Mobile Health, Smartphone/Device, and Apps for Psychiatry and Medicine
Competencies, Training, and Faculty Development Issues

Donald M. Hilty, MD, MBA[a],*, Steven Chan, MD, MBA[b],
John Torous, MD[c], John Luo, MD[d], Robert J. Boland, MD[e]

KEYWORDS

- Apps • Training • Mobile • Smartphone • Competencies • Health • Medicine
- Psychiatry

KEY POINTS

- Technology use is ubiquitous in the digital age; to ensure quality care, faculty and trainees need clinical skills, knowledge, and attitudes.
- An approach is needed to implement, teach, supervise, and evaluate clinical mobile health, smartphone/device, and app competences.
- Milestone domains of patient care, medical knowledge, practice-based learning and improvement, systems-based practice, professionalism, and interpersonal skills and communication may be used to organize these competencies.
- Faculty, department, and institutional approaches are needed to integrate mobile health into service delivery.

Disclosure Statement: The authors have nothing to disclose.
[a] Mental Health, Northern California Veterans Administration Health Care System, Department of Psychiatry and Behavioral Sciences, University of California Davis, 10535 Hospital Way, Mather, CA 95655, USA; [b] Addiction Treatment Services, Veterans Affairs Palo Alto Health Care System, University of California, San Francisco, 3801 Miranda Avenue, Building 520F, Mail Code 116A, Palo Alto, CA 94304, USA; [c] Digital Psychiatry Division, Department of Psychiatry, Beth Israel Deaconess Medical Center, 330 Brookline Avenue, Boston, MA 02215, USA; [d] UC Riverside Department of Psychiatry, UCR Health at Citrus Tower, 3390 University Avenue, Suite 115, Riverside, CA 92501, USA; [e] Department of Psychiatry, Brigham and Women's Hospital, Harvard Medical School, 60 Fenwood Road, Boston, MA 02115, USA
* Corresponding author.
E-mail address: donh032612@gmail.com

INTRODUCTION

Mobile communications smartphones and other devices (SP/D) supported by 3G and 4G mobile networks for data transport, computing and integration have been a force in business, entertainment and health communities. Mobile health and social media are propelled by the X, millennial/Y, and Z generations, delivering health care anytime and anywhere, and surpassing geographic, cost, temporal, and even organizational barriers.[1] This movement is consistent with person- and patient-centered care—known as participatory medicine—which moves patients from being mere passengers to responsible drivers of their health and as valued partners by physicians (persons will be called people going forward).[2] Accordingly, educational reform with technology is suggested by the World Health Organization[3] and the Institute of Medicine.[4,5]

In health care, mobile health components include monitoring, alerting, data collection, record maintenance, detection, and prevention systems.[6] Mobile health is defined as the application of mobile or wireless communication technologies to health and health care.[7] Mobile health services architecture include many settings, devices, and operational features—accessibility, timeliness, and integration (**Fig. 1**). Technology is a "practice extender" by performing some of the tasks others did to integrate
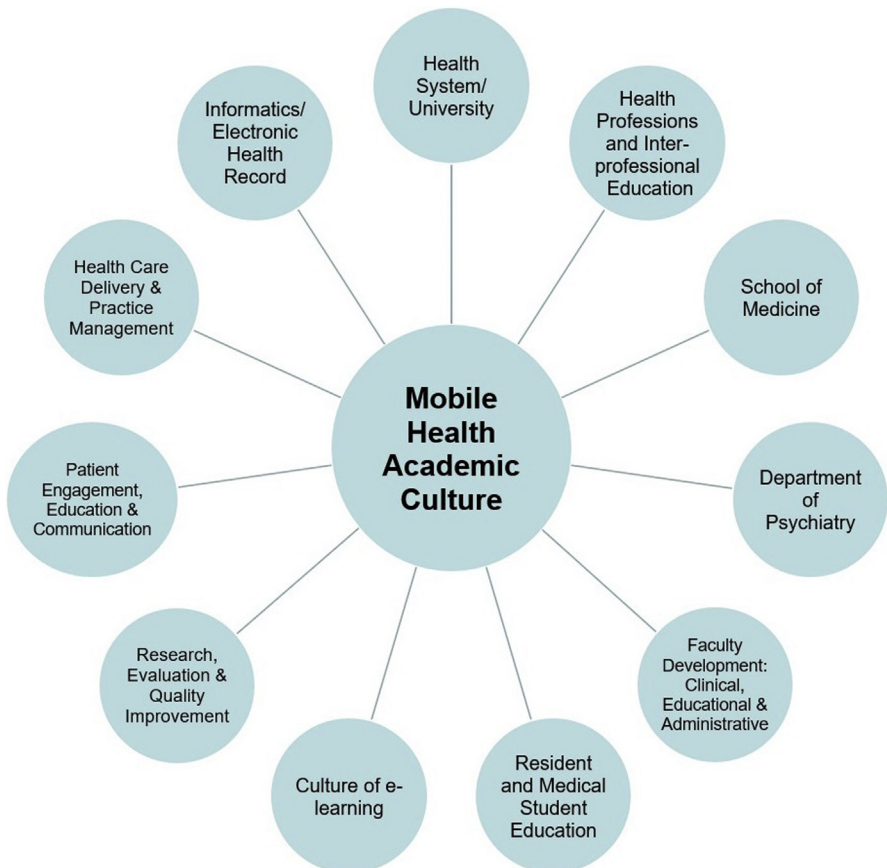

Fig. 1. How mobile health, smartphone/device, and apps integrate information in the digital age.

care[8]—indeed, it is considered a veritable team member.[9] Mobile health is used clinician to clinician, clinician to patient, and people to any others; the people and/or patient may be mobile or stationery.

Similar to telepsychiatry,[10] clinicians need a mobile health framework and skills and competencies and to meet needs of consumers, patients, caregivers, and other providers related to technology.[11–13] Mobile health may alter communication, boundaries, and privacy and confidentiality,[14] so clinicians are encouraged to screen what patients are using and help them use the "right" technology at the "right" time (eg, not using an app or text to express suicidal ideation). Similarly, it is important to evaluate apps to see if they are evidence-based and to use them in an evidence-based fashion.

