Tech Tips – Family Medicine Update 2016

CDC – http://www.cdc.gov/mobile

PubMed – http://www.ncbi.nlm.nih.gov/pubmed/

1. Clinical Queries
2. Keywords
3. Systematic Reviews …or
4. Clinical Study Categories

3D anatomy software

Smartphones and wearables

- See references

FitBit

- See references

Smartphone alarms for medication reminder

Smartphone apps for medication reminder

- iOS
  - MedCoach Medication Reminder
  - Pill Monitor Free – Medication Reminder and Logs
- Android
  - AnyTimer Pill Reminder
  - Med Helper Pill Reminder

Productivity

- Storage
  - DropBox – http://www.dropbox.com
  - iCloud Drive – http://www.apple.com/icloud/icloud-drive/
  - Google Drive – https://www.google.com/drive/
- Scheduling
  - Microsoft Outlook
- Ideas, web pages, PDFs, photos, etc.
  - Evernote – http://www.evernote.com
- Lists
  - Wunderlist – https://www.wunderlist.com/
  - Todoist – http://todoist.com
  - Google Keep – http://www.google.com/keep/

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PubMed – Smartphone and Exercise → systematic[sb] AND (smartphone exercise)

1. Alibhai SM, Santa Mina D, Ritvo P, Sabiston C, Krahn M, Tomlinson G, et al. A phase II RCT and economic analysis of three exercise delivery methods in men with prostate cancer on androgen deprivation therapy. BMC Cancer. 2015 Apr 25;15:312,015-1316-8.

   BACKGROUND: Androgen deprivation therapy is commonly used to treat prostate cancer, the most common visceral cancer in men. However, various side effects often worsen physical functioning and reduce well-being among men on this treatment. Based on existing evidence, both resistance and aerobic training provide benefits for this population yet adherence rates are often low. The method of exercise delivery (supervised in-center or home-based) may be important, yet few studies have compared different models. Additionally, long-term exercise adherence is critical to achieve sustained benefits but long-term adherence data and predictors of adherence are lacking. The primary aim of this phase II, non-inferiority randomized controlled trial is to determine whether three exercise training delivery models are equivalent in terms of benefits in quality of life and physical fitness in this population. Secondary aims include examination of long-term adherence and cost-effectiveness. DESIGN: Men diagnosed with prostate cancer, starting or continuing on androgen deprivation therapy for at least 6 months, fluent in English, and living close to one of two experienced Canadian study centers are eligible. Participants complete five assessments over one year, including a fitness assessment and self-report questionnaires. Socio-demographic and clinical data collection occur at baseline, bone mineral density testing at two time points, and blood work is performed at three time points. Participants are randomized in a 1:1:1 fashion to supervised personal training, supervised group training, or home-based smartphone- and health coach-supported training. Each participant receives a detailed exercise manual, including illustrations of exercises and safety precautions. Participants are asked to complete 4 to 5 exercise sessions per week, incorporating aerobic, resistance and flexibility training. Participant intensity levels will be monitored. The intervention duration is 6 months, with 6 months additional follow-up. Outcomes include: body composition, fitness testing, quality of life and fatigue, biological outcomes, and program adherence. Cost information will be obtained using patient diary-based self-report. DISCUSSION: The goals of this study are to gain a better understanding of health benefits and costs associated with commonly used yet currently not compared exercise delivery models as well as an increased understanding of adherence to exercise. TRIAL REGISTRATION: The trial has been registered at clinicaltrials.gov (Registration # NCT02046837), registered January 20(th), 2014.

2. Bort-Roig J, Gilson ND, Puig-Ribera A, Contreras RS, Trost SG. Measuring and influencing physical activity with smartphone technology: a systematic review. Sports Med. 2014 May;44(5):671-86.

