Programming Android Phones for Use in Clinical Research

Getting Participants to Record a Diary of Adverse Events.

Dr Tom Hartley : UTas : March 2017

BACKGROUND

Some appealing Literature :

➢Despite technical problems personal digital assistants outperform pen and paper when collecting patient diary data : J Clin Epi : January 2007 Volume 60, Issue 1, Pages 8–17

➢The feasibility of cell phone based electronic diaries for STI/HIV research : BMC Medical Research Methodology 2012, 12:75

➢How smart phones are changing the face of mobile and participatory healthcare: an overview, with example from eCAALYX : BioMedical Engineering OnLine 2011, 10:24   (Enhanced Complete Ambient Assisted Living Experiment)

➢The Smartphone in Medicine: A Review of Current and Potential Use Among Physicians and Students : J Med Internet Res 2012;14(5):e128

➢What makes a good clinical app? Introducing the RCP Health Informatics Unit checklist : Clinical Medicine 2015 Vol 15, No 6: 519–21

Best clue as to How I Could to Do It !

Building Android Apps with HTML, CSS, and JavaScript
Making Native Apps with Standards-Based Web Tools
By Jonathan Stark, Paco Nathan, John Papaconstantinou, Paco Lagerstrom, Paco Hope
Publisher: O'Reilly Media
Final Release Date: September 2010
Pages: 184

2.3

Read 14 Reviews | Write a Review

NO – use PHP on a locally installed web server!

If you know HTML, CSS, and JavaScript, you already have the tools you need to develop Android applications. This hands-on book shows you how to use these open source web standards to design and build apps that can be adapted for any Android device -- without having to use Java.

You'll learn how to create an Android-friendly web app on the platform of your choice, and then convert it to a native Android app with the free PhoneGap framework. Discover why device-agnostic mobile apps are the wave of the future, and start building apps that offer greater flexibility and a broader reach.

- Learn the basics for making a web page look great on the Android web browser
- Convert a website into a web application, complete with progress indicators and more
- Add animation with jQTouch to make your web app look and feel like a native Android app
- Take advantage of client-side data storage with apps that run even when the Android device is offline
- Use PhoneGap to hook into advanced Android features -- including the accelerometer, geolocation, and alerts
- Test and debug your app on the Web under load with real users, and then submit the finished product to the Android Market

This book received valuable community input through O'Reilly's Open Feedback Publishing System (OFPS). Learn more at http://labs.oreilly.com/ofps.html.

Building Android Apps with HTML, CSS, and JavaScript
O'REILLY
Jonathan Stark
Larger Cover

Power of Dell Latitude laptop (2004) compared to ZTE F286 Mobile Phone (2016)

DELL :
- Intel 1.4Ghz Pentium-M CPU
- 640MB Memory
- 40GB HDD
- 14.1" SXGA+ (1400x1050) display
- Weight: 5.3lbs
- Price tag: US$1,606

ZTE :
- 4.0" capacitive touch screen
- Android 4.4 operating system
- Dual core 1.0GHz CPU with 512MB RAM
- 4GB flash memory
- Expandable memory up to 32GB with microSD
- Price tag: AUS $29

Challenge – Can we use these as cheap data collection devices in Clinical Research ?

To do so we need to be able to program them ourselves –

Is this too complicated for most of us ?

So I experimented with two Telstra Tempo phones @ $29 each !

Programming Android Phones for Use in Clinical Research

TEST MODEL :
Getting Participants in a Drug Trial to Record a Diary of Adverse Events in a Dedicated Mobile Phone.

ERGONOMICS

How easy is it to fill in a
questionnaire with only 5 questions
on a 4 inch screen ?

WATTAREN ANTI-INFLAMMATORY CLINICAL TRIAL

Participant's Adverse events recording system

Use this form to record any adverse reactions during this clinical trial of Wattaren

You should use this App to record these events as close as possible to the time at which they occurred

There are 5 questions ....

Q1 : What is your ID number ?

Q2 : What are your symptoms ?

Q3 : What was the date and time you experienced these symptoms ?

Enter as d/m/y hh:mm

Q4 : How would you rate these symptoms ?

None selected

Q5 : What was your Glucometer glucose reading when this happened ?