There are a number of faculty development issues with mobile health, SP/D and apps—much like the case for social media competencies. The current generation of medical educators may not be as familiar with technology as much as the trainees, so bridging that gap must be done purposefully. This articles helps with reference to mobile health, SP/D, and app competencies so the reader can:

1. Have an outline of the competency-based medical education movement for competencies from telepsychiatry to social media to mobile health,
2. Grasp mobile health's components, concepts, operations, and processes, in comparison with in-person care, telepsychiatry and other technologies like social media,
3. Organize competencies for mobile health, SP/D, and apps using the Accreditation Council of Graduate Medical Education (ACGME) framework, and
4. Learn a basic approach to align teaching and evaluation with skill and patient outcomes for clinicians, departments and health care systems.

OVERVIEW OF COMPETENCIES IN MEDICINE, TELEPSYCHIATRY, AND OTHER TECHNOLOGIES

The Institute of Medicine's core competencies for the health professions include the ability to provide patient-centered care, work in interdisciplinary teams, use evidence-based practice, engage in quality improvement practices, *and* use information technology.[5] Competency-based medical education focuses on clinical skill development and curricula produce desired outcomes for learners rather than knowledge acquisition.[15] Learner-centered educational outcomes are set and teaching and assessment methods require alignment.[16,17] Faculty assessment of learners during patient care in addition to seminars ensures skill development.[17,18]

A straightforward competency framework is needed for technologies for faculty, program directors and administrators. The most common US framework is by the ACGME, which uses 6 domains: patient care, medical knowledge, practice-based learning and improvement, systems-based practice, professionalism, and interpersonal skills and communication.[18] Another useful framework is the Royal College Canadian Medical Education Directives for Specialists, which uses 7 roles that all physicians play: medical expert, communicator, collaborator, manager, health advocate, scholar, and professional.[19]

Other Technology Competencies

The telepsychiatry framework provided competencies, aligned standard andragogy/pedagogy methods for teaching and assessment, and highlighted faculty development issues.[10] It used a 3-level skill gradation rather than the Dreyfus model of learners with 5 levels[20]:

- Novice/advanced beginner (eg, early clinicians and/or those unfamiliar with technology);
- Competent/proficient (eg, able to translate in-person to technology-based care well); and
- Expert (eg, advanced in clinical care and via technology).

Telepsychiatry is similar to in-person care with patients and clinicians connecting synchronously (ie, in time), but a few significant and many minor adjustments in the clinical history (ie, interviewing, assessment, and treatment) and administration (eg, documentation, electronic health record [EHR], medicolegal issue, billing, and privacy/confidentiality).

The social media and networking competencies[21,22] provide a preview of how mobile health's asynchronous components may be approached. Social media may be defined as web-based and mobile services that allow people to share a connection, monitor progress, and create and manipulate text, audio, photos, and videos.[23] It poses substantial challenges compared with in-person and telepsychiatric care, such as:

1. It is asynchronous not synchronous, so it cannot be "organized" or structured like traditional care;
2. It may affect the therapeutic frame and create additional boundary issues;
3. It is conducted over public, private, and health system sites, making the data integration and security difficult, if not impossible;
4. Users overlap personal and professional life experiences, which causes complications similar to e-mail and texting; and
5. Clinicians cannot assume folks are who they state they are…there is a need to verify the identity of the patient for a social media account.[11]

A COMPETENCY-BASED FRAMEWORK FOR MOBILE HEALTH, SMARTPHONE/ DEVICE, AND APPS

Mobile health recontextualizes health care using mobile communication devices with mobile phones, tablet computers, wearable devices such as smart watches, and sensors.[24] As such, mobile health intersects with the field of remote patient monitoring of patients outside of conventional clinical settings (eg, at home for chronic disease management). Therefore, persons, patients, caregivers, and family members have more support if a problem arises and fewer emergency department visits and hospitalizations.

In era of health care, a physician or a patient can easily enter information (eg, appointment schedule), access it (eg, EHR) and make decisions anytime via a traditional desktop or his/her mobile personal computer, tablet, or SP/D. Mobile apps offer (1) portability for access anytime/anywhere, regardless of patient geography and transportation barriers; (2) an inexpensive option vs traditional desktop computers; and (3) additional features like context-aware interventions and sensors[25] with real-time feedback.

Similarities and Differences Between Mobile Health, Telepsychiatry, and Social Media

Mobile health is similar to in-person and telepsychiatric care, mainly because it is synchronous *and* anytime/anywhere—conceivably organized in a 24-hour, 7 days a week framework. This is similar to the Holter monitor in cardiology, which collects and transfers data, although those data are read intermittently and/or at the end of the data

collection; therefore, it may be seen as asynchronous. Mobile health is different than in-person and telepsychiatric care in a few ways. First, because many professionals often use the same SP/D for professional and personal life, mobile health is "live" around the clock. In addition, patients increasingly have clinicians' telephone numbers. Finally, people are cued to respond to alerts on SP/Ds such that intervisit contacts may reset expectations if clinicians may receive and respond to messages.

Mobile health and social media and networking have common elements. Not all patients may be suitable for mobile health and social media (eg, impulsivity, disclosing too much per poor boundaries, failing to understand the medium). In contrast, they may provide a wraparound approach to life, similar to case managers for community schizophrenics.[11] They are outside the clinical visit, but may affect the therapeutic frame and create additional boundary issues—like the spontaneous, disruptive use of texts. But if the clinician helps the patient to use 1 app in a (structured) way that feeds into the EHR—instead of a half dozen apps that do not—the process is simplified, privacy is protected, and clinical decision making is improved (eg, using an app weekly for monitoring of depression).

Unique Features of Mobile Health

The mobile health devices (see **Fig. 1**) have the following features[26]:

- Voice/video calling: a convenient way for clinicians and patients to remotely communicate;
- Short message services and multimedia message services: transmit text messages and video clips/sound files as a cost-effective way to deliver education;
- Multimedia functions: provide a range of learning opportunities;
- Inbuilt sensors: touch, motion, and GPS sensors that simplify clinical assessment and lifestyle and social activities; and
- Device connectivity: practical and less error-prone data entry than manual processes.

Mobile health also has clinical decision support (CDS) and information flow management features. CDS provides clinicians, patients, and others with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care.[27] This technology improves patient outcomes, reduces unnecessary mistakes and expenses, and increases efficiency.[28] CDS is often seen as part of clinical informatics, but it is a key part of graduate medical education and lifelong learning.[29]

The Conceptual and Consensus Approach to the Mobile Health Competencies

This framework was built on an extensive review of the literature on teaching and learning, as well as on expert opinion, and uses the ACGME framework. We reviewed publications in Pubmed/Medline, using the key terms mobile health, apps, mental health, smartphones, competency, teaching, faculty development, medical education, and other terms mentioned in the article. We also hand searched the abstracts and indices of the articles we culled.

