Minimally Invasive and Novel Therapeutics (M.I.N.T.)
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Digital Health Applications in Gastroenterology

Mythili Pathipati, MD Massachusetts General Hospital

Digital health is becoming ubiquitous

- There has been significant investment in digital health applications
- Combination of secular trend towards consumerization of care and acceleration during COVID
- Surveys suggest 40-70% of US adults are using mobile health apps

Rock Health, 2023

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GI remains in early stages of app uptake

- Several digital tools have been developed but many remain in research stage
- Strong momentum in certain subspecialties including IBS and obesity medicine
- Tools broadly fit into four categories: symptom tracking, physiologic monitoring (wearables), care provision, and patient support

	Mobile apps	Telemedicine	AI	Wearables or biosensors	AR or VR	Blockchain	Remote monitoring
Barrett's esophagus	Available	Available	Clinical	Clinical	None	None	None
Celiac disease	Available	Available	Experimental	Experimental	Clinical	Experimental	Clinical
Chronic liver disease	Available	Available	Experimental	Clinical	Clinical	None	Clinical
Colorectal cancer	Available	Available	Available	Clinical	Clinical	Experimental	Clinical
Constipation	Available	Available	Experimental	Clinical	Clinical	None	Clinical
Diarrhea	Available	Available	Experimental	Experimental	None	Experimental	Clinical
Diverticular disease	Available	Available	Experimental	None	Clinical	None	None
Gallbladder & biliary disease	Available	Available	Experimental	None	Clinical	None	None
Gastroesophageal reflux disease	Available	Available	Experimental	Standard	None	None	Standard
Gastrointestinal hemorrhage	Available	Available	Experimental	Available	None	None	Available
Hemorrhoids	Available	Available	None	None	Clinical	None	None
Inflammatory bowel disease	Available	Available	Experimental	Clinical	Clinical	Clinical	Available
Irritable bowel syndrome	Available	Available	Clinical	Available	Clinical	None	Clinical
Pancreatitis	Available	Available	Experimental	Clinical	Clinical	None	Clinical

Abbreviations: AI, artificial intelligence; AR, augmented reality; VR, virtual reality
Technology maturity definitions: None, not present; experimental, proof of concept or using clinical data only; clinical, testing in humans or applied clinically; available, for clinical use presently; and standard, gold standard.

Mathews, Simon C., and Vorada Sakulsaengprapha. "Digital health landscape in gastroenterology and hepatology." Clinical Gastroenterology and Hepatology 19.3 (2021): 421-424.

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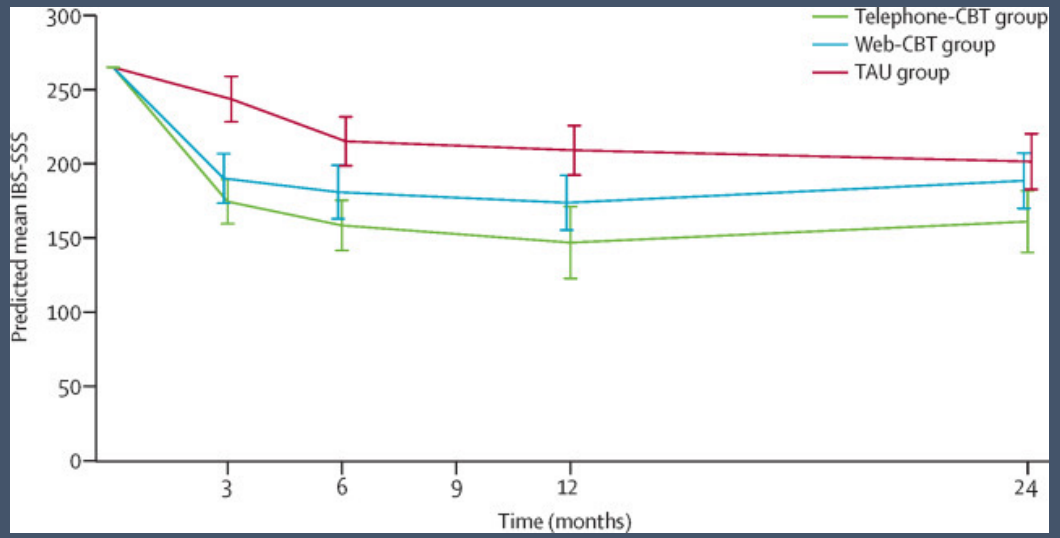
Case study: Digital Therapy for DGBIs

- Psychological therapy is a well-established treatment for IBS with more than 40 published RCTs and evidence of symptom improvement
- Yet use in practice is low due to practical limitations – fewer than 50% of gastroenterologists report having access to and GI psychologists, who are instrumental in delivering care
- Technology-enabled programs (e.g. Mahana, Regulora, Nerva, etc.) help fill this care gap with several early indicators of success



Everitt, Hazel A., et al. "Cognitive behavioural therapy for irritable bowel syndrome: 24-month follow-up of participants in the ACTIB randomised trial." The Lancet Gastroenterology & Hepatology 4.11 (2019): 863-872.