File your answers

WATTAREN ANTI-INFLAMMATORY CLINICAL TRIAL

Participant's Adverse events recording system

Use this form to record any adverse reactions during this clinical trial of Wattaren

You should use this App to record these events as close as possible to the time at which they occurred

There are 5 questions ....

Q1 : What is your ID number ?

Q2 : What are your symptoms ?

Type in this URL :
www.medlabstats.com/seminar/q.html

How convenient was it to fill in ?
(mark out of 10)

Q3 : What was the date and time you experienced these symptoms ?

Enter as d/m/y hh:mm

Q4 : How would you rate these symptoms ?

None selected

Q5 : What was your Glucometer glucose reading when this happened ?

File your answers .

Issue 1 : Small screen size makes for difficult data entry ... Will lead to poor compliance.

Overall the combination of different phones, screen sizes, browsers and user dexterity will lead to participants reporting widely varying experience

NETWORK COVERAGE

Different phones, different providers,
different reception areas ...... All make
for an inhomogeneous (i.e. unpredictable)
solution.

(We are privileged to work on an
'infrastructure rich' campus ... Our
participants are not so lucky !)
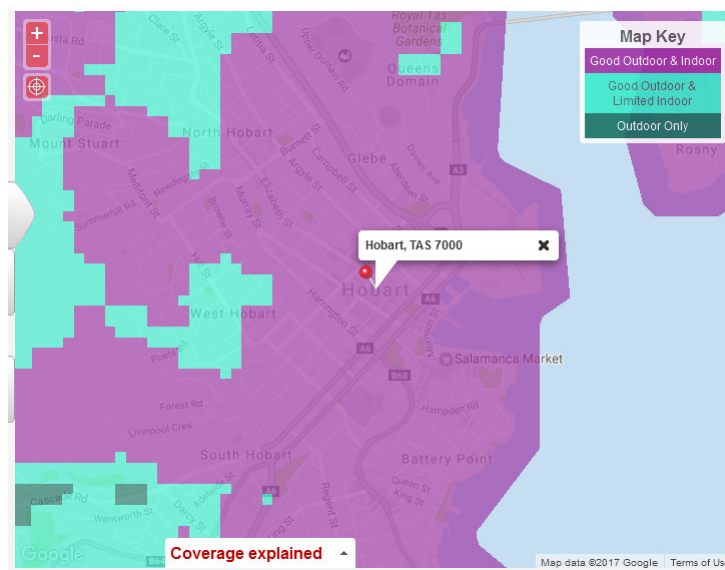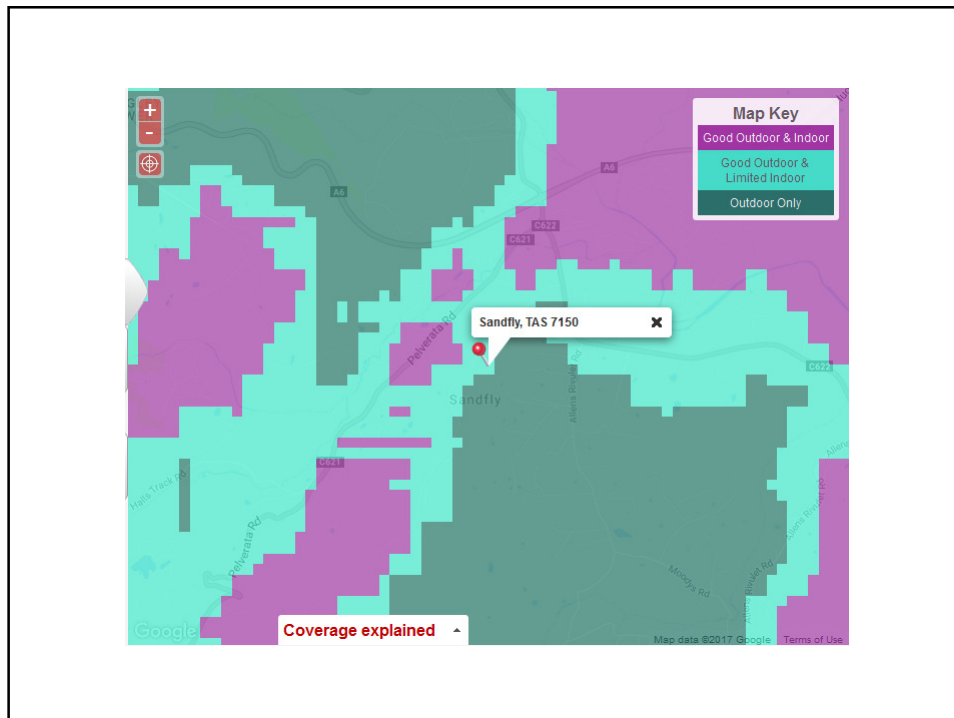
WORK AROUNDS