Expert option was solicited in 4 ways:

1. A series of medical educator conference calls focused on teaching competencies—for example, the conference calls series were composed of 2 groups of 8 medical educators from the United States and Canada to discuss educational competency development;

2. Discussion during several regional and national presentations (eg, American Association for Directors of Psychiatry Residency Training); for example, the participants included educational leaders (eg, course/program directors, chairs, deans, a national society executive director), educational researchers;
3. Individual discussions with educational and technological experts[13,14]—for example, those experienced in health services, mobile health, technology (eg, mobile health, SP/D. and apps), medicine, and informatics;
4. Input from national behavioral health organizations—for example, psychiatry/medicine, psychology, social work, counseling, marriage/family, psychiatric nursing, behavioral analysis)—via 2 rounds of input for the consensus process.[10,21]

Overall, a modified Delphi process[30] was used to develop an initial framework of areas (Fig. 2) based on qualitative analysis of identified themes. Then the themes were organized into competencies using the ACGME Milestones and the Royal College Canadian Medical Education Directives for Specialists roles.[18,19]

Mobile Health, Smartphones and Other Devices, and Apps Competencies

The patient care competency mainly includes history taking, engagement, interpersonal skills, assessment, education, management, and treatment planning
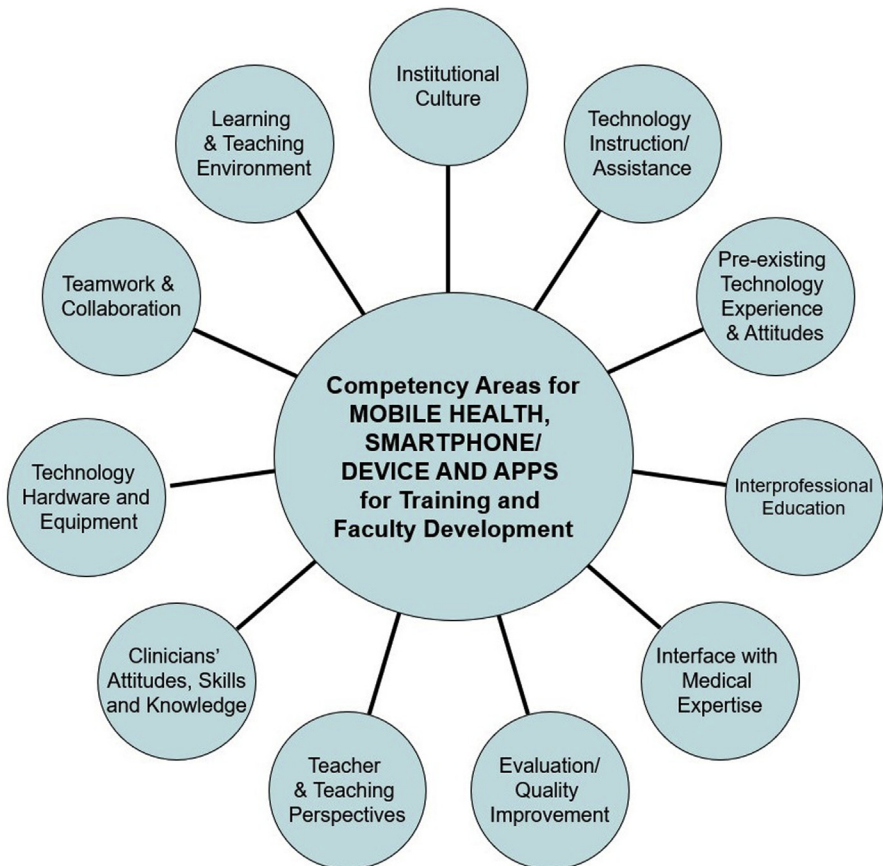

Fig. 2. Competency areas in mobile health, smartphone/device, and apps for training and faculty development.

(**Table 1**). It also includes administration, documentation, and medicolegal issues such as privacy, confidentiality, safety, data protection and integrity, and security. Clinicians should help patients to reflect on the pros and cons of mobile health, SP/D, and apps use as part of ongoing treatment and document these encounters (eg, as part of the consent form or in a progress note). This process may include, but is not be limited to, the competent or proficient clinician selecting the SP/D option based on patient preference, skill, and need (ie, purpose), as well as selecting the CDS tool option based on patient need, clinical purpose, and weighing the pros and cons of comparison apps. She or he may also find it helpful to know if the patient uses SP/D and apps for personal life, health care, and/or mental/behavioral health care, and seeing if the patient is aware of risks (eg, privacy, self-disclosure, potential for cyberbullying).

The patient care competency also included a subdomain for between visit data collection. Technology in the form of mobile health, SP/D, and apps can be useful for overcoming many of the barriers to accurate assessment of day-to-day life, including habits (eg, smoking), mood changes (ie, depression), activity, and vital signs (eg, blood pressure). This work is called ecological momentary assessment, and it involves repeated sampling of naturalistic behaviors and experiences.[31,32] A review of the topic discussed how technology methods have evolved from paper-and-pencil diary methods (eg, medication calendars) so that SP/Ds capture immediate self-reports by alarms (ie, signal dependent), within-person trajectories, and temporal sequences of behavior.[11] Changes in mood or affect therefore correlate better with clinician-rated affective symptoms and the subsequent risk of suicidal ideation in bipolar patients.

TEACHING, ASSESSMENT, AND EVALUATION OF MOBILE HEALTH, SMARTPHONES AND OTHER DEVICES, AND APPS

The outcome (ie, competency skill or behavior) should predetermine its measurement as well as teaching, supervision, and organization of clinical services. The supervisor's approach requires many things, including a plan for information flow and decisions and, if applicable, procedures for contact after hours. Initial, ongoing (ie, monitoring), and longitudinal documentation is needed (eg, consent form; progress notes). Patient requests for nonphone contact between visits (eg, apps, texts, e-mails) are increasing and this may not be a good regular practices and expectations for many patients.

