Technologies for remote therapy and management – multiple criteria, multiple stakeholders

NIHR MindTech Healthcare Technology Co-operative

Michael P. Craven, Ph.D

Nottinghamshire Healthcare NHS Trust & University of Nottingham:
Institute of Mental Health + Faculty of Engineering
MindTech Healthcare Technology Co-operative

- A catalyst for the development of new technologies
- Focusing on 8 areas of high unmet clinical need
- Working with NHS, service users, academia & industry

NIHR Healthcare Technology Co-operatives

- Nottingham MindTech: Mental Health & Dementia
- Sheffield: Devices for Dignity
- Cambridge: Brain Injury
- Bart’s: Gastrointestinal Disease
- Leeds: Colorectal Therapies
- Bradford: Wound Care
- Guy’s: Cardiovascular Disease
- Birmingham: Trauma Management
MindTech Partnerships

Users
Patients, clinicians, NHS Trusts, charities & the public

SMEs & Developers

University Research
Behavioural Science, Psychiatry, Computer Science, Human Factors, Clinical Trials, Bio-engineering

Funding, Policy, Regulation & Governance

MindTech

Nottinghamshire Healthcare NHS Trust
Surrey and Borders Partnership NHS Foundation Trust
Mental Health Network NHS Confederation
ADDiSS
Tourettes Action
MANCHESTER 1824
The University of Manchester Informatics
The University of Nottingham
UNITED KINGDOM • CHINA • MALAYSIA
EPSRC
Engineering and Physical Sciences Research Council
Institute of Digital Healthcare
the institute of mental health
Nottingham
Knowledge Transfer Network
HealthTech and Medicines
Knowledge Transfer Network
ICT
Knowledge Transfer Network
Creative Industries
Department of Health
NHS England
NHS
National Institute for Health Research
HANDI
Supporting the ambitions of the Digital Health Revolution
MQ
Transforming mental health
MHRA
Regulating Medicines and Medical Devices
Contents

• Opportunities for digital tools in healthcare
• Digital healthcare - design and requirements
• Examples
  1. Video calling for remote therapy
  2. Apps development framework for mental health
  3. ADHD Apps
     a. SnappyApp – self-management CPT
     b. iRAM – remote medication monitoring
The potential for digital health

Britons are digital
- 80% access the internet regularly
- 60% own a smartphone
- 19% own a tablet
- We consume more digital data on the move than any other country
- The UK is the cheapest place for consumers to exploit online channels
- >160 million apps downloaded in December 2012
- Texting is the most frequent way adults keep in touch

Britons want digital health
- 60% would monitor their chronic condition using a mobile app
- 70% of us search for health info online
- 80% would like to view medical records online
- 90% would use an online GP appointment booking service
- 90% would use a service letting you ask a clinician a question

Source: Patient.co.uk, survey of 7,000 patients, Aug 2012
Digital healthcare - design & requirements

Perceptions about user involvement
- Limited involvement of health professional involvement (Rosser et. al., 2011)
- Lack of end user involvement in the design process (McCurdie et al., 2012)

Evidence
- Little good quality evidence of benefits (Free et al., 2013)

Additional demands – examples of ‘non-functional requirements’
- Regulatory/governance - is it a medical device? safety? cost effectiveness (Charani et al., 2013)
- Patient & Public Involvement (Brooks et al., 2011)
- Data security on mobile networks/ data integrity (Wasserman, 2010)
- Ethical - patient burden, health impact etc.
Example 1. Video calling for remote therapy (PS CBT)

- EM CLAHRC project Clinical and Cost Effectiveness of Remotely Delivered Problem Solving CBT in Adolescents and Young Adults with Depression who Repeatedly Self-Harm (EDASH)

- **Study Aims**
  - To determine acceptable ways to engage and retain adolescents and young adults (aged 16-30) in a remotely delivered problem solving CBT (video, telephone, chat).
  - To find out whether a remotely delivered problem solving CBT is clinically effective and cost effective in comparison to 'usual care'.
  - Work with clinicians, commissioners and service users to carry out qualitative analysis in identifying barriers, drivers and success in the delivery of the psychological intervention.

