feedback

Training for important skills (critical thinking, problem solving, teamwork, strategic thinking, and planning)

Role playing for constructive learning

Modeling of behaviors

Training in self-regulation

Immersion of players in a storyline into which behavior change procedures can be built

The use of gaming in changing dietary behavior

Major differences between games used

- Target populations
- Dietary behavior targets (e.g., fruit, vegetables, general nutrition information, Mediterranean diet)
- Theories (social cognitive, persuasion, health belief model, attachment, or even none)
- Game elements/mechanics
- Behavior change procedures
- Research designs, and measures

Game playbooks

Policy:

Resources should be directed toward “games for health” that propose to develop a Game Playbook to guide the development, implementation, and testing of important health behavior change interventions.

Research:

Game Playbooks are critical for the creation and empirical testing of videogame interventions because they help to ensure fidelity and reproducibility.

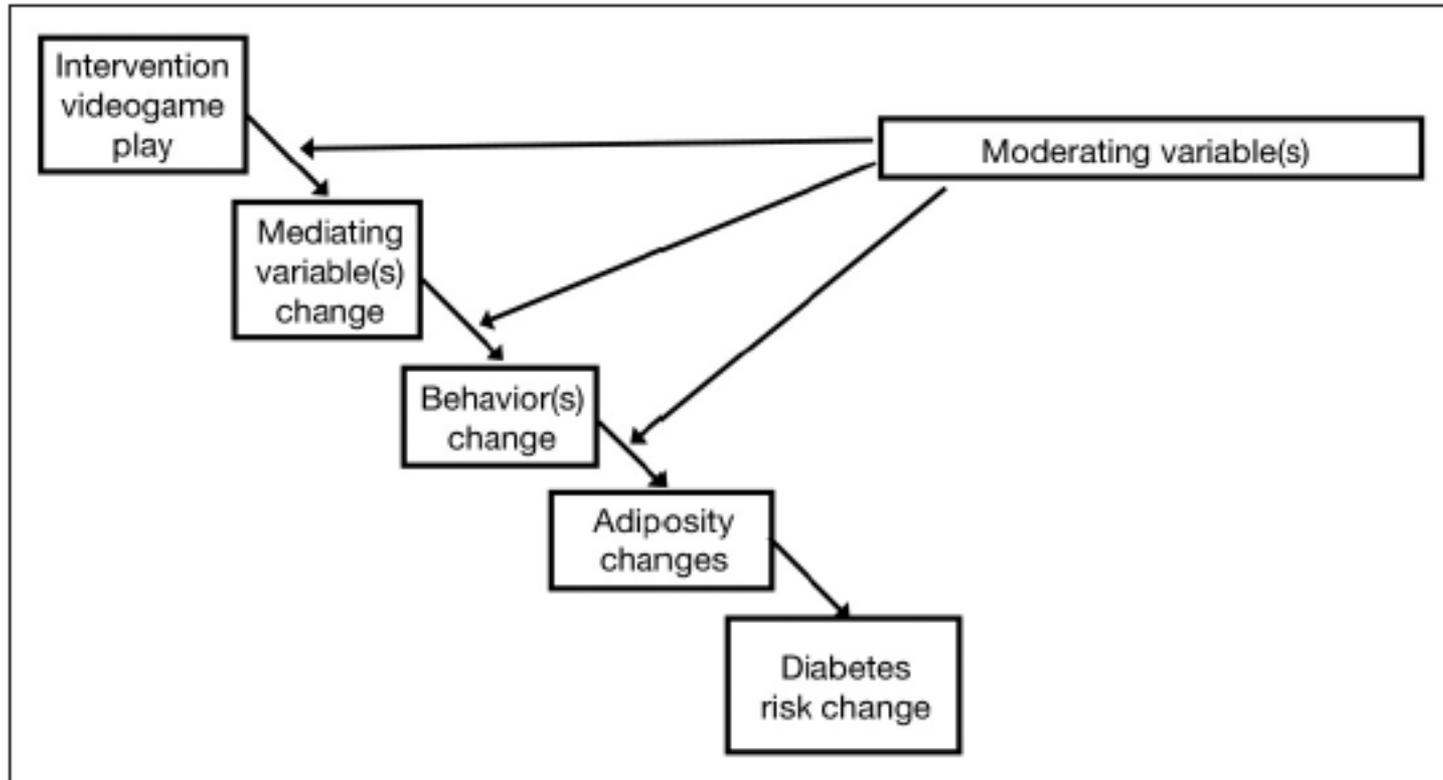
Practice:

Game Playbooks may be a critical tool for individuals seeking to develop games for health to ensure that proven mechanisms of change are implemented into the game play.