Clinical Supervision of Mobile Health, Smartphones and Other Devices, and Apps Competencies

An approach to teaching these competencies involves a wide range of methodologies, settings, and participants (**Table 2**). Contacts with the patient throughout the week are best funneled into scheduled supervision as part of a caseload or quickly dealt with by a curbside consultation in real time. Time to reflect, consider options, and get advice before responding is suggested owing to clinical, administrative (ie, policies) and other ramifications. Trainees' work related to the patient care (eg, high-risk behaviors) and communication competencies can be aligned with teaching methods for clinical care with p and professional reflection, monitoring, and hygiene related to patient care and supervision (see **Table 2**). For example, a resident decided to add an app to track a veteran's mood because soldiers prefer to complete psychometric measures (eg, depression screening questionnaire) by iPhone rather than paper or computer owing to its interface, portability, and convenience.[11] However, an urgent issue arose, when an app transfer indicated new suicidal ideation. The trainee had to decide what to do: nothing (if it is a chronic behavior), e-mail, text, telephone call,

Table 1
A framework for faculty and trainee competencies for mobile health, smartphone/device and apps

Area/Topic	Novice/Advanced Beginner (ACGME Milestone Level 1–2)	Competent/Proficient (ACGME Milestone Level 3–4)	Advanced/Expert (ACGME Milestone Level 5)
Patient care			
History taking	Standard history and basic screen Are you using an SP/device and/or apps and for what? What for? Exercise? Entertainment? Social reasons? Health care?	Reflect on pros/cons of use and better screen Which SP/device and/or apps do you use? Use more/less than other technologies (e-mail, Internet, social media? Use SP/device and/or apps for health care: With your doctor, nurse or other staff? Share mental health (mental/behavioral health) issues? Aware of risks (eg, privacy, self-disclosure, time delays)?	Include SP/device and/or apps informed consent specifically Integrate details of personal and health care use into the history Discriminate types of personal use: significant other/spouse, friends, family; individual/group Screen for the patient use of privacy settings and provide advice
Engagement and interpersonal skills	Discuss impact of SP/device and/or apps use with others Incorporate SP/device and/or apps impact on professional life related to health care	Ask about preferences and how it/these influenced relationships with family, peers, and professional colleagues Consider how intimacy, emotion, and therapeutic relationship are affected Consider how it/these affect boundaries (see Professionalism)?	Provide guidance to patient and family on effective communication Instruct on impact of asynchronous vs synchronous communication methods Discuss expectations of parties

Assessment	Assess if use is important for personal life and/or health care Assess if SP/device and/or apps should not be used by a patient and document reason	Assess the healthy and unhealthy use in personal life and health care Consider the need for collateral info Integrate with overall in-person and longitudinal assessments Demonstrate flexibility and decide with the patient the role of SP/device and/or apps	Synthesize information from in-person TP, SP/device, and/or apps and other methods (including discordant data) Train, supervise, and consult to optimize assessment Identify pros/cons of using SP/device and/or apps and for what purpose(s)
Management and treatment planning	Integrate SP/D and/or apps into biopsychosocial approach Weigh pros/cons of decision support tool or app (see CDS in Knowledge) Monitor ongoing use and document memorable and problematic events If reasonable, focus part of a visit on the use of SP/device and/or apps and other technologies to talk in depth	Select option based on patient preference, skill (ie, purpose) (see Knowledge CDS) App to monitor mood Capture day-to-day accurate accounts of emotions, functioning, and activity Integrate the use of SP/device and/or apps on one treatment goal to monitor and engage Identify safety and other risk factors of use Triage complex, urgent/emergent issues to in-person care Research and apply tools (CDS Knowledge)	Select best mode for a given task: SP/device and/or apps, e-mail/text, telephone, and/or in person For medication issues: be aware of legal, billing and jurisdictional issues Research and disseminate procedures to prevent problems and manage clinical and administrative issues Advise on specific mental/behavioral health problems and specific patient populations with relative/absolute contraindications
Administration and documentation	Adhere to clinic, health system and professional requirements for in-person care Seek supervision and advice if needed	Develop standard language for these technologies for consent form, treatment plan and progress notes, particularly for nonroutine telepractice; seek consultation	Instruct on in-person, TP and SP/device, and/or apps applications related to documentation, privacy, and billing

Table 1
(continued)

Area/Topic	Novice/Advanced Beginner (ACGME Milestone Level 1–2)	Competent/Proficient (ACGME Milestone Level 3–4)	Advanced/Expert (ACGME Milestone Level 5)
Medicolegal issues: privacy, confidentiality, safety, data protection/integrity and security	Identify and adhere to relevant laws and regulations in the practice jurisdiction(s) of patient Clarify public or private access (ie, in EHR Communicate and data privacy (eg, email within EHR not Gmail)	Apply in-person relevant laws and regulations in any/all jurisdiction(s) to these technologies and adjust clinical care Educate patient about existing laws and adapt if none exist Obtain clinical and/or legal advice, as applicable	Teach/consult on in-person laws and regulations applied to technologies Develop legal and regulatory strategies (eg, emergencies) Update and consult with regulatory boards and health authorities
Interpersonal and communication skills			
Communication	Be flexible in discussing use Discuss problems if they arise with asynchronous options and arrange alternative options Seek advice on merit and method of responses, to patients	Discuss scope of communication, clarify expectations and anticipate problems (eg, feasibility of checking mobile health device off-site) Educate patient about pros/cons of asynchronous options Make brief, clear communications	Identify and trouble-shoot communication issues (eg, multiple meanings of acronyms, abbreviations and such communication) Educate/consult to colleagues about asynchronous technology use
Evaluation and feedback	Use evaluation parameter(s) for decision making and care Review examples with learner/supervisor	Adjust regular evaluation parameter(s) to incorporate real-time examples Coreview of others' examples of communication with learner/supervisor	Role model application of in-person skill to synchronous and asynchronous (ie, mobile health) technologies Develop and oversees in situ examples
Culture, diversity and special populations	Recognize culture impacts use and other trends in populations (eg, generation Y, autism spectrum)	Consider preferences and other implications of use and preference (eg, adolescent, veteran with posttraumatic stress disorder)	Instruct on cultural variations and how to adapt assessment and management approaches according to differences