   BACKGROUND: Rapid developments in technology have encouraged the use of smartphones in physical activity research, although little is known regarding their effectiveness as measurement and intervention tools. OBJECTIVE: This study systematically reviewed evidence on smartphones and their viability for measuring and influencing physical activity. DATA SOURCES: Research articles were identified in September 2013 by literature searches in Web of Knowledge, PubMed, PsycINFO, EBSCO, and ScienceDirect. STUDY SELECTION: The search was restricted using the terms (physical activity OR exercise OR fitness) AND (smartphone* OR mobile phone* OR cell phone*) AND (measurement OR intervention). Reviewed articles were required to be published in international academic peer-reviewed journals, or in full text from international scientific conferences, and focused on measuring physical activity through smartphone processing data and influencing people to be more active through smartphone applications.

STUDY APPRAISAL AND SYNTHESIS METHODS: Two reviewers independently performed the selection of articles and examined titles and abstracts to exclude those out of scope. Data on study characteristics, technologies used to objectively measure physical activity, strategies applied to influence activity; and the main study findings were extracted and reported. RESULTS: A total of 26 articles (with the first published in 2007) met inclusion criteria. All studies were conducted in highly economically advantaged countries; 12 articles focused on special populations (e.g. obese patients). Studies measured physical activity using native mobile features, and/or an external device linked to an application. Measurement accuracy ranged from 52 to 100% (n = 10 studies). A total of 17 articles implemented and evaluated an intervention. Smartphone strategies to influence physical activity tended to be ad hoc, rather than theory-based approaches; physical activity profiles, goal setting, real-time feedback, social support networking, and online expert consultation were identified as the most useful strategies to encourage physical activity change. Only five studies assessed physical activity intervention effects; all used step counts as the outcome measure. Four studies (three pre-post and one comparative) reported physical activity increases (12-42 participants, 800-1,104 steps/day, 2 weeks-6 months), and one case-control study reported physical activity maintenance (n = 200 participants; >10,000 steps/day) over 3 months. LIMITATIONS: Smartphone use is a relatively new field of study in physical activity research, and consequently the evidence base is emerging. CONCLUSIONS: Few studies identified in this review considered the validity of phone-based assessment of physical activity. Those that did report on measurement properties found average-to-excellent levels of accuracy for different behaviors. The range of novel and engaging intervention strategies used by smartphones, and user perceptions on their usefulness and viability, highlights the potential such technology has for physical activity promotion. However, intervention effects reported in the extant literature are modest at best, and future studies need to utilize randomized controlled trial research designs, larger sample sizes, and longer study periods to better explore the physical activity measurement and intervention capabilities of smartphones.

3. Chaplais E, Naughton G, Thivel D, Courteix D, Greene D. Smartphone Interventions for Weight Treatment and Behavioral Change in Pediatric Obesity: A Systematic Review. Telemed J E Health. 2015 Oct;21(10):822-30.

BACKGROUND: Traditional approaches for treating or managing children and adolescents with overweight or obesity have limited effectiveness. Current advances in smartphone technology may improve the attractiveness and accessibility of weight management support for children and adolescents with overweight or obesity. This systematic review aimed to provide a comparative evaluation of the effectiveness of using smartphones in the multidisciplinary treatment of child and adolescent overweight or obesity, with a specific interest in behavior change. MATERIALS AND METHODS: The databases of Medline complete, OVID, CINAHL, EMBASE, and PubMed were searched for randomized controlled trial (RCT) studies addressing behavioral change using smartphone technology, plus nutrition and/or physical activity, to treat or manage child and adolescent obesity. RESULTS: Only two RCTs have described the effectiveness of smartphone devices in pediatric overweight or obesity treatment. Within the limitation of the two studies, electronic contact (e-contact) appeared unsuccessful in achieving weight loss. However, smartphone usage was linked to improved engagement and reduced dropout rates during important sustainability phases of these long-term interventions. CONCLUSIONS: Smartphone technologies allow users to accomplish tasks anywhere and anytime and, as such, provide researchers with additional and generationally appropriate

capacities to deliver health promotion. E-contact should be used for its significant capacity to prolong engagement and decrease withdrawal during sustainability phases that follow intensive intervention for weight management in young populations. Despite increasing popularity in published protocols of weight management trials, the effectiveness of the impact of smartphone technology in pediatric programs remains equivocal.