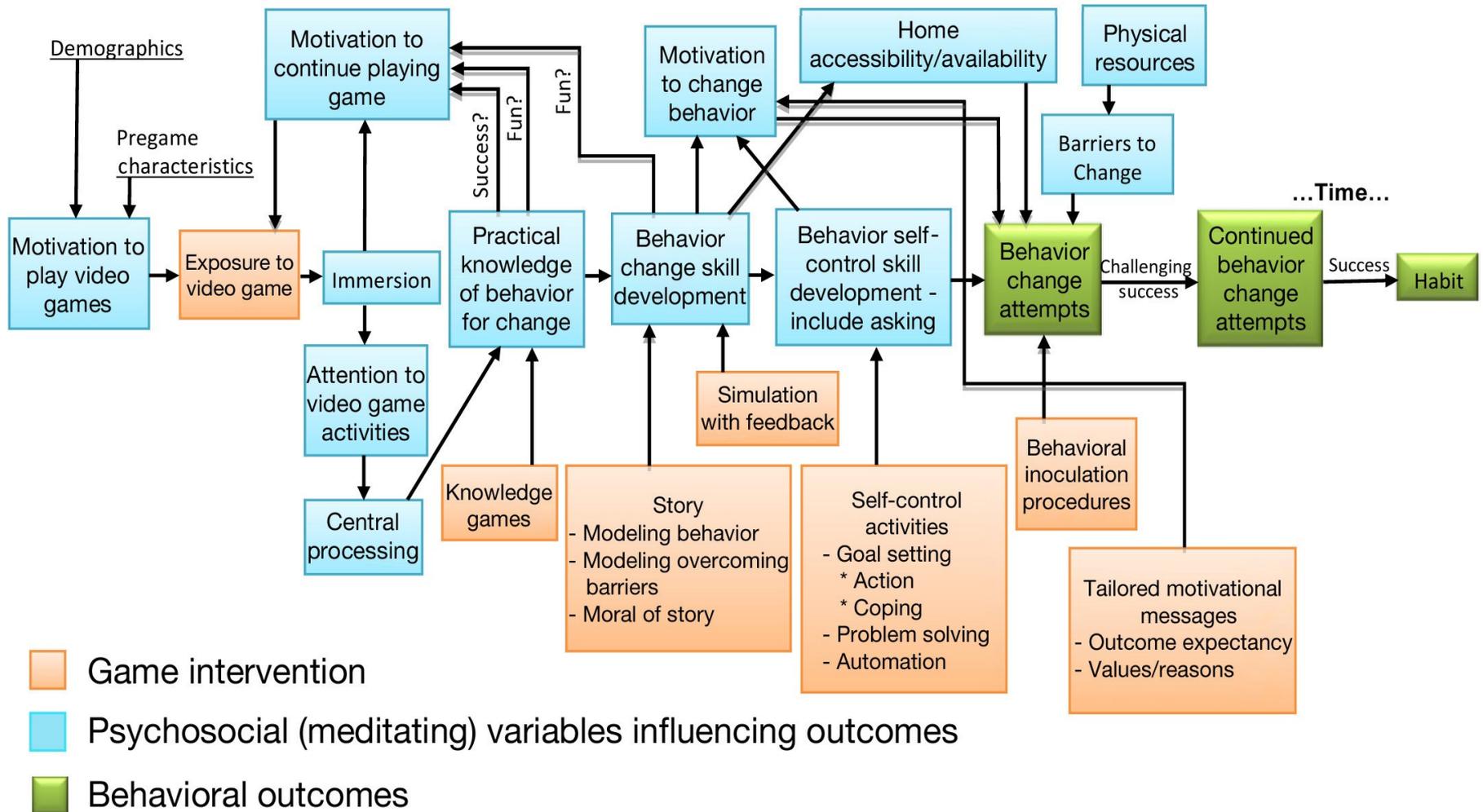
Game playbooks

Playbook section	Content and features
Player transformation/ learning goals	<ul style="list-style-type: none"> Bulleted list of what the player will learn or acquire through game play Represents the factors that will have a direct causal effect on the behavioral target of the videogame Derived from the “individual determinants” outlined in the logic model Written in layman's terms
Curriculum content	<ul style="list-style-type: none"> Describes proven strategies for influencing the desired outcome Represents the bulk of what the game designers use to create content and gameplay system structures in the game design Derived from a thorough review of the literature
Targeted variables	<ul style="list-style-type: none"> Defines the specific behavioral, cognitive, or motivational targets of the videogame Drawn directly from the established theoretical frameworks guiding the intervention content Closely aligned with the transformation/learning goals Valuable for evaluation of effectiveness of the videogame intervention
Theoretical frameworks	<ul style="list-style-type: none"> Describes the theories from which the target outcome variables are derived Describes the mechanisms by which the target outcome may be affected through the intervention Provides a deeper context for understanding the target outcome