1. ERGONOMICS : Present the questions one at a time on separate screens.

2. NETWORK COVERAGE : Dispense with the need to have any sort of network connection, mobile plan etc ...... Only necessary if you are wanting to look at a participants data in real-time and feed back corrective action !

> Remember from my introductory slide
>
> 'Building Android Apps with HTML, CSS, and JavaScript'
>
> NO – use PHP on a locally installed web server!
>
> 'Building Android Apps with HTML, CSS, PHP and JavaScript on a local Web Server'

WORK AROUNDS

ERGONOMICS

1. Present the questions one at a time on separate screens
2. Make available only a single web browser – in this case Opera proved to be the best.
3. Make available a good keyboard – TouchPal proved to be the best.
4. Supply a stylus pen

Type in this URL :
www.medlabstats.com/seminar/q1.html
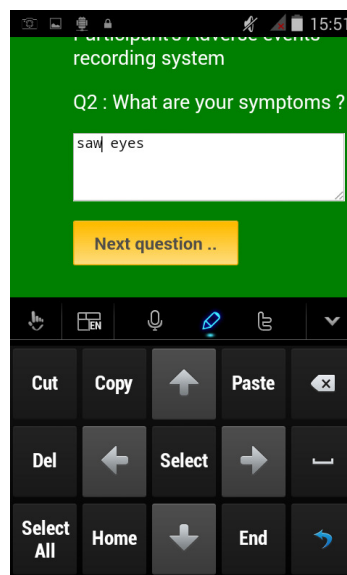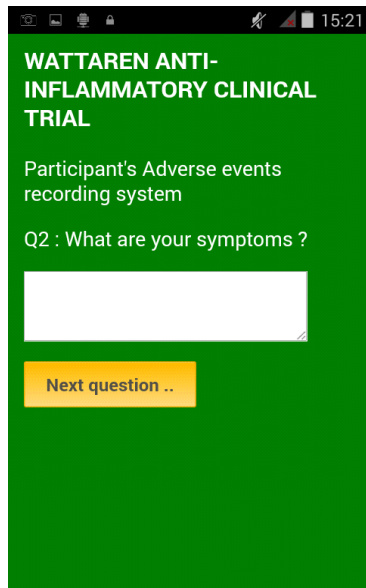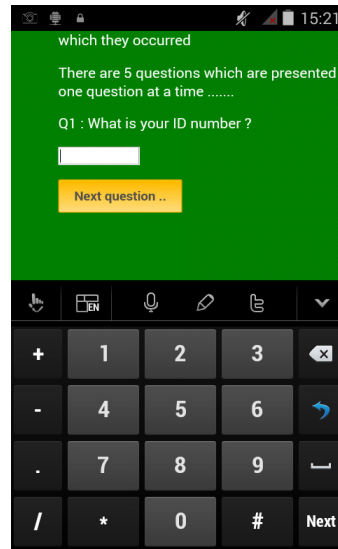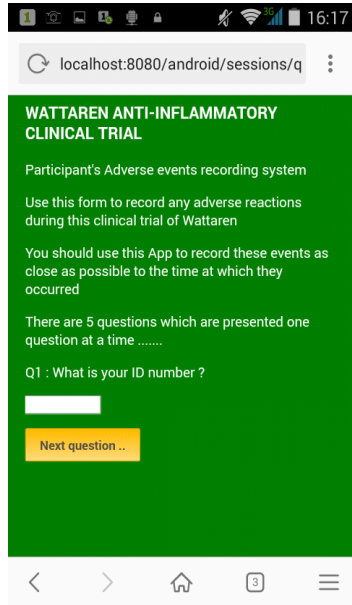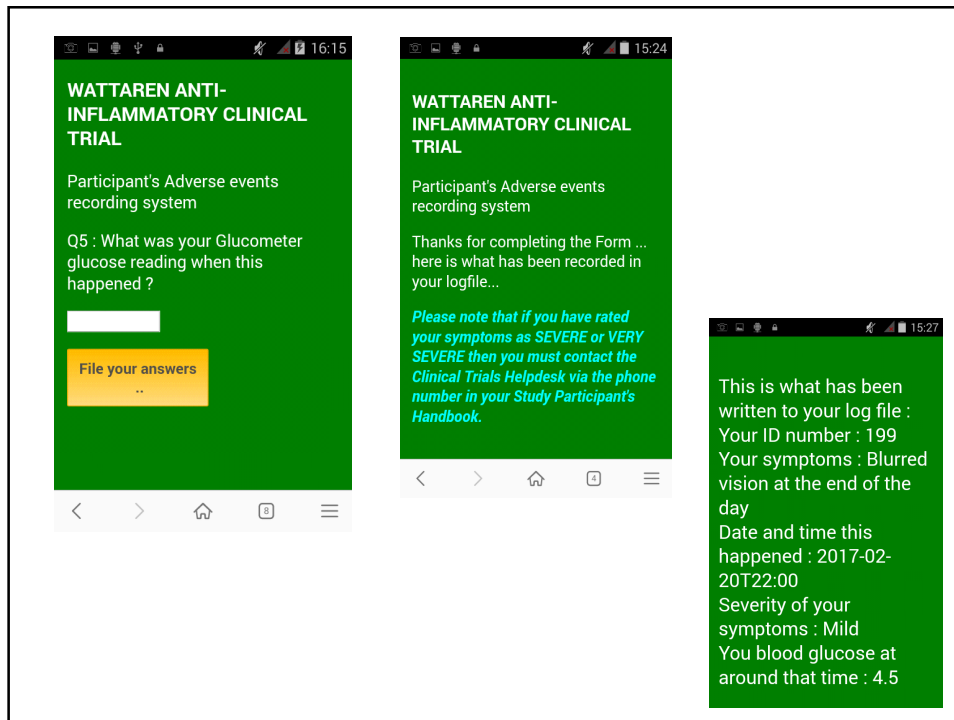
How convenient was it to fill in ?
(mark out of 10)

