



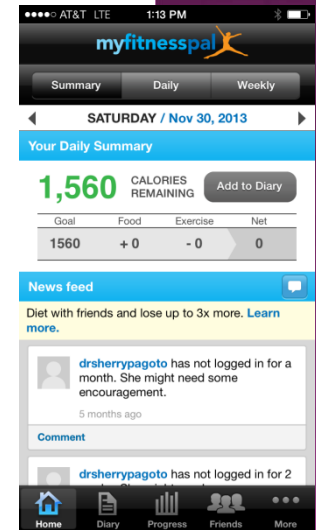
# COMMERCIAL APPS AND THE EVIDENCE: GUIDE FOR RESEARCHERS

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# SO YOU WANT TO DEVELOP EVIDENCE FOR COMMERCIAL APPS?

- Content Analysis
  - Clinical guidelines
  - Evidence-based treatment strategies
  - Behavior change strategies
- “Big data” secondary analyses
- Small N designs
- Randomized controlled trials



# CONTENT ANALYSIS

May be a way to identify apps that are good candidates for more rigorous efficacy testing



*What is the content of the app?*

*Are the strategies consistent with...*

*Clinical guidelines for that condition?*

*Evidence-based strategies?*

*Evidence-based principles?*

*Theoretically driven?*

# PROCEDURE

Search strategy

Inclusion criteria

Coding criteria

Coding protocol

Two coders (interrater reliability, Kappa)



# SEARCH STRATEGY

Which apps to include?

- ⦿ Android (Google Play), iPhone (iTunes) markets
- ⦿ Top 100 in a class or all available?
- ⦿ Appropriate keywords to hone in on relevant apps
- ⦿ Beware of ever-changing market

# INCLUSION CRITERIA

- Be specific
  - But if unique condition, consider broad focus
  - E.g., medication adherence in IBD → medication adherence apps
- If a large market, hone in on apps that have some evidence of credibility
  - E.g., self-monitoring for weight loss
- Certain number of user ratings?
- Free vs paid?
- Consider how a patient/consumer would search for an app

# CODING CRITERIA

- ⦿ Must be specific
- ⦿ Are there clinical guidelines?
- ⦿ Are there agreed upon behavioral strategies?
- ⦿ Code presence of evidence-based content
- ⦿ Code presence of non-evidence-based content
- ⦿ Code content that is misinformation, counter to evidence, false?

# CODING PROTOCOL

- Coders should code same version of app
  - beware of app updates
- Code quickly to stay timely
- Operational definitions of strategies coded—  
what is minimal necessary to qualify?
- Verify and refine your coding scheme by  
coding a few apps as a group.
- How long will you use the app?



# CODING PROTOCOL

- ◉ Coders enter into a spreadsheet independent of other coder
- ◉ When coding is complete, discrepancies should be identified and discussed
- ◉ Consensus needs to be reached

# INTERRATER RELIABILITY

- Calculate mean % agreement among coder pairs
- $\geq 80\%$  interrater reliability is a standard to shoot for
- Kappa coefficient



# EVIDENCE-BASED BEHAVIORAL STRATEGIES

# WEIGHT LOSS APPS

A systematic review of weight loss mobile apps in top 100 health apps on iPhone and Android platforms (N=30)

- App must include *at very least* a self-monitoring function for diet, physical activity and weight

Pagoto et al 2013, American Journal of Preventive Medicine

# METHODOLOGY

All apps were downloaded

20 behavioral strategies were taken from the *Diabetes Prevention Program Lifestyle Intervention*

Two investigators coded each app, compared codings, and came to consensus on discrepancies (interrater agreement = 92%)

<b>Behavioral Strategy</b>	<b>% apps</b>
Tracking	100%
Weight goal setting	93.3%
Diet goal setting	90%
Calorie Balance (energy in – energy out)	86.7%
Physical activity goal setting	20%
Exercise Safety	20%
Education on benefits of healthy diet and physical activity	13.3%
Food Substitutions	10%
Food Pyramid/My Plate	6.7%
Stimulus Control	6.7%

<b>Behavioral Strategy</b>	<b>% apps</b>
Portion Control	6.7%
Lifestyle Activity	6.7%
Target Heart Rate	6.7%
Problem Solving	3.3%
Stress Reduction	0%
Relapse Prevention	0%
Negative Thinking	0%
Social Cues	0%
Develop Regular Pattern of Eating	0%
Time Management	0%
Nutrition Label Reading	0%