Game design application	<ul style="list-style-type: none"> Includes an overview of the narrative setup, the player's objectives, the player progression model, a breakdown of the game's systems, and how feedback of players' success or failure will be incorporated into gameplay May also include sketches, images, and diagrams of game play

Pathway from intervention implementation to T2DM risk



Model of how video games with component change procedures influence mediators to change behaviors.





SCORE:

0

BUCKETS REMAINING:

12



LABEL EACH BIN. HARDER ONES ARE WORTH MORE POINTS!

HIGHEST IN ____ (BY WEIGHT)

5 PTS

HIGH IN "GOOD" FATS

1 PT

FRUITS

1 PT

GRAINS

1 PT

PROTEINS

1 PT

VEGETABLES

1 PT

DAIRY

1 PT

HIGH IN SUGAR

3 PTS

HIGH IN CALCIUM

3 PTS

HIGH IN FIBER

3 PTS

HIGH IN VITAMIN C

4 PTS

BALANCED MEALS

5 PTS

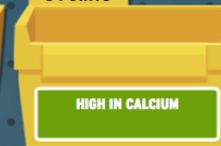
PEEK AT TILES ▶

PLAY!

3 POINTS



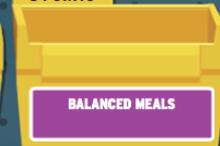
3 POINTS



4 POINTS



5 POINTS



Rango cards



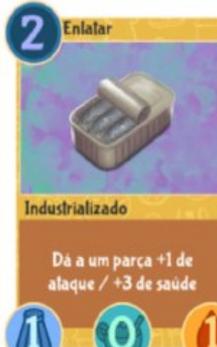
Boiled eggs



Balanced Snack



Canned food



Junk food combo



Whole food card	Homemade card	Industrialized card	Super Industrialized card
+ 1 energy point	Give 3 health point to all partners	Give to one partner +1 attack point/ +3 health point	-8 health point in the opponent score