Professionalism

Attitude	Be flexible and open to learning Role model reflection Consider all sources of information on decisions	Understand, educate and evaluate how use affects communication, relationship building, spontaneity, and quality Role model willingness to engage improve	Provide leadership to colleagues on organizational policy or curricula for SP/device and/or apps and professionalism
Integrity and ethical behavior	Adhere to professional and governmental guidelines Recognize boundary issues Attend to privacy, confidentiality and professional boundaries	Weigh the pros and cons of use and data transfer with clinical and ethical principles Reflect on personal vs professional contexts and microboundary and macroboundary violations (eg, texting patient after hours)	Role model, teach/consult others to manage complicated ethical issues for practice and professional identity Research and develop approaches maintain therapeutic relationship
Scope and therapeutic objective(s)	Attend to in-person scope issues and observe for changes Keep shared primary objective	Practice within scope and educate patient within license and standards (eg, Federal Trade Commission substantiation rule)	Teach/consult on in-person and technology adaptations and follow legal regulatory and fiscal issues

Systems-based practice

Interprofessional education	Learn/teach about technologies, and share information with others	Discuss specific issues for patients with team members for care and communication	Teach/consult to interprofessional education teams on/roles and practices; give feedback
Safety (see Patient care and professionalism)	Educate patient to call and/or set up additional appointment for emergencies Seek consultation, when needed	Prevent, identify and stratify risk based on history (eg, not good for treatment plan) Use in-person/synchronous (eg, video, telephone) methods for urgent issues	Adjust risk and its management to specific technology and instruct others in pitfalls in health care
Mobile health system practice	Incorporate and integrate data into workflow with technology (eg, EHR, desktop, portable)	Advise administration on (in) efficiencies, Use sensors, remote monitors and other devices across sites (eg, home)	Use individual consult as an opportunity for building ongoing relationship Integrate data into care

Table 1 (*continued*)			
Area/Topic	Novice/Advanced Beginner (ACGME Milestone Level 1–2)	Competent/Proficient (ACGME Milestone Level 3–4)	Advanced/Expert (ACGME Milestone Level 5)
	Communicate and send data privately (eg, not Gmail)	Use EHR to collect and organize data and implement evidence-based decisions	Instruct on home health options to enhance evaluation and treatment
Practice-based learning			
Evaluation approach	Use global evaluations from patients, team and clinic about in-person and technology-based care	Be aware that in-person and other technologies have similarities/ differences Develop/promote attitudes and skills for consistency and quality of evaluation	Teach/consult on practice standards Compare/contrast information across professions and states/governments Shift policies and procedures
Quality improvement	Participate in chart review, case/ morbidity and mortality conference and other activities related to in-person and technology-based care	Apply/adapt in-person quality improvement principles to adjust assessment and/or care Educate participants on technology-specific principles and measures	Develop strategies to adhere and adapt in-person standards Teach/consult on how to analyze, select and evaluate quality improvement options
Learning, and teaching practices	Add technology-based learning opportunities to regular activities Consider role of technology in care	Seek out technology-specific education Develop additional technology-specific education in the short and/ or long term	Determine best context(s) for teaching and learning (eg, supervision, seminar/case conference)
Technology			
Adapt to technology	Use basic etiquette Identify differences between care in-person, TP, SP/device, and/or apps Clarify/spell out communications	Acknowledge issues and engage the patient (eg, can depressed patient use an app?) Prevent, identify and manage barriers, obstacles and miscommunications Learn to project self and express empathy	Advise on communication: avoid humor, self-deprecatory remarks and jokes; ways to express empathy Analyze what happens and make adjustments for next time

Technology operation	Pilot 1 or 2 SP/device and/or apps with peers to learn communication options	Gain experience with SP/device and/or apps Navigate options, if needed, and advise patients relative to goal and purpose	Research/teach/consult on approaches for clinical quality (eg, hard/software; accessories; trouble shooting)
Knowledge			
Definition of SP/device and/or apps	Recall definition of mobile health, SP/device and/or apps Name 2 or 3 mobile health, SP/device and/or apps with pros and cons	Define mobile health, SP/device and/or apps and various uses and risks/benefits to patients Professional skill with 2–3 SP/device and/or apps and a mobile health platform	Teach multiple SP/device and/or apps varieties; consults with colleagues Instruct on the approach to mobile health, selections of apps and pros and cons
Evidence base	Know basic dos and don'ts	Know if an app is evidence-based and used in an evidence-based clinical approach	Teach/consult to colleagues on best practice guidelines
Problem solving and prevention	Recognize and report problems Explain ways to better learn how to use an SP/device and/or apps product	Evaluate new products' and options' pros and cons Diagnose complex problems and/or resolve nonroutine problems that affect team Request/provide technical assistance	Research and disseminate information on platforms and latest developments (eg, privacy)
Decision support	Understand the ability of technology to help decision making Use for decision making and care Review examples with learner/supervisor	Find and evaluate ability of mobile health, SP/device and/or apps to help in decision making Compare the pros/cons for manual operations (eg, errors, duplications) Use for and adjust decision support	Advise/teach colleagues on how to evaluate decision support tools Instruct on fundamentals of adjusting to SP/device and/or apps parameter(s) to aid in decision making
Risks of using SP/device and/or apps	Identify 1 potential patient and 1 provider risk of SP/device and/or apps use (ie, boundary or privacy violation)	Identify 2–3 patient and provider risks and prevent, mitigate or eliminate them (eg, use privacy settings; avoid self-disclosure; manage cyberbullying)	Demonstrate extensive knowledge of use and advise colleagues Anticipate common pitfalls and how to prevent/mitigate them

Technically, mobile health options may be synchronous although most are asynchronous, so that term is used.

Abbreviation: TP (video), telepsychiatry.

Table 2
Faculty development related to mobile health, smartphone/device, and apps clinical competencies: teaching, assessment, and evaluation methods

Teaching Method	Context(s)	Competency Domain(s) Addressed	Learner Assessment
Didactic teaching: Patient care and knowledge			
All methods	Dependent on venue/setting	Knowledge, patient care, systems-based practice, technology—primarily knowledge at the precompetency and competency levels	Tests: multiple choice and short answer questions Audience participation
Brief didactic Grand rounds or longer didactic	Clinical setting (eg, replace nonsecure with secure technology) Classroom in person, by video, or webinar	Focus: solve immediate question/dilemma (eg, privacy) Focus: engage/help learners contextualize day-to-day events and gain further education Focus: research, trends and relevance vs e-mail/and synchronous modes (eg, in-person, TP, or telephone) Focus: CDS	Application to context (eg, pretest and posttest) Written tests: multiple choice and short answer questions
Case-based learning for attitudes and skills			
Brief vignettes Complex, multistep cases	Individual, pair/share and problem- and/or team-based learning (eg, how to triage a patient who reports suicidal ideation on a questionnaire)	Patient care, system-based practice, technology—knowledge for all levels of competency Provide content knowledge and effective for developing attitudes and skills Focus: apply knowledge to real-life examples and complex clinical situations to develop steps of treatment/management plans (eg, emergency) Focus: effective for highlighting key asynchronous events that are between visits and/or after hours	Case-based written tests: multiple choice, pretests and posttests and/or short answer questions (eg, next best step is . . .) Oral presentation with preassigned case (like flipped classroom) or in session case