What the final 'App' looked like on the Telstra Tempo phone …

Remember to 'Double Tap'

This is browser specific ...

This is browser specific ...

WATTAREN ANTI-INFLAMMATORY CLINICAL TRIAL

Participant's Adverse events recording system

Q5 : What was your Glucometer glucose reading when this happened ?

File your answers ..

WATTAREN ANTI-INFLAMMATORY CLINICAL TRIAL

Participant's Adverse events recording system

Thanks for completing the Form ... here is what has been recorded in your logfile...

Please note that if you have rated your symptoms as SEVERE or VERY SEVERE then you must contact the Clinical Trials Helpdesk via the phone number in your Study Participant's Handbook.

This is what has been written to your log file :
Your ID number : 199
Your symptoms : Blurred vision at the end of the day
Date and time this happened : 2017-02-20T22:00
Severity of your symptoms : Mild
You blood glucose at around that time : 4.5

Type in this URL :
**www.medlabstats.com/seminar/q1.html**

REMINDER –

How convenient was it to fill in ?
(mark out of 10)

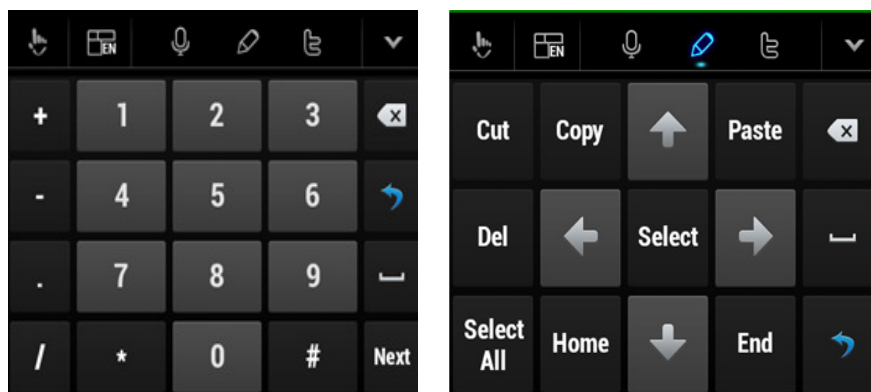Some technical details to complete the information on what has to be done in the background :

The Web Server

*Why do you have to use a web server ? – because browsers have been designed **not** to write back data to your disk drive.*
They can write 'cookies' but writing back data that persists after the session is a "no no"
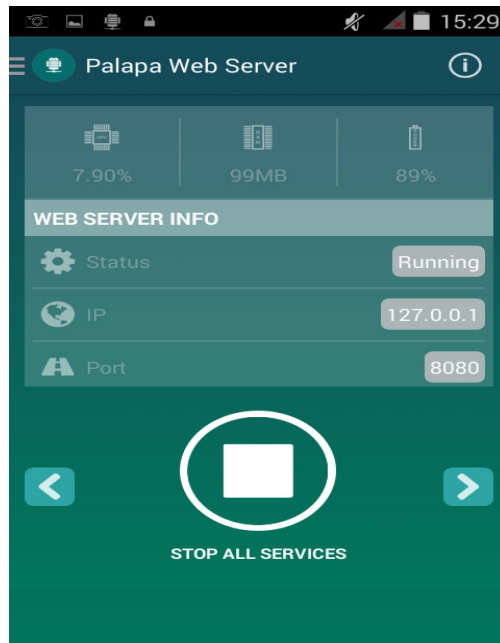
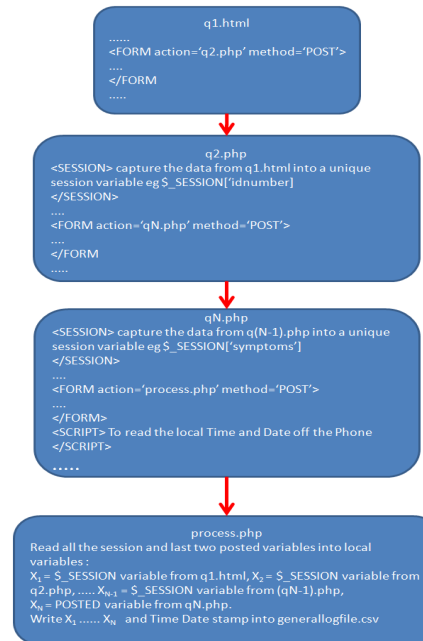Some technical details to complete the information on what has to be done in the background :
The Keyboard

This is Keyboard specific … Note the decimal point and the cursor pad

Some technical details to complete the information on what has to be done in the background :

The Schema for the web pages.

q1.html
......
<FORM action='q2.php' method='POST'>
....
</FORM>
.....

q2.php
<SESSION> capture the data from q1.html into a unique session variable eg $_SESSION['idnumber]
</SESSION>
....
<FORM action='qN.php' method='POST'>
....
</FORM>
.....

qN.php
<SESSION> capture the data from q(N-1).php into a unique session variable eg $_SESSION['symptoms']
</SESSION>
....
<FORM action='process.php' method='POST'>
....
</FORM>
<SCRIPT> To read the local Time and Date off the Phone
</SCRIPT>
.....

process.php
Read all the session and last two posted variables into local variables :
X_1 = $_SESSION variable from q1.html, X_2 = $_SESSION variable from q2.php, ... X_{N-1} = $_SESSION variable from (qN-1).php, X_N = POSTED variable from qN.php.
Write X_1 ...... X_N and Time Date stamp into generallogfile.csv

