How good are apps for patient care?

Kit Huckvale
Global eHealth Unit, Imperial College London
Overview

Effectiveness
Safety
Acceptability and Practicability
  For clinicians
  For patients
Why apps, why now?

A specific context for interventions

Fully-fledged mobile computer with Sensors
Vital Signs Camera, Philips (iOS)
Why apps, why now?

A specific **context** for interventions

- Fully-fledged mobile computer with Sensors
- Population-scale uptake
Why apps, why now?

Population-scale uptake

- 47% (±10%) use mobile internet
- 33% (±9%) download apps

Ofcom CMR data
Why apps, why now?

A specific context for interventions

- Fully-fledged mobile computer with Sensors
- Population-scale uptake
- Always carried, always on
Diabetes Companion
mySugr GMBH
(iOS/Android)

Cancer Emergency Response Tool
Portable Medical Technology Ltd.
(iOS/Android)
Why apps, why now?

A specific **context** for interventions

- Fully-fledged mobile computer with Sensors
- Population-scale uptake
- Always carried, always on
Apps for asthma

Cross sectional systematic surveys of all apps for Android and iOS (2011, 2013)

84 (2011) 241 (2013)
## Apps for asthma

Cross sectional systematic surveys of all apps for Android and iOS (2011, 2013)

<table>
<thead>
<tr>
<th></th>
<th>Information apps</th>
<th>Diaries</th>
<th>Alerts</th>
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<tr>
<td><strong>57%</strong></td>
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<tr>
<td><strong>22%</strong></td>
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<tr>
<td><strong>8%</strong></td>
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Half present alternative content (vs a third in 2011)
1. Evidence for effectiveness

Promising but limited
Systematic review findings

**Type 2 diabetes**  Baron et al. 2012
Clinician-supported mobile diet/glucose monitoring vs standard care
Clinically-relevant improvements in A1c in 10/13 (n=1333)
Greater reductions in those that are poorly controlled

**Asthma**  Marcano-Belisario 2013
Clinician supported action plan and peak flow monitoring vs standard care
Possibility of improved self-reported QoL, lung function and unplanned care use in 1/2 (n = 308)
1. Evidence for effectiveness

Promising but limited

Recent trials

**Smartphone-based cardiac rehab** (Varnfield et al. 2014)
RCT, n=120, versus hospital-based rehab
Outcomes equivalent to hospital care but significantly better adherence and completion.

**Weight loss smartphone intervention** (Allen et al. 2013)
RCT, n=68, combinations of counselling/smartphone use
Self-monitoring plus counselling more effective than smartphone or counselling alone

**Smartphone artificial pancreas** (Kovatchev et al. 2014)
Randomised crossover study, n=20, versus usual care
Reduction in hypos, but increase in average glycaemia
1. Evidence for effectiveness

Three big(ish) gaps:
  - Pragmatic
  - Cost-effectiveness
  - Theoretical

Are trials the best approach?
2. Safety

Many apps offer medical advice

19% (n=47) asthma apps provide directive guidance on managing attacks
Over 1/3 provide guidance that has no basis in evidence

Some offer diagnostic and therapeutic services

Commercial app stores are essentially unregulated

Is there evidence of safety risks?
In its default state, this diabetes calculator app, which has been downloaded over 10,000 times, recommends increasing insulin doses in response to falling blood sugar levels.
Diagnostic inaccuracy of melanoma detection
(Wolf et al. 2013)
Camera-based analysis of 188 test images compared to expert judgement

3/4 apps offering image analysis of possible skin cancers classified 30% or more melanomas as unconcerning.