- **Which video system to choose?**
  - Methods for multi-criteria decision-making (MCDM): decision support grids, Analytic Hierarchy Process, etc.

**Principal Investigator:** Dr Kapil Sayal  
**Lead Researcher:** Dr Athfah Akhtar  
## Video calling Decision Support Grid

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Must have?</th>
<th>Skype</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Functions:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>video recording, chat/IM, file sharing, field notes, shared notes, apt reminder via email/text message</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>Desirable</td>
<td>Desirable</td>
<td>✓</td>
</tr>
<tr>
<td>Desirable</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Platforms:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mobile, tablet, PC, TV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>✓</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Session requirements:</strong></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>time/date recording, pausing, scheduling (meeting room/virtual waiting room), rescheduling</td>
<td>Yes</td>
<td>? (need App)</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>Yes</td>
<td>Desirable</td>
<td>✓</td>
</tr>
<tr>
<td>Desirable</td>
<td>Desirable</td>
<td>X</td>
</tr>
<tr>
<td><strong>Physical:</strong></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>gaze, full body, hands</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td><strong>Audio visual:</strong></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>camera (HD?), audio quality</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

### Information Governance:
- Privacy
- Data security
- Data location
- HIPAA as well as Data protection act?
- Ownership of data

<table>
<thead>
<tr>
<th>Information Governance</th>
<th>Must have?</th>
<th>Skype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy</td>
<td>Yes</td>
<td>X</td>
</tr>
<tr>
<td>Data security</td>
<td>Yes</td>
<td>X</td>
</tr>
<tr>
<td>Data location</td>
<td>Yes</td>
<td>X</td>
</tr>
<tr>
<td>HIPAA as well as Data protection act?</td>
<td>?</td>
<td>X</td>
</tr>
<tr>
<td>Ownership of data</td>
<td>Yes</td>
<td>N/A</td>
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### Network:
- Broadband speed
- Minimum browser
- N3 compatibility

<table>
<thead>
<tr>
<th>Network</th>
<th>Desirable</th>
<th>✓</th>
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</thead>
<tbody>
<tr>
<td>Broadband speed</td>
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<td>✓</td>
</tr>
<tr>
<td>Minimum browser</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>N3 compatibility</td>
<td>Yes</td>
<td>X</td>
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</table>

### Usability:
- therapist, service user
- No software download

<table>
<thead>
<tr>
<th>Usability</th>
<th>Yes</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>therapist, service user</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>No software download</td>
<td>Desirable</td>
<td>X</td>
</tr>
</tbody>
</table>

### Reliability in use:
- down time
- support for contingencies

<table>
<thead>
<tr>
<th>Reliability in use</th>
<th>Yes</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>down time</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>support for contingencies</td>
<td>Desirable</td>
<td>✓</td>
</tr>
</tbody>
</table>

### Company:
- due diligence
- registration date
- country of origin
- board structure

<table>
<thead>
<tr>
<th>Company</th>
<th>Yes</th>
<th>✓</th>
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<tr>
<td>due diligence</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>registration date</td>
<td>Desirable</td>
<td>✓</td>
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<tr>
<td>country of origin</td>
<td>Desirable</td>
<td>✓</td>
</tr>
<tr>
<td>board structure</td>
<td>Yes</td>
<td>✓</td>
</tr>
</tbody>
</table>

### Costs/capital outlay:
- ongoing/subscription
- installation
- broadband installation
- training

<table>
<thead>
<tr>
<th>Costs/capital outlay</th>
<th>Desirable</th>
<th>✓</th>
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<tbody>
<tr>
<td>ongoing/subscription</td>
<td>Desirable</td>
<td>✓</td>
</tr>
<tr>
<td>installation</td>
<td>Yes</td>
<td>✓</td>
</tr>
<tr>
<td>broadband installation</td>
<td>Desirable</td>
<td>✓</td>
</tr>
<tr>
<td>training</td>
<td>Desirable</td>
<td>✓</td>
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</tbody>
</table>