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Case study: Digital Therapy for DGBIs

- Hypnotherapy has demonstrated efficacy in small trials of functional dyspepsia, non-cardiac chest pain, globus sensation, and functional heartburn
    - Mechanism is unknown, but two related processes are believed to underlie the majority of refractory esophageal symptoms—esophageal hypersensitivity and esophageal hypervigilance
- One study found that functional dyspepsia (FD) occurred in 55% people who met Rome IV criteria for IBS and that those with overlap of IBS and FD reported significantly more severe IBS symptoms

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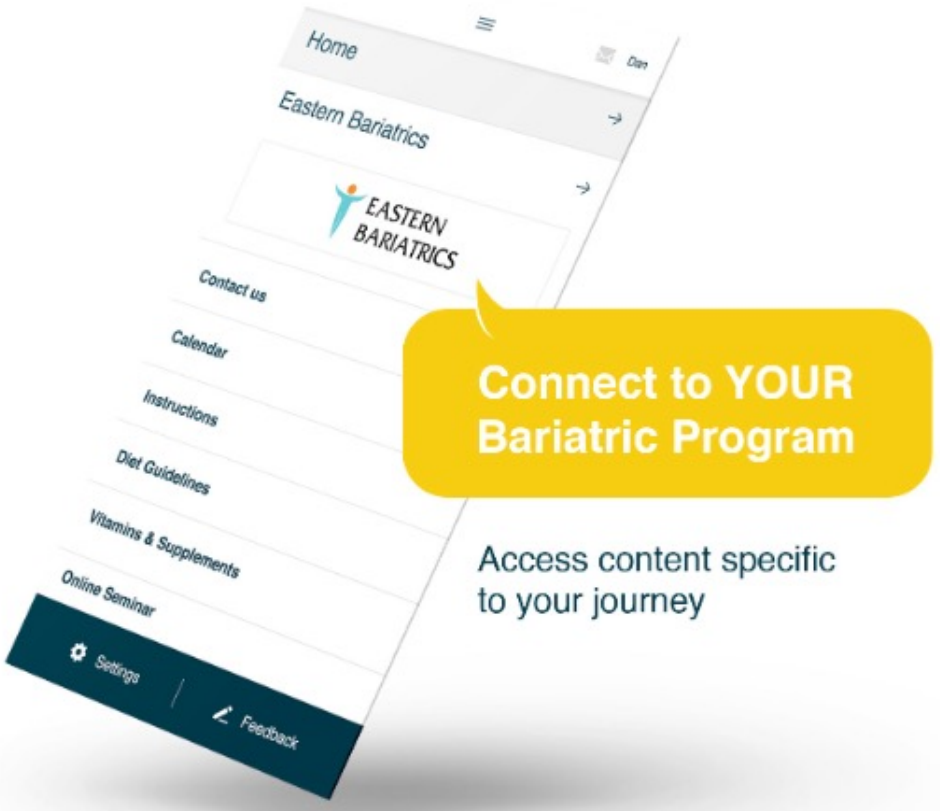
Barberio B, Yiannakou Y, Houghton LA, et al. Overlap of Rome IV irritable bowel syndrome and functional dyspepsia and effect on natural history: a longitudinal follow-up study. Clinical Gastroenterology and Hepatology 2022;20:e89-e101.

Case study: Weight loss

- Consumer weight loss apps (e.g. MyFitnessPal, Fitbit, etc.) are among the most popular tools in digital health, and include calorie counters, step trackers, exercise programs, and more
- Provider-directed programs have recently gained traction. These are typically offered through one of three channels:
  - Direct-to-consumer: Popularity has exploded due to availability of GLP-1s. Several companies (e.g. Ro, Calibrate, etc.) offer telehealth medication prescriptions in combination with digital platforms
  - Payer/employer: Several health plans and employers offer access to weight management platforms (e.g. Noom, Virta Health, etc.) as a member benefit
  - Provider: Apps purpose-built for use with the patient's physician/surgeon (e.g. Baritastic, Virtual Health Partners, BMIQ, etc.) have had less commercial traction but have potential to improve care