# TOP APPS

App	Version	Platform	Cost	% criteria met	Stars out of 5
MyNetDiary PRO	3.40	iPhone	3.99	65%	5
MyNetDiary	3.3	iPhone	free	65%	5
All-in Fitness	2.0	iPhone	.99	25%	3.5
Noom Weight Loss	2.0	Android	Free	25%	4.5
Calorie Counter & Diet Tracker	2.3.1	Android	Free	20%	4.5
Daily Burn	1.2.3	iPhone	Free	20%	3.5
Sparkpeople	2.5	iPhone	Free	20%	4.5
SparkPeople	2.1	Android	Free	20%	3

App	Version	Platform	Cost	% criteria met	Stars out of 5
Absolute Fitness	2.1.6	Android	4.99	15%	4
Livestrong	1.2	Android	2.99	15%	3
Calorie counter Arawella		iPhone	Free	15%	4
Caloriecount.com	3.0	iPhone	Free	15%	4.5
MyFitnessPal	3.3.1891	iPhone	Free	15%	5
MyFitnessPal	2.3.1.007	Android	Free	15%	5
Calorie counter by FatSecret	2.2.6	Android	Free	15%	4.5
Calorie Counter by FatSecret		iPhone	Free	15%	4

App	Version	Platform	Cost	% criteria met	Stars out of 5
MyNetDiary	1.0.5	Android	3.99	15	4.5
Livestrong	3.0.2.120 1172152	iPhone	2.99	15	4.5
FitBit	1.2.3	iPhone	Free	15	3
Lose It!	3.7.2	iPhone	Free	15	5
Lose It!	1.1.9	Android	Free	15	4.5
Tap and Track Calorie Counter	7.2.1	iPhone	3.99	15	4.5
P90X	1.0, Build 94	iPhone	4.99	10	4
Nutrition Menu	1.26	iPhone	.99	5	4.5

# FREE VS PAID APPS?

Paid apps did not have more evidence-based strategies than free apps.



# CONCLUSIONS

Weight loss mobile apps do tracking, goal setting and feedback on energy balance very well.

Most other behavioral strategies are missing

- MyNetDiary Pro included a “library” that discussed a wider range of behavioral strategies.

Missing behavioral strategies (problem solving, relapse prevention, stress management, etc) are particularly instrumental for people with low adherence and motivation

# LIMITATIONS

Some apps had accompanying websites, books, DVDs, e-coaching, etc that may have included additional behavioral strategies

We don't know if an app that included all 20 strategies in the DPP Lifestyle Intervention would be effective

We did not evaluate usability (although apps were all in top 100 of Droid Marketplace and iTunes)

# CLINICAL GUIDELINES

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Are app features consistent with established clinical guidelines put forth by professional and authoritative organizations?



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Practice Guideline | July 2014

## 2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society

FREE

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*J Am Coll Cardiol.* 2014;63(25\_PA):. doi:10.1016/j.jacc.2013.11.004



## Weight loss—there is an app for that! But does it adhere to evidence-informed practices?

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### Abstract

Little is known about how much smartphone apps for weight control adhere to evidence-informed practices. The aim of this study was to review and summarize the content of available weight control apps. Information on content, user rating, and price was extracted from iTunes on September 25, 2009. Apps ( $n=204$ ) were coded for adherence to 13 evidence-informed practices for weight control. Latent class analysis was used to identify subgroups of apps based on endorsement practices. Only a small percentage of apps had five or more of the 13 practices (15%). Latent class analysis revealed three main types of apps: diet, physical activity, and weight journals (19%); dietary advice and journals (34%); and weight trackers (46%). User ratings were not associated with apps from these three classes. Many apps have insufficient evidence-informed content. Research is needed that seeks to develop, improve, and evaluate these apps.

### Keywords

mHealth, Weight loss, Smartphones, Apps

### Implications

**Practice:** Although popular among the lay public, many smartphone apps may lack comprehensive evidence-informed recommendations or practices for healthy weight control, so practitioners need to discuss the utility of these apps with patients if patients are using them as a supplement to treatment.

**Policy:** There are no industry standards so app developers will need to consider incorporating evidence-informed content.