Clinical care with patients (see patient care in Table 1)

Observing faculty	Live patient interview in-person or TP (eg, initial evaluation) in which SP/device and/or apps issue arises, is screened for and/or the focus of the conversation	Patient Care, communication, systems-based practice, technology—primarily at the pre competency level Adjust attitudes and demonstrate complex skills by faculty role modeling Foci: develop skills to set realistic expectations and communicate unidirectionally vs bidirectionally Focus: inappropriate use (eg, emergency; after hours; suicidal ideation comments)	Evaluation supplemented by review of SP/device and/or apps and chart Research on trends with SP/device and/or apps Develop and disseminate policies for technologies to in-person care
Group observed or cointerviewing	Group interview in person or TP: take turns with assessment; group and supervisor feedback Can also use separate room or 1-way mirror	Patient care, communication, professionalism, technology and systems-based practice (eg, decision support)—precompetency and competency levels Focus: develop skills and apply knowledge to screen, evaluate and plan Focus: use group/discussion and reflection to explore scope of practice, professionalism and cultural factors	Mini clinical evaluation exercise completed by faculty on each learner and direct verbal feedback. Peer-recorded written evaluation; peer review

Professional reflection, monitoring, and hygiene related to patient care and supervision

Caseload-based self-reflection, presentation, discussion and decision making In time supervision in person or at a distance on a critical incident (eg, emergency)	Review of personal and professional use Compare/contrast How is professional image projected? Supervision about	Patient care, communication, systems-based practice, professionalism, technology—all levels of competency Effective for developing attitudes and skills	Oral presentation in supervision, group, or grand rounds Chart review of treatment plan for decision making Policy development, review, and adaptation

Table 2 (continued)			
Teaching Method	**Context(s)**	**Competency Domain(s) Addressed**	**Learner Assessment**
	Purpose(s), outcomes and adjustments Patient errors for those ill-equipped to use Review unexpected events Suicidal ideation, HI, bullying and/or aggressive or sexual overtone	Focus: synthesis in a complex case or pattern analysis across a population; adjust management plans Focus: evaluate reactions and meaning of events, including transference and countertransference Focus: assess systems- and population-level thinking, decision support, workflow and resource allocation Examples: prevent/manage boundary violations (eg, personal picture or video transferred; patient friends trainee on social media); help patient adherence Focus: engage emergency response systems including authorities for duty to warn	Peer and faculty feedback Follow-up report on interventions and impact Longitudinal, cumulative evolution of clinical skills and relationship Timeliness of supervision
Quality improvement, evaluation, and research			
Case write-ups Literature reviews Quality improvement presentation/project with interprofessional team, informatics team and administration	Trainee and mentor submission for committee, conference presentation, and/or final report or publication Evidence-, measurement-, and population-based care; systems-	Systems-based practice, practice-based learning—all levels of competency Effective for developing attitudes and skills, but less so for gaining knowledge	Evaluation of literature search Evaluation of written synopsis Verbal presentation, discussion, and group feedback Peer, interprofessional, supervisor, and administrator feedback

Quality improvement-related (eg, length of stay, informatics) committee	level thinking and health planning/ resource allocation	Focus: synthesis of a case in the short and long term and application to other cases Focus: good introduction to administration, evaluation and policy-oriented factors (eg, advanced knowledge gaps) Focus: evaluate apps to see if they are outcome and evidence based; develop an approach to use them in an evidence-based fashion	
Role as educator			
Provide didactic sessions and participate in group and interprofessional learning sessions	Learner participates in or leads discussions on mobile health, SP/ device, and/or apps	Knowledge, technology, systems-based practice, practice-based learning—all competency levels Develop attitudes and skills more so than content knowledge Focus: learn to work with an interprofessional team and adapt communication to multiple people Focus: develop advanced skills, such as enhancing capacity in distance staff (eg, teaching to use technology, decision support tools) Focus: evaluate apps to see if they are evidence-based and develop and used in an evidence-based approach Focus: dissemination, establish community/culture of practice and outreach across institutions	Reflection journal for observation Questions by participants Evaluation forms completed by participants Feedback solicited from participants of interest (eg, content expert, training director, informatics director)

Abbreviation: TP (video), telepsychiatry.

and/or trigger an emergency response. A text may be considered surprising in this context, but with personalization, caring sentiments, and a polite message, it may be therapeutic and successfully prevent worsening. Reflection, peer advice, and/or faculty supervision may be required quickly, which may necessitate on-site on-call or faculty of the day supervision, but they may triage this very differently than the trainee's ongoing supervisor. Regardless of the outcome, follow-up teaching methods of case presentation and/or a quality improvement project may help others to learn and investigate how a clinic can move forward.

A patient care and knowledge competency (eg, CDS) can be aligned with teaching methods for same, as seen in patient care and knowledge (see **Table 2**). For example, a resident decided to use attendance notifications to communicate with a depressed outpatient, caregivers, and other social supports. Over 3 months, it did not work, even though the depression had apparently started to lift with medication initiation and supportive therapy. The faculty supervisor reviewed the treatment plan, which was in order, but suggested to combine it with a tool for remote psychoeducation with motivational suggestions and personalized supportive messages.[33] This suggestion led to an occasional homework assignment[34] and, although the mood had not improved, the augmented treatment plan was helping.

Case-based learning (see **Table 2**) is a good teaching and learning method which uses real life examples or vignettes in seminar, site-based case conference and/or quality improvement/grand round presentations. It is important to draw from trainees' own experience with patients about mobile health, SP/D, and apps. Interactive methods like role plays can be used for flushing out the issues, to practice communication skills, identify options for decisions, and propose solutions for patients. The context for other settings and in-depth learning occurs through group input and feedback from peers and faculty. Furthermore, this provides an opportunity to build and/or solidify the resident role as an educator in teaching others (see **Table 2**).