Connect to Your Bariatric Program

Access your Bariatric Program's:

- Diet guidelines
- Discharge instructions
- Patient portal
- Education modules
- Videos
- Vitamin & supplement guidelines
- Success stories
- Support services
- Calendar of events with automatic reminders 24 hours in advance
- Key contacts to get questions answered quickly

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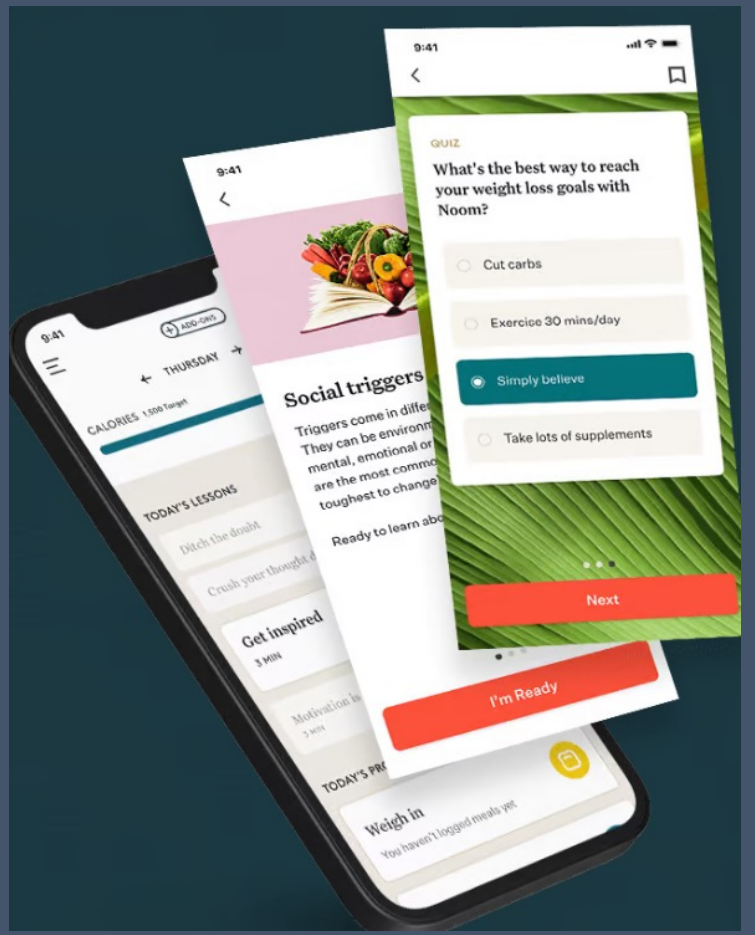
Case study: Weight loss (cont.)

- Regardless of channel, digital weight loss solutions commonly fall into three categories:
  - Information: Includes advice on nutrition and exercise (including recipes and specific workouts), often alongside tips on sleep, meditation, stress management, and other topics
  - Behavior change tools: These include both static tools such as weight targets, diet logging, and activity tracking, and active engagement with coaches/trainers
  - Social support: Most apps include a social media component allowing users to interact with each other and in some cases post content