Sensitivity as low as 6.8%.
“[H]old a jar of honey under the nose of someone who is suffering an asthma attack…”

“... make sure that you have their emergency nebulizer to hand, just in case this particular method doesn’t work in an emergency situation.”
This predicted peak flow calculator changes the value of its output depending on whether the screen is in landscape or portrait orientation.
2. Safety

Why do issues arise?
- Commercial app stores place very few limitations
- Different development context
- Global distribution

Future prospects
- US FDA Mobile Medical Apps regulation
- Existing EU/MHRA Medical Device Directive
- Health app stores
  - NHS Health Apps Library
    “Reviewed by the NHS to ensure that they are clinically safe”
  - Others e.g. US-based Happtique
3. Acceptability

For clinicians

Clinical benefit
Implementation, support, training

For patients

Trial populations generally display high levels of acceptance
But why?
“When I was first diagnosed, I was given a little record book thing. But I’d go to record it, and I wouldn’t have a pen with me, or I’d forget the diary. I was in uni and running around everywhere and it just didn’t work it out. I have to record it immediately or I won’t record it. [The app is] just so easy, it’s just so fast.”

“I’ve had a GP say to me in the past “Why can’t you do this?” And people will ask, opticians or whatever, “Are you a good diabetic?” And my automatic response is “No.” So I guess when now I see [the summary chart generated by the app] all in green, I feel like I’m getting there. And I’ll tag the data, it reminds me if I need to explain.”
“You can create a report of your readings in PDF. I’ve got a really good GP and I can print it out and give them to her. Using the tags, you can map it all together, that’s really helpful for figuring out what’s going on. She’ll go through it and say: “Okay, you exercised here, you’ve had a hypo, you’ve eaten too many carbs to compensate for your hypo.”
How good are apps for patient care?

Are they effective?
   No evidence worse than traditional methods of supporting self-care
   Other considerations: acceptability, cost, etc.

Are they safe?
   Question mark over diagnostic apps and calculators
   App Stores have something of the Wild West about them

Are they acceptable?
   Clinical evidence is lacking
   Generally highly acceptable in trial populations

Match between clinical priorities and patient needs
Thank you for listening.
c.huckvale@imperial.ac.uk

Thanks to Josip Car, Cecily Morrison, Jose Marcano and Julie Reed
Why apps, why now?

An intersection of **maturing technology** and a **consumer phenomenon**.

Differentiated adoption... ...and different patterns of use

**By age**

<table>
<thead>
<tr>
<th>Age</th>
<th>Smartphone Ownership</th>
<th>Main device for surfing</th>
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</thead>
<tbody>
<tr>
<td>16-24</td>
<td>77%</td>
<td>33%</td>
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<tr>
<td>65-74</td>
<td>11%</td>
<td>9%</td>
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<tr>
<td>75+</td>
<td>2%</td>
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**By social group**

<table>
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<tr>
<th>Social Group</th>
<th>Smartphone Ownership</th>
<th>Main device for surfing</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>60%</td>
<td>19%</td>
</tr>
<tr>
<td>DE</td>
<td>38%</td>
<td>23%</td>
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Unclear if mobile is less inequitable than past technologies
Why apps for long-term conditions?

Always carried, always on
   Support and interaction in the moment of experience
      Logging data
      Timed (and contextual) reminders
   “Convenience gap”

Personal and private

Multimedia capabilities

Connected
   Clinical feedback
   Peer and social support
   Data collection

Low-cost distribution
Asthma

Cross sectional systematic surveys of all apps for Android and iOS (2011, 2013)

84 (2011) >69,000 Android downloads

241 (2013) >300,000 Android downloads (median 100)
Asthma

Cross sectional systematic surveys of all apps for Android and iOS (2011, 2013)

57% Information apps
Half present alternative content (vs a third in 2011)
Asthma

Cross sectional systematic surveys of all apps for Android and iOS (2011, 2013)

Information apps

22% Diaries and trackers
## Asthma

Cross sectional systematic surveys of all apps for Android and iOS (2011, 2013)

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<tr>
<th>Diagnostics</th>
<th>Social networking</th>
<th>Sensors</th>
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<tbody>
<tr>
<td>(n=3)</td>
<td>(n=1)</td>
<td>(n=5)</td>
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8%