9 video conferencing systems to choose from:

<table>
<thead>
<tr>
<th>System</th>
<th>Skype</th>
<th>Lync</th>
<th>Saypage</th>
<th>VSee</th>
<th>Go to Webinar</th>
<th>Red Embedded</th>
<th>Polycom</th>
<th>WebEx</th>
<th>Facelook</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skype</td>
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<td>Lync</td>
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<td></td>
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<tr>
<td>Saypage</td>
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<tr>
<td>VSee</td>
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<tr>
<td>Go to Webinar</td>
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<tr>
<td>Red Embedded</td>
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<tr>
<td>WebEx</td>
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<td>Facelook</td>
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</table>
Example 2. App development framework for mental health

Rationale
- There are many different types of Apps for smartphone and tablets
  - Regulated medical devices
  - Well-being support tools
  - Lifestyle accessories
- Apps are inexpensive and rapidly evolving
- Large-scale evaluations are expensive & time consuming
- Not appropriate to hold all apps to same standard …
- … but some factors should always be considered:
  - Safety, Privacy, Security

Can we devise a proportionate evaluation framework?
Mental Health Apps Working group

Michael Craven, Jennifer Martin, Paul Radin, Lucy Simons
Victoria Betton, Nikoo Atraki

NIHR MindTech HTC, Institute of Mental Health, University of Nottingham Innovation Park, Nottingham, UK
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Chris Hollis
David Daley
Heather Steele
Jeremy Wyatt
Joy Fisher
Scott Angle
Tim Croudacre

Charlie Young
Dave Waldram
Emma Rowley
Jayne Birch-Jones
John Crowe
Judith Johnson
Shaun Lawson
Zoe Young

What’s different about mental health apps?

Different challenges:

• Wide ranging symptoms that can change rapidly:
  ▪ Severity, frequency

• Stigma of mental health
  ▪ Reluctance to use (App’s name, appearance may be v. important)

• Reliance on apps: what happens if they disappear or change?
• Possible negative effect on symptoms (e.g. anxiety)
• Equity: variable access to devices and/or internet connection
What’s different about mental health apps?

But also different strengths and opportunities:

• Many evidence-based therapies are ideally suited to digital delivery
  Talking therapies (especially ‘top-ups’ between appts), Peer support, Psychoeducation

• Regular (self-)monitoring can be particularly useful for mental health
  Daily rather than weekly, monthly or yearly? Or whenever is desired/needed.

• Many people already use digital technology and social networking to help manage their condition
  Facebook  #bpd  #BigMadChat

• For mild & moderate conditions digital tools may provide flexibility, choice, self-management strategies

• MH user communities are active and include many digital health leaders (including young people)
The Evaluation Framework: 5 Categories

1. Safety, security and privacy
2. Source
3. Access
4. Relevance, content and accuracy
5. Impact
1. Safety, security and privacy

- What data is collected, who owns it, what’s done with it?

<table>
<thead>
<tr>
<th>SAFETY, SECURITY AND PRIVACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is it clear what data is collected by the app (both automatically and entered by user)</td>
</tr>
<tr>
<td>Who has responsibility for the data? (e.g. who is the data controller and who is the data processor)</td>
</tr>
<tr>
<td>Who owns the data?</td>
</tr>
<tr>
<td>Do any third parties have access to personal data? (advice that this should not be the case unless for a clinical purpose)</td>
</tr>
<tr>
<td>What data does it ask users for? Is any of it personal data</td>
</tr>
<tr>
<td>Will the data (personal or otherwise) be sold or given to anyone?</td>
</tr>
<tr>
<td>Are third party services delivered through the app? If yes, are they (a) acceptable (b) if yes, how will the user be informed?</td>
</tr>
<tr>
<td>Is it possible to delete the app and all assorted data? (if yes, this needs to be clearly explained to the end user)</td>
</tr>
<tr>
<td>Is the user security fit for purpose? (i.e. authentication)</td>
</tr>
<tr>
<td>Where is the data stored and for how long? (must be in the UK)</td>
</tr>
<tr>
<td>Is third party licensing required? (e.g. for materials used on the app)</td>
</tr>
<tr>
<td>Is the software compliant with relevant open interface standards?</td>
</tr>
<tr>
<td>Is the software able to interoperate with other relevant IT platforms?</td>
</tr>
<tr>
<td>What functions of the phone does the app use? (sensors, camera, microphone, gps, etc.)</td>
</tr>
<tr>
<td>Does it ask users to register (by email or facebook)?</td>
</tr>
<tr>
<td>Is the media employed appropriate/proportionate to the activity?</td>
</tr>
<tr>
<td>Can the analytics/usage data be checked and accessed?</td>
</tr>
</tbody>
</table>