4. El-Gayar O, Timsina P, Nawar N, Eid W. Mobile applications for diabetes self-management: status and potential. J Diabetes Sci Technol. 2013 Jan 1;7(1):247-62.

BACKGROUND: Advancements in smartphone technology coupled with the proliferation of data connectivity has resulted in increased interest and unprecedented growth in mobile applications for diabetes self-management. The objective of this article is to determine, in a systematic review, whether diabetes applications have been helping patients with type 1 or type 2 diabetes self-manage their condition and to identify issues necessary for large-scale adoption of such interventions. METHODS: The review covers commercial applications available on the Apple App Store (as a representative of commercially available applications) and articles published in relevant databases covering a period from January 1995 to August 2012. The review included all applications supporting any diabetes self-management task where the patient is the primary actor. RESULTS: Available applications support self-management tasks such as physical exercise, insulin dosage or medication, blood glucose testing, and diet. Other support tasks considered include decision support, notification/alert, tagging of input data, and integration with social media. The review points to the potential for mobile applications to have a positive impact on diabetes self-management. Analysis indicates that application usage is associated with improved attitudes favorable to diabetes self-management. Limitations of the applications include lack of personalized feedback; usability issues, particularly the ease of data entry; and integration with patients and electronic health records. CONCLUSIONS: Research into the adoption and use of user-centered and sociotechnical design principles is needed to improve usability, perceived usefulness, and, ultimately, adoption of the technology. Proliferation and efficacy of interventions involving mobile applications will benefit from a holistic approach that takes into account patients' expectations and providers' needs.

5. Huckvale K, Car M, Morrison C, Car J. Apps for asthma self-management: a systematic assessment of content and tools. BMC Med. 2012 Nov 22;10:144,7015-10-144.

BACKGROUND: Apps have been enthusiastically adopted by the general public. They are increasingly recognized by policy-makers as a potential medium for supporting self-management of long-term conditions. We assessed the degree to which current smartphone and tablet apps for people with asthma offer content and tools of appropriate quality to support asthma self-management. METHODS: We adapted systematic review methodology to the assessment of apps. We identified English-language asthma apps for all ages through a systematic search of official app stores. We systematically assessed app content using criteria derived from international guidelines and systematic review of strategies for asthma self-management. We covered three domains: comprehensiveness of asthma information, consistency of advice with evidence and compliance with health information best practice principles. RESULTS: We identified 103 apps for asthma in English, of which 56 were sources of information about the condition and 47 provided tools for the management of asthma. No apps offered both types of functionality. Only three information apps approached our definition of comprehensiveness of information about asthma. No apps provided advice on lay management

of acute asthma that included details of appropriate reliever medication use. In 32 of 72 instances, apps made unequivocal recommendations about strategies for asthma control or prophylaxis that were unsupported by current evidence. Although 90% of apps stated a clear purpose, compliance with other best practice principles for health information was variable. Contact details were located for 55%, funding source for 18% and confidentiality policy for 17%. CONCLUSIONS: No apps for people with asthma combined reliable, comprehensive information about the condition with supportive tools for self-management. Healthcare professionals considering recommending apps to patients as part of asthma self-management should exercise caution, recognizing that some apps like calculators may be unsafe; that no current app will meet the need of every patient; and that ways of working must be adapted if apps are to be introduced, supported and sustained in routine care. Policy-makers need to consider the potential role for assurance mechanisms in relation to apps. There remains much to be done if apps are to find broad use in clinical practice; clinicians cannot recommend tools that are inaccurate, unsafe or lack an evidence base.

6. Nicholas J, Larsen ME, Proudfoot J, Christensen H. Mobile Apps for Bipolar Disorder: A Systematic Review of Features and Content Quality. J Med Internet Res. 2015 Aug 17;17(8):e198.