Big eater



Health coach



Cooking



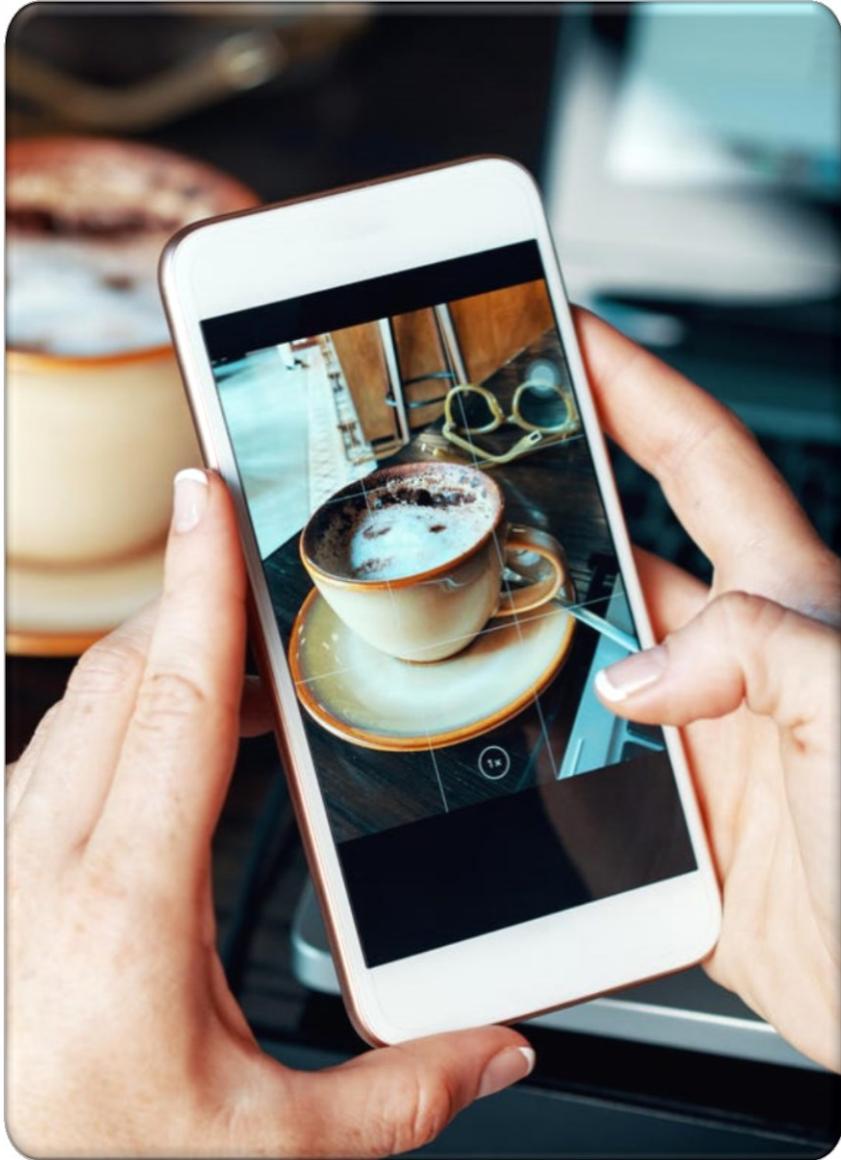
Reading front-of-pack labels



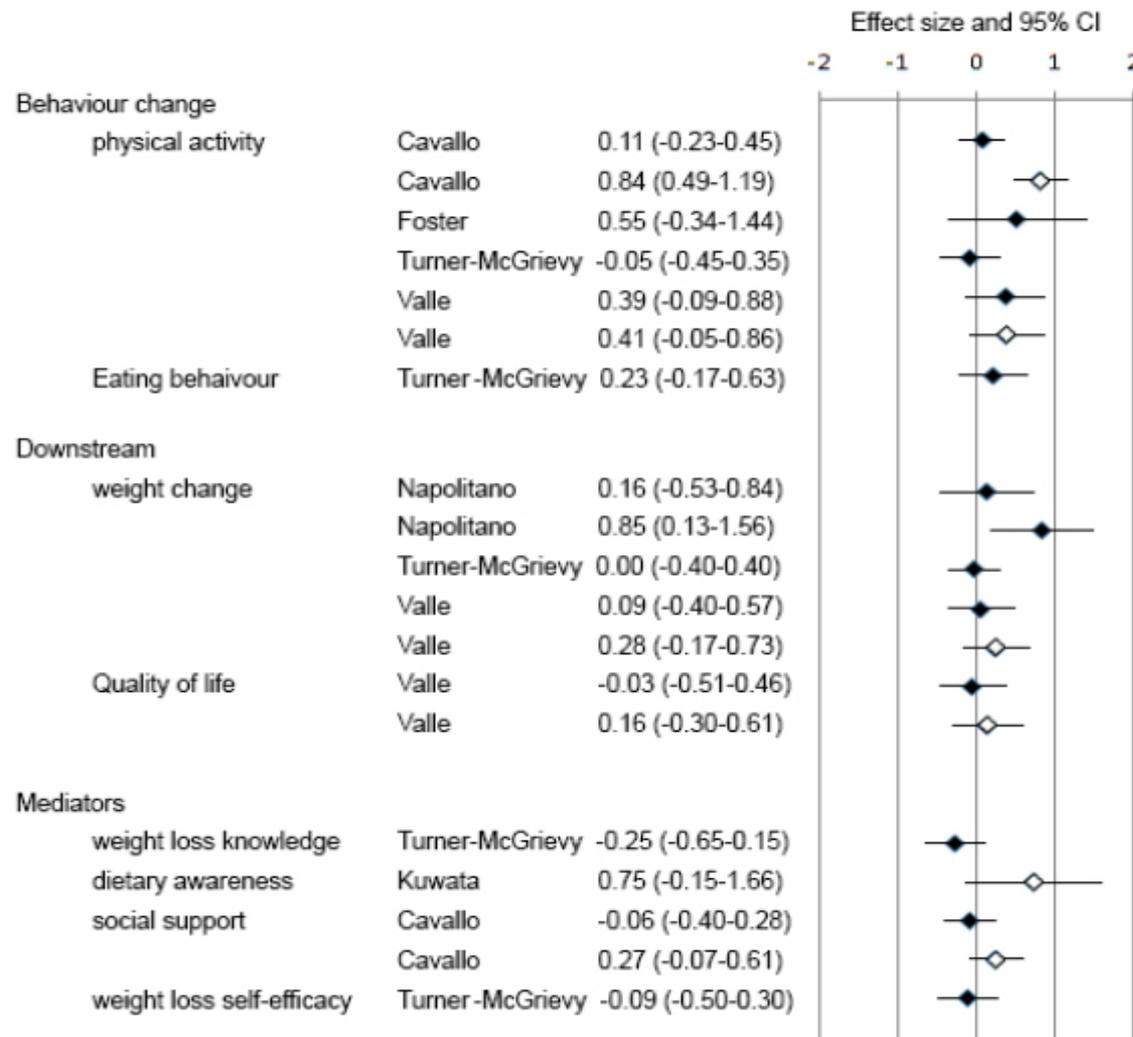
Partner	Partner	Good habits	Good habits
What about giving me a piece of your food?	All your other partners receive +1 attack point	Recover +1 energy point. Prepare a Homemade Food card	Check food labels to invalidate the effect of misleading information

Future diet-related game research should use

- Randomized controlled designs
- Common validated outcome measures (preferably more objective measures)
- Behavior change procedures as specified in recent Taxonomic inventories
- Be guided by conceptual models that reflect the complexities of game design, user experience, and their interactivity.
- A taxonomic inventory of game elements needs to be developed to clearly specify game designs



Social media



◇ within group
◆ between groups

Meta-analysis with
113,988 children
or adults, including
healthy
participants and
patients

Social media – Thoughts for future studies

Design social-networking interventions that can be delivered primarily within the social network setting. Provision of a small degree of supplementary equipment or printed resources is reasonable

Examine interventions delivered via existing popular social network websites, such as Facebook, given their proven ability to attract and retain participants and potential for mass dissemination. Such interventions should be responsive to the way people use online social networks (predominantly with existing friends and for entertainment).

Utilize large sample sizes to ensure they are sufficiently powered to detect effects, should they exist.

Involve high quality research methods, such as carefully designed randomized controlled trials.

Emphasize online recruitment strategies.

Involve long-term follow-up (eg, behavior change at 12 months and beyond).

Problems with digital support for dietary change

Access to digital infrastructure, including device ownership and availability of broadband connection

Many digital health tools are developed in order to be used by highly educated, and advantaged populations

Lack of human support for health care professionals

Lack of training for patients

Evaluation of digital tools is lacking



Thank you!