**Research:** Continued research is needed that sheds light on the accuracy of smartphone apps for health behavior change in the public domain, and research is also needed that seeks to develop, improve, and evaluate these apps.

**Electronic supplementary material** The online version of this article (doi:10.1007/s13142-011-0076-5) contains supplementary material, which is available to authorized users.

Apps were reviewed by whether they included evidence informed weight loss practices common to CDC, NIH, FDA, USDA.

Table 1 | Percent of each evidence-informed practice among the 204 apps reviewed

Practices	Percent
Keep a food diary	43
Assessing your weight	36
Maintain calorie balance	34
Keep a physical activity journal	27
Portion control	25
Read nutrition facts labels	22
Regular physical activity	21
Eating a Diet Rich in Fruits and Vegetable	12
Meal planning	9
Drink water instead of soda or juice	7
Loss of 1 to 2 lb/week	6
Social support	3

# BEHAVIOR CHANGE TAXONOMY

# EVALUATION OF ACTIVITY MONITORS

Monitor names and descriptions.

Brand	Model	Where worn	Display/compatibility	Measures	Possible measures <sup>a</sup>	Food/Weight tracking
Basis		Wrist	Display, personal computer, iOS <sup>b</sup> , Android	PA <sup>c</sup> , Steps, Heart rate, Skin temperature, Perspiration, Sleep		
BodyMedia	Fit	Upper arm	Personal computer, iOS, Android	PA, Steps, Sleep	Heart rate, Weight	Food, Weight, Balance
Fitbit	Force	Wrist	Display, personal computer, iOS, Android	PA, Steps, Sleep, Stairs, Distance, Calories	Weight	Food, Weight, Balance
Fitbug	Orb	Multiple	Personal computer, iOS, Android	Steps, Distance, Calories, Sleep	Weight	Food, Weight, Balance
Gruve		Waist	Personal computer	Calories, Activity zones		
Ibitz	Unity	Waist	iOS	Steps, Distance, Calories		Weight
Jawbone	Up24	Wrist	iOS, Android	PA, Steps, Sleep, SB <sup>d</sup>		Food, Weight, Balance

BCT #	Behavior change technique	Source
8.1	Prompt practice	[28,37,38]
2.3	Prompt self-monitoring of behavior	[29,36,37,39]
1.1	Goal-setting/intention formation	[29,36-39]
1.2	Barrier identification/problem solving	[38,39]
2.2	Provide feedback on performance	[29]
1.5	Prompt review of behavioral goals	[29]
5.1	Provide information on consequences of behavior in general	[27]
1.4	Action planning	[27]
10.3	Prompt rewards contingent on effort or progress towards behavior	[27,28]
6.2	Facilitate social comparison	[27,40]
4.1	Provide instruction	[27,36]
15.4	Self-talk	[39]
10.9	Self-rewards	[39]
3	Social support	[39]
7.1	Teach to use prompts/cues	[28]

Technique	Recommendation	Monitors, n
Goal-setting	Specific	13
	Measurable	13
	Moderately challenging	13
	Long-term goals broken into short-term goals	6
	Easier goals successfully accomplished before attempting more difficult ones	3
Self-monitoring	Conducted regularly	13
	Conducted close in time to target activity	13
	Track precise information	13
	Track personally valued information	6
	Emphasize performance successes	9
	Focus on behavior modifiable by deliberate effort	13
Feedback	Specific	13
	Give a clear idea of how well participant is doing	13
	Compare performance to past accomplishments	13
	Compare performance to norms of similar groups	5
	Compare performance to precise goals	13

# THEORETICAL MODELS

**Original Paper**

# Smoking Cessation Apps for Smartphones: Content Analysis With the Self-Determination Theory

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Basic needs and app features	n (%)
<b>Autonomy</b>	
Information addressing reason for smoking cessation	59 (33.7)
Function allowing one's own smoking cessation plan	35 (20.0)
Offers at least 1 of the autonomy features above	85 (48.6)
<b>Competence</b>	
How-to information and resources	70 (40.0)
<b>Tools assisting implementation of behavior</b>	
Functions to send alert or alarm messages to warn or remind	18 (10.3)
Function to record and track one's own quitting or smoking attempts	60 (34.3)
<b>Offers feedback</b>	
Analysis of performance for quitting attempts or efforts	50 (28.6)
Cues to achievement or progress	77 (44.0)
Offers at least 1 of the competence features above	152 (86.9)
<b>Relatedness</b>	
<b>Function to interact with others</b>	
Connected to online communities	7 (2.4)
Connected to social media	31 (17.7)
Function to offer or record messages to cheer up	2 (1.1)
Offers at least 1 of the relatedness features above	37 (21.1)