BACKGROUND: With continued increases in smartphone ownership, researchers and clinicians are investigating the use of this technology to enhance the management of chronic illnesses such as bipolar disorder (BD). Smartphones can be used to deliver interventions and psychoeducation, supplement treatment, and enhance therapeutic reach in BD, as apps are cost-effective, accessible, anonymous, and convenient. While the evidence-based development of BD apps is in its infancy, there has been an explosion of publicly available apps. However, the opportunity for mHealth to assist in the self-management of BD is only feasible if apps are of appropriate quality. OBJECTIVE: Our aim was to identify the types of apps currently available for BD in the Google Play and iOS stores and to assess their features and the quality of their content. METHODS: A systematic review framework was applied to the search, screening, and assessment of apps. We searched the Australian Google Play and iOS stores for English-language apps developed for people with BD. The comprehensiveness and quality of information was assessed against core psychoeducation principles and current BD treatment guidelines. Management tools were evaluated with reference to the best-practice resources for the specific area. General app features, and privacy and security were also assessed. RESULTS: Of the 571 apps identified, 82 were included in the review. Of these, 32 apps provided information and the remaining 50 were management tools including screening and assessment (n=10), symptom monitoring (n=35), community support (n=4), and treatment (n=1). Not even a quarter of apps (18/82, 22%) addressed privacy and security by providing a privacy policy. Overall, apps providing information covered a third (4/11, 36%) of the core psychoeducation principles and even fewer (2/13, 15%) best-practice guidelines. Only a third (10/32, 31%) cited their information source. Neither comprehensiveness of psychoeducation information (r=-.11, P=.80) nor adherence to best-practice guidelines (r=-.02, P=.96) were significantly correlated with average user ratings. Symptom monitoring apps generally failed to monitor critical information such as medication (20/35, 57%) and sleep (18/35, 51%), and the majority of self-assessment apps did not use validated screening measures (6/10, 60%). CONCLUSIONS: In general, the content of currently available apps for BD is not in line with practice guidelines or established self-management principles. Apps also fail to provide important information to help users assess their quality, with most lacking source citation and a privacy policy. Therefore, both consumers and clinicians should exercise caution with app selection. While mHealth offers great

opportunities for the development of quality evidence-based mobile interventions, new frameworks for mobile mental health research are needed to ensure the timely availability of evidence-based apps to the public.

7. Stephens J, Allen J. Mobile phone interventions to increase physical activity and reduce weight: a systematic review. J Cardiovasc Nurs. 2013 Jul-Aug;28(4):320-9.

OBJECTIVE: This systematic review was conducted to determine user satisfaction and effectiveness of smartphone applications and text messaging interventions to promote weight reduction and physical activity. METHODS: Studies of smartphone applications and text messaging interventions related to the cardiovascular risk factors of physical inactivity and overweight/obesity published between January 2005 and August 2010 were eligible. Studies related to disease management were excluded. Study characteristics and results were gathered and synthesized. RESULTS: A total of 36 citations from CINAHL, EMBASE, MEDLINE, PsycINFO, and PubMed were identified; 7 articles were eligible for inclusion. The most frequent outcome measured in the studies was change in the weight of participants (57%). More than half of the studies (71%) reported statistically significant results in at least 1 outcome of weight loss, physical activity, dietary intake, decreased body mass index, decreased waist circumference, sugar-sweetened beverage intake, screen time, and satisfaction or acceptability outcomes. CONCLUSIONS: All of the technology interventions that were supported by education or an additional intervention demonstrated a beneficial impact of text messaging or smartphone application for reduction of physical inactivity and/or overweight/obesity. More rigorous trials that determine what parts of the technology or intervention are effective as well as establishment of cost-effectiveness are necessary for further evaluation of smartphone and text messaging interventions.

8. Wearing JR, Nollen N, Befort C, Davis AM, Agemy CK. iPhone app adherence to expert-recommended guidelines for pediatric obesity prevention. Child Obes. 2014 Apr;10(2):132-44.