If yes, this may have implications for repurposing the app in the future.

Is this a good thing or bad thing?
2. Source

- Who developed it, who’s making money from it, who was involved?

<table>
<thead>
<tr>
<th>SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who developed this product?</td>
</tr>
<tr>
<td>Who commissioned/funded this product?</td>
</tr>
<tr>
<td>Who is making money from it?</td>
</tr>
<tr>
<td>How are the developers linked to relevant communities</td>
</tr>
<tr>
<td>What design processes were used – which stakeholders were involved?</td>
</tr>
<tr>
<td>Does it adhere to design industry standards on accessibility?</td>
</tr>
<tr>
<td>Have appropriate considerations been made for people with communication or sensory impairments?</td>
</tr>
<tr>
<td>What is the business/sustainability model? Is it likely to be regularly updated and available in the long-term?</td>
</tr>
</tbody>
</table>

- e.g. service users, clinicians, practitioners, NHS IT, commissioners

- provide links to these
3. Access

- How do you get it, what does it cost, what devices do users need?

**ACCESS**

- How does the user access the tool – independently or through the NHS?
- Is there any cost to using the tool or other aspects which might affect equity of access?
- What devices can be used (smartphone, tablet, iOS, Android) and can it be used across devices?
The Framework: Category 4

4. Relevance, content and accuracy

- Does it address a need or priority? Is it based on good practice or theory of change?
The Framework: Category 5

5. Impact

- Who will potentially benefit from the use of the app and how can this be measured?
  - A range of evidence may be considered depending on availability and what's appropriate, e.g. case studies, facts and figures, patient and clinician evaluations.
  - Include links to information on evaluation

<table>
<thead>
<tr>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>User – could use PROMS (Patient Reported Outcome Measures) or PREMS (Experience) or Holistic Needs Assessment.</td>
</tr>
<tr>
<td>Provider – info on NET economic impact (e.g. reduction in hospital admissions, QALYs)</td>
</tr>
<tr>
<td>Organisation – workflow/time/productivity gains, opportunity costs, attitudinal change in workforce confidence in such tools.</td>
</tr>
<tr>
<td>Commissioners – better/more appropriate use of services, efficiency, has it created new ideas for transformation?</td>
</tr>
<tr>
<td>What are the potential benefits for quality outcomes?</td>
</tr>
<tr>
<td>What are the potential cost benefits?</td>
</tr>
<tr>
<td>What are the potential benefits for clinical quality</td>
</tr>
<tr>
<td>What are the potential unintended outcomes/risks for users</td>
</tr>
<tr>
<td>What are the potential unintended outcomes/risks for providers</td>
</tr>
<tr>
<td>What are the potential unintended outcomes/risks for organisations</td>
</tr>
<tr>
<td>What are the potential unintended outcomes/risks for commissioners</td>
</tr>
</tbody>
</table>
Proportionate assessment of Apps – 4 excel-based tools

www.mindtech.org.uk Please try these out!