MOBILE HEALTH IMPLICATIONS FOR ACADEMIC HEALTH CENTERS
Challenges for Clinicians and Systems

Traditionally, clinicians depend on research and clinical measures for care, so better customized measures for technologies are needed. Evidence-based guidelines for apps stratify purposeful use, content/process, measurement/assessment, and quality,[35,36] although app quality varies.[37] The Healthcare Information and Management Systems Society has created assessment guidelines for mobile technologies.[38] Current guidelines on e-mail, social media, and other technologies, however, are essentially just suggestions for clinicians integrating technology into practice.[10,14,21,22]

Faculty Development

Faculty and trainees are instruments of organizational change. Trainees teach faculty about the latest mobile health, SP/D, app, social media, Internet education websites, and other technologies. They inspire faculty—particularly through quality improvement and scholarship and research projects (eg, writing project, copresentations). Program evaluation uses quality improvement to meet patient (ie, Joint Commission, reimbursement), training, and other standards. It requires a philosophical approach, from seeing what happens with planned services to planning the outcomes and then designing the services—in advance. A grant may also facilitate system changes related to technology use (eg, an Institute of Medicine as a Profession and the Josiah Macy Jr. Foundation 2-year grant on social media).

Clinicians and faculty are at the crux of these paradigm shifts because they lead teams, provide care, and supervise trainees. One disturbing study revealed that students' digital professionalism deteriorated during core clinical clerkships, as measured by behavior, privacy, and attitudes.[39] Although today's clinicians and health care leaders and decision makers espouse, support, and drive innovation, they may also inadvertently stifle progress with inaction, conservative approaches (not to be confused with true incremental change), and resistance to change.

A Change in Culture Related to Technology, Training, and Patient Care

Many believe the academic psychiatry and medicine facilitate much of the change to technological innovation in the digital age, but many things like this get left behind to competing demands, inadequate resources, and/or higher priorities like patient care, training, and research.[40,41] Indeed, clinicians, leaders, and other stakeholders may not see mobile health, SP/D, and apps as central to the clinical care mission. Technology is significantly shaping people's lives and they have expectations in health care. Undergraduate universities, business,[42] banking, and even dating firms learned that, to survive, they had to adjust to people's preferences for electronic and online modalities. Businesses readily address change to remain viable and find new markets.[42,43] Medicine and business have one thing in common: the need to understand the person who is the patient or customer, their needs, and their behavior.[2,44]

New paradigms that integrate information technology, business, and medicine,[10,45] and are guided by institutional competencies and change management,[10] are needed. This process ensures that the technological infrastructure is in place, evidence based, supported by policy environment, and overall provides value-added clinical, education, and research interactions. For mobile health, SP/D and apps, there are at least 6 paradigm shifts at hand:

1. Patients and trainees of the X, Millennial/Y, and Z generations want and expect a digital health care experience[21,22];
2. Technology-based health care is different in some ways, but is at least as efficacious (eg, telepsychiatry) as in-person care and it leverages resources much more efficiently[46];
3. Health care systems must shift from a focus on knowledge to skills/competencies and then measure, evaluate and certify attainment to ensure the quality, safety, and efficiency of care[10,15,16];
4. Health care systems need an e-platform with information systems and technologies (eg, EHR, multiple entry portals via mobile health) as a foundation for "good" clinical care[10];
5. The mobile health paradigm is—and this may be the hardest part to see—a completely different, new and strategic way to frame health care—it may be staggeringly better and develop health care in completely new ways[11,45]; and
6. Financing and reimbursement streams (eg, the Center for Medicare and Medicaid Services) are beginning to reasonably let go of constraints and facilitate this change.[47]

Limitations to this set of mobile health and app competencies include that a broader consensus, with experts across organizations and fields of medicine (eg, American Medical Association, American Psychiatric Association, American Telemedicine Association). Second, the metrics of a more detailed approach to evaluation need to be spelled out; all competencies need to be measurable. Third, for both cross-sectional and longitudinal trajectories, with qualitative and quantitative evaluation of participants is suggested to iteratively improve the process. Finally, research is

needed on organization change with technology and how a paradigm shift like mobile health recontextualizes digital health care.

REFERENCES

1. Tachakra S, Wang X, Istepanian RS, et al. Mobile e-health: the unwired evolution of telemedicine. Telemed J E Health 2003;9(3):247–57.
2. Frydman GJ. Patient-driven research: rich opportunities and real risks. J Particip Med 2009. Available at: http://ojs.jopm.org/index.php/jpm/article/view/28/18. Accessed December 15, 2018.
3. World Health Organization. Telemedicine opportunities and developments in member states. Results of the second global survey on eHealth. Geneva (Switzerland): WHO Press; 2011.
4. Institute of Medicine. The core competencies needed for health care professionals. In: Health professions education: a bridge to quality. Washington, DC: The National Academies Press; 2003. https://doi.org/10.17226/10681. Accessed May 30, 2019.
5. Institute of Medicine. Health professions education summit. Available at: https://www.ncbi.nlm.nih.gov/books/NBK221516/. Accessed May 30, 2019.
6. Silva BMC, Rodrigues JPC, de la Torre I, et al. Mobile-health: a review of current state in 2015. J Biomed Inform 2015;56:265–72.
7. Steinhubl SR, Muse ED, Topol EJ. Can mobile health technologies transform health care? JAMA 2013;310:2395–6.
8. Raney L, Bergman D, Torous J, et al. Digitally driven integrated primary care and behavioral health: how technology can expand access to effective treatment. Curr Psychiatry Rep 2017;19(11):86.
9. Hilty DM, Sunderji N, Suo S, et al. Telepsychiatry/telebehavioral health and integrated care: evidence-base, best practice models and competencies. Int Rev Psychiatry 2019;1:1–18.
10. Hilty DM, Crawford A, Teshima J, et al. A framework for telepsychiatric training and e-health: competency-based education, evaluation and implications. Int Rev Psychiatry 2015;27:569–92.
11. Hilty DM, Chan S, Torous J, et al. New frontiers in healthcare and technology: Internet- and web-based mental options emerge to complement in-person and telepsychiatric care options. J Health Med Inform 2015;6:1–14.
12. Chan S, Torous J, Hinton L, et al. Towards a framework for evaluating mobile mental health apps. Telemed J E Health 2015;21:1038–41.
13. Hilty DM, Maheu M, Drude K, et al. Telebehavioral health, telemental health, e-therapy and e-health competencies: the need for an interdisciplinary framework. J Technol Behav Sci 2017. https://doi.org/10.1007/s41347-017-0036-0.
14. Maheu M, Drude K, Hertlein K, et al. An interdisciplinary framework for telebehavioral health competencies. J Technol Behav Sci 2018. Available at: https://link.springer.com/content/pdf/10.1007%2Fs41347-018-0046-6.pdf.