BACKGROUND: Pediatric obesity is a serious and prevalent problem. Smartphone technology, which is becoming increasingly available to children of diverse backgrounds, presents a unique opportunity to instill healthy behaviors before the onset of obesity. Past studies have examined the use of smartphone applications as tools of health behavior modification for adults. The present study examines the content of children's exercise and nutrition smartphone apps. METHOD: Sixty-two iPhone apps were identified and coded by two independent raters for adherence to expert-recommended behaviors (e.g., five fruits/vegetables per day) and strategies (e.g., self-monitoring diet/physical activity) for the prevention of pediatric obesity. RESULTS: App behavioral and strategy index scores were uniformly low. Apps were more likely to address expert-recommended behaviors for the prevention of pediatric obesity (93.5%), whereas few apps addressed recommended strategies (20.9%). The most common behaviors addressed included physical activity (53.2%) and fruit/vegetable consumption (48.3%). Other important behaviors (e.g., screen time [1.6%] and family meals together [1.6%]) were rarely addressed. CONCLUSIONS: Current children's diet and exercise apps could be improved with increased adherence to expert-recommended guidelines, especially expert-recommended strategies.

PubMed – FitBit → systematic[sb] AND (FitBit)

1. Evenson KR, Goto MM, Furberg RD. Systematic review of the validity and reliability of consumer-wearable activity trackers. Int J Behav Nutr Phys Act. 2015 Dec 18;12(1):159,015-0314-1.

   BACKGROUND: Consumer-wearable activity trackers are electronic devices used for monitoring fitness- and other health-related metrics. The purpose of this systematic review was to summarize the evidence for validity and reliability of popular consumer-wearable activity trackers (Fitbit and Jawbone) and their ability to estimate steps, distance, physical activity, energy expenditure, and sleep. METHODS: Searches included only full-length English language studies published in PubMed, Embase, SPORTDiscus, and Google Scholar through July 31, 2015. Two people reviewed and abstracted each included study. RESULTS: In total, 22 studies were included in the review (20 on adults, 2 on youth). For laboratory-based studies using step counting or accelerometer steps, the correlation with tracker-assessed steps was high for both Fitbit and Jawbone (Pearson or intraclass correlation coefficients (CC) > =0.80). Only one study assessed distance for the Fitbit, finding an over-estimate at slower speeds and under-estimate at faster speeds. Two field-based studies compared accelerometry-assessed physical activity to the trackers, with one study finding higher correlation (Spearman CC 0.86, Fitbit) while another study found a wide range in correlation (intraclass CC 0.36-0.70, Fitbit and Jawbone). Using several different comparison measures (indirect and direct calorimetry, accelerometry, self-report), energy expenditure was more often under-estimated by either tracker. Total sleep time and sleep efficiency were over-estimated and wake after sleep onset was under-estimated comparing metrics from polysomnography to either tracker using a normal mode setting. No studies of intradevice reliability were found. Interdevice reliability was reported on seven studies using the Fitbit, but none for the Jawbone. Walking- and running-based Fitbit trials indicated consistently high interdevice reliability for steps (Pearson and intraclass CC 0.76-1.00), distance (intraclass CC 0.90-0.99), and energy expenditure (Pearson and intraclass CC 0.71-0.97). When wearing two Fitbits while sleeping, consistency between the devices was high. CONCLUSION: This systematic review indicated higher validity of steps, few studies on distance and physical activity, and lower validity for energy expenditure and sleep. The evidence reviewed indicated high interdevice reliability for steps, distance, energy expenditure, and sleep for certain Fitbit models. As new activity trackers and features are introduced to the market, documentation of the measurement properties can guide their use in research settings.

2. Lee J, Finkelstein J. Consumer sleep tracking devices: a critical review. Stud Health Technol Inform. 2015;210:458-60.