**Tool A:** Personal diary, logging or goal-setting Apps (no connectivity or sharing)

**Tool B:** Apps for Information or signposting

**Tool C:** Apps that connect and share with family, friends and peers

**Tool D:** Apps that connect with NHS services and/or systems

NIHR MindTech HTC, Institute of Mental Health, University of Nottingham Innovation Park, Nottingham, UK

mHealthHabitat: Leeds and York Partnership NHS Foundation Trust, The University of Leeds
Example 3. ADHD Apps:

a. **SnappyApp**: Mobile self-assessment for Attention Deficit Hyperactivity Disorder (ADHD)

### QbTest
- Computerised assessment of attention and activity
- Supports clinical decision making
- Provides patients with objective reports on their condition

### SnappyApp
- Continuous ‘AX’ performance test delivered by mobile phone App
  - Measure of (in)attention & impulsivity
- In-built accelerometer and gyroscope
  - Assess levels of (hyper) activity during test

### Requirements
- **Researcher/Ethics demands**
  - Short development time
  - Convenience sample
  - Two times a week data collection – limited burden
- **End-user demands**
  - Works on own phone
  - Aesthetics
  - Motivational aspects
- **Solutions**
  - Cross-platform implementation - web-app
  - Send email prompts
  - Gamification potential identified

[http://eprints.nottingham.ac.uk/3273](http://eprints.nottingham.ac.uk/3273)
b. Remote monitoring of ADHD symptoms using mobile phones

**Aims:** To explore the value of using mobile technology to promote timely treatment optimisation through the completion of clinically useful outcome measures and remote communication between the clinic and the patient.

**Methods:** A prototype system was developed by an industry partner, Qbtech Ltd. Perspectives were explored through an initial user workshop and a series of focus groups with four stakeholder groups (N=51):

- NHS staff working with people with ADHD
- Adults with ADHD
- Young people with ADHD
- Parents of children and young people with ADHD

<table>
<thead>
<tr>
<th></th>
<th>Staff</th>
<th>Adult</th>
<th>Young people</th>
<th>Parent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nottinghamshire</strong></td>
<td>N = 9</td>
<td>N = 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Leicestershire</strong></td>
<td>N = 7</td>
<td>N = 7</td>
<td>N = 6</td>
<td>N = 7</td>
</tr>
<tr>
<td><strong>Derbyshire</strong></td>
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<td></td>
<td>N = 2</td>
<td>N = 2</td>
</tr>
<tr>
<td><strong>Total (N=51)</strong></td>
<td>23</td>
<td>11</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>
User elicitation for iRAM

How satisfied were you with the process when you/your child started medication?

"It quantifies how you are as you’re not always aware of what effects [the medication] is having" (Adult)

"You and the doctor can look at it together" (Adult)

"You can look at your progress" (Young person)

"A printout of good days and bad days is useful as by the time the patient sees you they have forgotten the bad day" (NHS staff)

"If you have a graph, you would be able to see when the dips happen" (Parent)
Where we started ... an idea for an App

**Problem**

Time to reach optimum dose of medication takes longer than recommended by NICE

**Digital solution**

Clinic controlled online system to collect information between appointments via smartphones

... where we are now

**Problem**

Time to reach optimum dose of medication takes longer than recommended by NICE

**Digital solution**

Clinic controlled online system to collect information between appointments via smartphones

[UKCRN Study Portfolio (Observational Study) title: iRAM](http://public.ukcrn.org.uk/search/StudyDetail.aspx?StudyID=16365)
... where we are now

**Problem**
Delay to diagnosis and the need for more information and support

**Digital solution**
Clinic controlled online system to collect information between appointments via smartphones

UKCRN Study Portfolio (Observational Study) title: iRAM  
http://public.ukcrn.org.uk/search/StudyDetail.aspx?StudyID=16365
... where we are now

Problem
Delay to diagnosis and the need for more information and support

Digital solution
Patient controlled app
- Monitor over time (pre and post diagnosis)
- Tailored real time advice and support

UKCRN Study Portfolio (Observational Study) title: iRAM  
http://public.ukcrn.org.uk/search/StudyDetail.aspx?StudyID=16365
Thank you

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