15. Frank JR, Mungroo R, Ahmad Y, et al. Toward a definition of competency-based education in medicine: a systematic review of published definitions. Med Teach 2010;32(8):631–7.
16. Iobst WF, Sherbino J, Ten Cate O, et al. Competency-based medical education in postgraduate medical education. Med Teach 2010;32(8):651–6.
17. Snell LS, Frank JR. Competencies, the tea bag model, and the end of time. Med Teach 2010;32(8):629–30.
18. Accreditation Council on Graduate Medical Education, 2013. Common Program Requirements. Available at: https://www.acgme.org/acgmeweb/Portals/0/PFAssets/ProgramRequirements/CPRs2013.pdf. Accessed May 30, 2019.
19. Royal College of Physicians and Surgeons, CanMEDS Framework, 2005. Available at: http://www.royalcollege.ca/portal/page/portal/rc/canmeds/framework. Accessed May 30, 2019.
20. Dreyfus SE, Dreyfus HL. A five-stage model of the mental activities involved in directed skill acquisition. Berkeley (CA): University of California, Operations Research Center; 1980. Available at: https://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA084551. Accessed May 30, 2019.
21. Hilty DM, Zalpuri I, Stubbe D, et al. Social media/networking as part of e-behavioral health and psychiatric education: competencies, teaching methods, and implications. J Tech Behav Sci 2018. https://doi.org/10.1007/s41347-018-0061-7.
22. Zalpuri I, Liu H, Stubbe D, et al. A competency-based framework for social media for trainees, faculty and others. Acad Psychiatry 2018;42(6):808–17.
23. Boyd DM, Ellison NB. Social network sites: definition, history, and scholarship. J Comput Mediat Commun 2008;13:210–30.
24. Torous J, Chan RS, Yee-Marie Tan S, et al. Patient smartphone ownership and interest in mobile apps to monitor symptoms of mental health conditions: a survey in four geographically distinct psychiatric clinics. JMIR Ment Health 2014;1:e5.
25. Kumari P, Mathew L, Syal P. Increasing trend of wearables and multimodal interface for human activity monitoring: a review. Biosens Bioelectron 2017;90:298–307.
26. Honeyman E, Ding H, Varnfield M, et al. Mobile health applications in cardiac care. Interv Cardiol 2014;6(2):227–40.
27. Osheroff JA, Teichc JM, Middletone B, et al. A roadmap for national action on clinical decision support. J Am Med Inform Assoc 2007;14:141–5.
28. Kawamoto K, Houlihan Ca, Balas EA, et al. Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. BMJ 2005;330:765.
29. Torous J, Chan S, Boland R, et al. Clinical informatics in psychiatric training. Acad Psychiatry 2017. https://doi.org/10.1007/s40596-017-0811-4.
30. Srinivasan M, Li ST, Meyers FJ, et al. Teaching as a competency for medical educators: competencies for medical educators. Acad Med 2011;86(10):1211–20.
31. Carlson EB, Field NP, Ruzek JI, et al. Advantages and psychometric validation of proximal intensive assessments of patient-reported outcomes collected in daily life. Qual Life Res 2016;25:507–16.
32. Van Os J, Delespaul P, Barge D, et al. Testing an mHealth momentary assessment Routine Outcome Monitoring application: a focus on restoration of daily life positive mood states. PLoS One 2014;9:e115254.
33. Gonzalez J, Williams JW, Noël PH, et al. Adherence to mental health treatment in a primary care clinic. J Am Board Fam Pract 2010;18:87–96.
34. Harrison V, Proudfoot J, Wee PP, et al. Mobile mental health: review of the emerging field and proof of concept study. J Ment Health 2011;20:509–24.

35. Gonnermann A, von Jan U, Albrecht UV. Draft guideline for the development of evidence based medicine-related apps. Stud Health Technol Inform 2015;210: 637–41.

36. Agarwal S, LeFevre AE, Lee J, et al. Guidelines for reporting of health interventions using mobile phones: mobile health (mHealth) evidence reporting and assessment (mERA) checklist. BMJ 2016;352:i1174.

37. Grundy QH, Wang Z, Bero LA. Challenges in assessing mobile health app quality: a systematic review of prevalent and innovative methods. Am J Prev Med 2016;51(6):1051–9.

38. Arellano P, Bochinski J, Elias B, et al. Selecting a mobile app: evaluating the usability of medical applications 2012. Available at: www.mhimss.org/sites/default/files/resourcemedia/pdf/HIMSSguidetoappusabilityv1mHIMSS.pdf. Accessed May 30, 2019.

39. Mostaghimi A, Olszewski AE, Bell SK, et al. Erosion of digital professionalism during medical students' core clinical clerkships. JMIR Med Educ 2017;3(1):e9.

40. Armstrong EG, Mackey M, Spear SJ. Medical education as a process management problem. Acad Med 2004;79:721–8.

41. Bowe CM, Lahey L, Armstrong E, et al. Questioning the "big assumptions." Part II: recognizing organizational contradictions that impede institutional change. Med Educ 2003;37(8):723–33.

42. Christensen CM. Disruptive innovation: can health care learn from other industries? A conversation with Clayton M. Christensen. Interview by Mark D. Smith. Health Aff (Millwood) 2007;26(3):w288–95.

43. Kotter J. Leading change. Boston: Harvard Business School Press; 1996.

44. Miles A, Mezzich J. The care of the patient and the soul of the clinic: person-centered medicine as an emergent model of modern clinical practice. Int J Pers Cent Med 2011;1:207–22.

45. Hilty DM, Uno J. Chan S, et al. Role of technology in professional development. Psychiatr Clin N Amer, in press.

46. Hilty DM, Ferrer D, Callahan EJ. The effectiveness of telemental health: a 2013 review. Telemed J E Health 2013;19:444–54.

47. Center for Medicare and Medicaid Services. Clinical decision support. Available at: https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentive Programs/Downloads/ClinicalDecisionSupport_Tipsheet-.pdf. Accessed December 15, 2018.