   Consumer sleep tracking devices are widely advertised as effective means to monitor and manage sleep quality and to provide positive effects on overall heath. However objective evidence supporting these claims is not always readily available. The goal of this study was to perform a comprehensive review of available information on six representative sleep tracking devices: BodyMedia FIT, Fitbit Flex, Jawbone UP, Basis Band, Innovative Sleep Solutions SleepTracker, and Zeo Sleep Manager Pro. The review was conducted along the following dimensions: output metrics, theoretical frameworks, systematic evaluation, and FDA clearance. The review identified a critical lack of basic information about the devices: five out of six devices provided no supporting information on their sensor accuracy and four out of six devices provided no information on their output metrics accuracy. Only three devices were found to have related peer-reviewed articles. However in these articles wake detection accuracy was revealed to be quite low and to vary widely (BodyMedia, 49.9+/-3.6%; Fitbit, 19.8%; Zeo, 78.9% to 83.5%). No supporting evidence on how well tracking devices can help mitigate sleep loss and manage sleep disturbances in practical life was provided.

3. Lyons EJ, Lewis ZH, Mayrsohn BG, Rowland JL. Behavior change techniques implemented in electronic lifestyle activity monitors: a systematic content analysis. J Med Internet Res. 2014 Aug 15;16(8):e192.

BACKGROUND: Electronic activity monitors (such as those manufactured by Fitbit, Jawbone, and Nike) improve on standard pedometers by providing automated feedback and interactive behavior change tools via mobile device or personal computer. These monitors are commercially popular and show promise for use in public health interventions. However, little is known about the content of their feedback applications and how individual monitors may differ from one another. OBJECTIVE: The purpose of this study was to describe the behavior change techniques implemented in commercially available electronic activity monitors. METHODS: Electronic activity monitors (N=13) were systematically identified and tested by 3 trained coders for at least 1 week each. All monitors measured lifestyle physical activity and provided feedback via an app (computer or mobile). Coding was based on a hierarchical list of 93 behavior change techniques. Further coding of potentially effective techniques and adherence to theory-based recommendations were based on findings from meta-analyses and meta-regressions in the research literature. RESULTS: All monitors provided tools for self-monitoring, feedback, and environmental change by definition. The next most prevalent techniques (13 out of 13 monitors) were goal-setting and emphasizing discrepancy between current and goal behavior. Review of behavioral goals, social support, social comparison, prompts/cues, rewards, and a focus on past success were found in more than half of the systems. The monitors included a range of 5-10 of 14 total techniques identified from the research literature as potentially effective. Most of the monitors included goal-setting, self-monitoring, and feedback content that closely matched recommendations from social cognitive theory. CONCLUSIONS: Electronic activity monitors contain a wide range of behavior change techniques typically used in clinical behavioral interventions. Thus, the monitors may represent a medium by which these interventions could be translated for widespread use. This technology has broad applications for use in clinical, public health, and rehabilitation settings.

4. Tully MA, McBride C, Heron L, Hunter RF. The validation of Fibit Zip physical activity monitor as a measure of free-living physical activity. BMC Res Notes. 2014 Dec 23;7:952,0500-7-952.

BACKGROUND: The new generation of activity monitors allow users to upload their data to the internet and review progress. The aim of this study is to validate the Fitbit Zip as a measure of free-living physical activity. FINDINGS: Participants wore a Fitbit Zip, ActiGraph GT3X accelerometer and a Yamax CW700 pedometer for seven days. Participants were asked their opinion on the utility of the Fitbit Zip. Validity was assessed by comparing the output using Spearman's rank correlation coefficients, Wilcoxon signed rank tests and Bland-Altman plots. 59.5% (25/47) of the cohort were female. There was a high correlation in steps/day between the Fitbit Zip and the two reference devices ($r = 0.91$, $p < 0.001$). No statistically significant difference between the Fitbit and Yamax steps/day was observed (Median (IQR) 7477 (3597) vs 6774 (3851); $p = 0.11$). The Fitbit measured significantly more steps/day than the Actigraph (7477 (3597) vs 6774 (3851); $p < 0.001$). Bland-Altman plots revealed no systematic differences between the devices. CONCLUSIONS: Given the high level of correlation and no apparent systematic biases in the Bland Altman plots, the use of Fitbit Zip as a measure of physical activity. However the Fitbit Zip recorded a significantly higher number of steps per day than the Actigraph.