# “BIG DATA” SECONDARY ANALYSIS

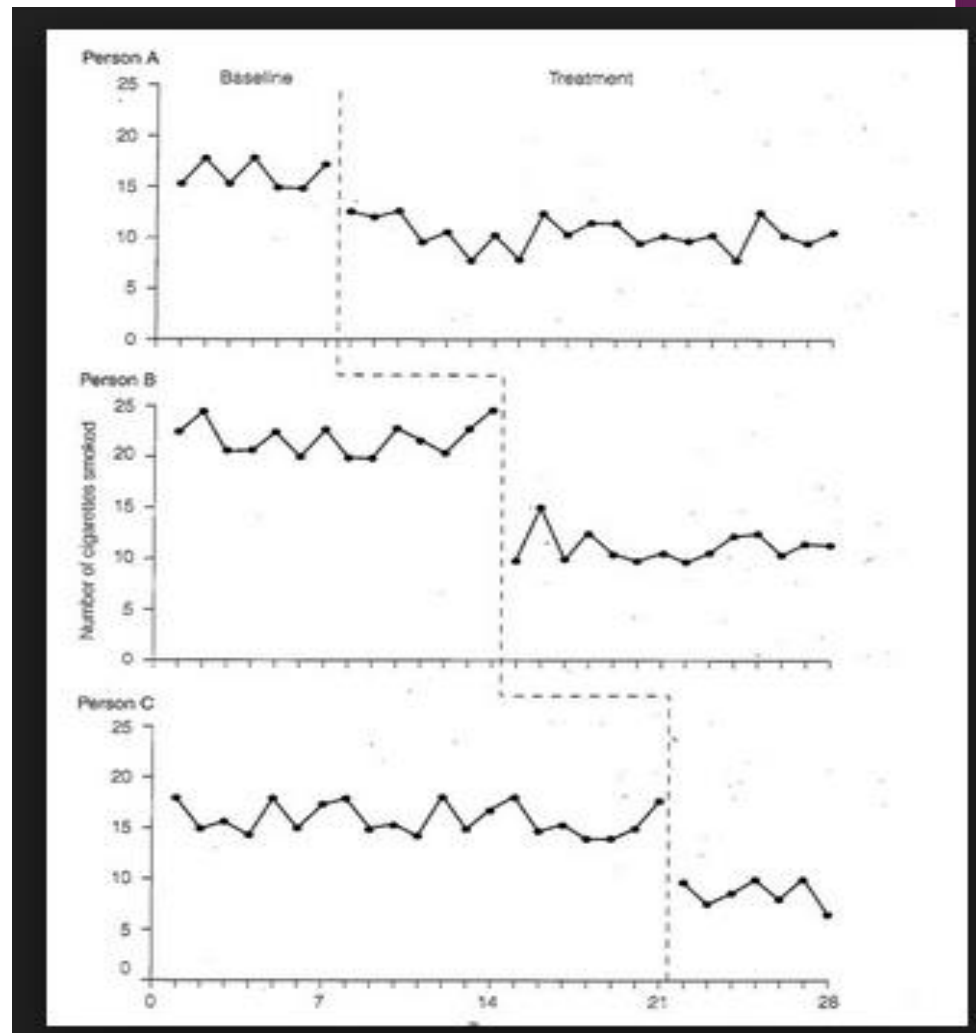
- Need data from app companies
- Usage, outcome, adherence data

# SMALL N DESIGNS

Careful measurement of multiple persons, traits or settings both before and after a intervention. The start of intervention is always staggered so that changes are more clearly tied to the intervention.

Quicker than larger trials

May identify apps worth testing on a larger scale



# RANDOMIZED CONTROL TRIAL

- ◉ Efficacy testing
- ◉ Mobile app alone vs control?
- ◉ Mobile app with other intervention vs other intervention only?
  - Counseling
  - Social network
- ◉ Conditions should match your question of interest.