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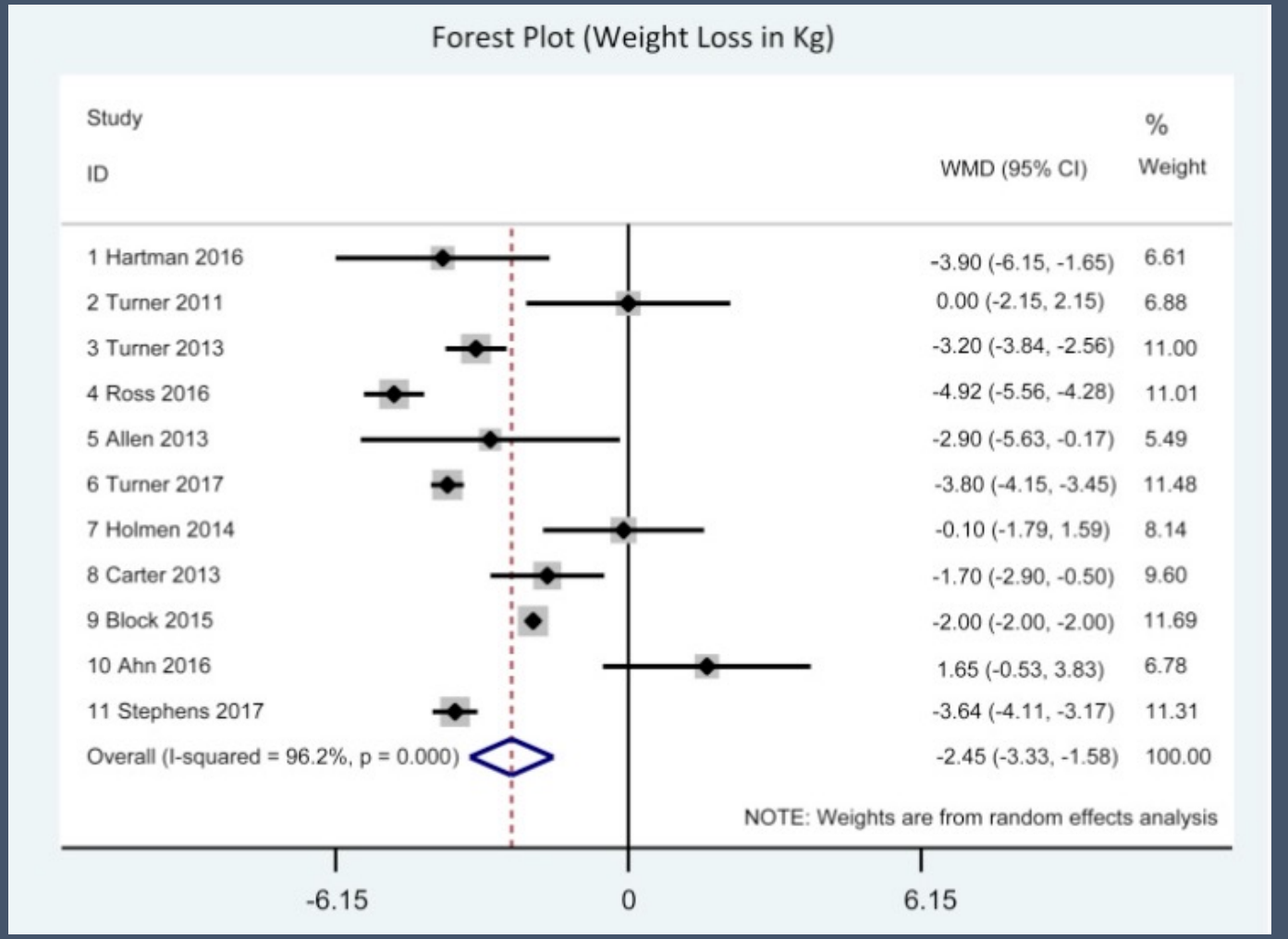
Case study: Weight loss (cont.)

- Outcomes data on digital weight management are mixed, likely due to heterogeneity in product offerings, patient populations, compliance, and other factors
- A 2019 systematic review found a net decrease of 2.45 kg for mobile app users vs control across 11 pooled RCTs



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El Khoury, Cosette, et al. "The Effects of Dietary Mobile Apps on Nutritional Outcomes in Adults with Chronic Diseases: A Systematic Review and Meta-Analysis." Journal of the Academy of Nutrition and Dietetics 119.4 (2019): 626-651.

Three steps to wider adoption

1. Better clinical data – The quality of evidence for digital applications in GI disease lags that of other specialties. Larger, high-quality trials can build more confidence among prescribers, health systems, and patients

- Studies frequently take the form of small, single-center, uncontrolled pilots. Trials going forward require greater scale and control groups to draw meaningful conclusions
- Studies often focus on digitally native patients who are excited about using technology. Studies must enroll representative populations
- Trials tend to have short durations of follow-up, in many cases, less than one year. The promise of digital rests in their ability to improve chronic symptoms, making longer term findings crucial

Three steps to wider adoption

2. Business model clarity – Digital apps span a range of business models including free ad-supported products, DTC sales to patients, industry partnerships, employer contracts, reimbursed models, and others. More clarity is needed, or else digital health businesses are constantly at risk of failure (most recently evidenced by Pear Therapeutics' bankruptcy)

- The most important initial question that remains unanswered: Who is the customer? With this question left unanswered, many business models suffer from a lack of sustainability. The absence of reliable and replicable models creates barriers to access, particularly for those with limited means

Three steps to wider adoption

3. Integrated service offerings – Many digital tools are point solutions, but they are most effective when offered together in a unified platform

- A lot of the digital health tools are narrow – in weight loss for instance, there are dozens of calorie counters. What will make it interesting is when everything gets integrated into one stop shop, and that consolidation is starting to take place now

Questions?