---

➢ Listing of q1.html : Template for the first question

```
<html>
<head>
<link rel="stylesheet" href="style1.css" />
</head>
<body>
<body bgcolor='green'>
<font size=4>
<font color='white'>
<div class="container">
<div class="main">
<h3>WATTAREN ANTI-INFLAMMATORY CLINICAL TRIAL
</h3>

Participant's Adverse events recording system

<p>
Use this form to record any adverse reactions during this clinical trial of
Wattaren
<p>

You should use this App to record these events as close as possible
to the time at which they occurred
<p>

There are 5 questions which are presented one question at a time .......

<form action="q2.php" method="post">
Q1 : What is your ID number ?
<p>
<input name="idnumber" type="number">
<p>
<input type="submit" name="Submit" value="Next question...">
</form>
</div>
</div>
</body>
</html>
```

> Listing of qn.php : Template for the nth question

```php
<?php
session_start();
$_SESSION['symptoms'] = $_POST['symptoms'];
?>

<html>
<head>
<link rel="stylesheet" href="style1.css" />
</head>
<body>
<body bgcolor='green'>
<font size=4>
<font color='white'>
<div class="container">
<div class="main">
<h3>WATTAREN ANTI-INFLAMMATORY CLINICAL TRIAL
</h3>
Participant's Adverse events recording system
<p>
<form action="qn+1.php" method="post">
Q3 : What was the date and time you experienced these symptoms ?
<p>
<input type='datetime-local' name='day'>
<p>
<input type="submit" value="Next question..">
</form>
</div>
</div>
</body>
</html>
```

> Listing of qN.php : Template for the Nth / Last question

```php
<?php
session_start();
$_SESSION['rating'] = $_POST['rating'];
?>

<html>
<head>
<link rel="stylesheet" href="style1.css" />
</head>
<body>
<body bgcolor='green'>
<font size=4>
<font color='white'>
<div class="container">
<div class="main">
<h3>WATTAREN ANTI-INFLAMMATORY CLINICAL TRIAL
</h3>
Participant's Adverse events recording system
<p>
<form action="process.php" method="post">
Q5 : What was your Glucometer glucose reading when this happened ?
<p>
<input name='glucose' type='number' step=0.1>
<p>

<input type="hidden" id="dmy" name="NOW" value="Content of the extra
variable" >

<script>
var d = Date();
document.getElementById("dmy").value = d;
</script>


<p>
<input type="submit" value="File your answers..">
</form>
</div>
</div>
</body>
</html>
```

15

> Listing of_process.php : Template for processing and filing the data from all N questions plus a time and date stamp

```php
<?php
session_start();
?>

<html>
<head>
<link rel="stylesheet" href="style1.css" />
</head>
<body>
<body bgcolor='green'>
<font size=4>
<font color='white'>
<div class="container">
<div class="main">
<h3>WATTAREN ANTI-INFLAMMATORY CLINICAL TRIAL
</h3>
Participant's Adverse events recording system
<p>
Thanks for completing the Form ... here is what has been recorded in your
logfile...
<p>
<b>
<i>
Please note that if you have rated your symptoms as SEVERE or VERY SEVERE
then you must contact the Clinical Trials Helpdesk via the phone number in
your Study Participant's Handbook.
</i>
</b>
<br>

<p>
<?php
$a = $_SESSION['idnumber'];
$b = $_SESSION['symptoms'];
$c = $_SESSION['day'];
$d = $_SESSION['rating'];
$e = $_POST['glucose'];
$f = $_POST['NOW'];

print "This is what has been written to your log file :";
print "<br>";
print "Your ID number : " . $a;
print "<br>";
print "Your symptoms : " . $b;
print "<br>";
print "Date and time this happened : " . $c;
print "<br>";
print "Severity of your symptoms : " . $d;
print "<br>";
print "Your blood glucose at around that time : " . $e;
print "<p>";
print "----------------debugging------------------";
```

To get correct syntax for other FORM FIELDS use form wizard @
http://www.phpform.org/

16

Pages go into a designated folder on the phone

Phone storage ⟩ pws

📁 logs

📁 phpmyadmin

📁 www

ws ⟩ www ⟩ android ⟩ sessions

process.php
Size 1.42 KB

q1.html
Size 0.75 KB

q2.php
Size 0.59 KB

q3.php
Size 0.6 KB

q4.php
Size 0.71 KB

q5.php
Size 0.78 KB
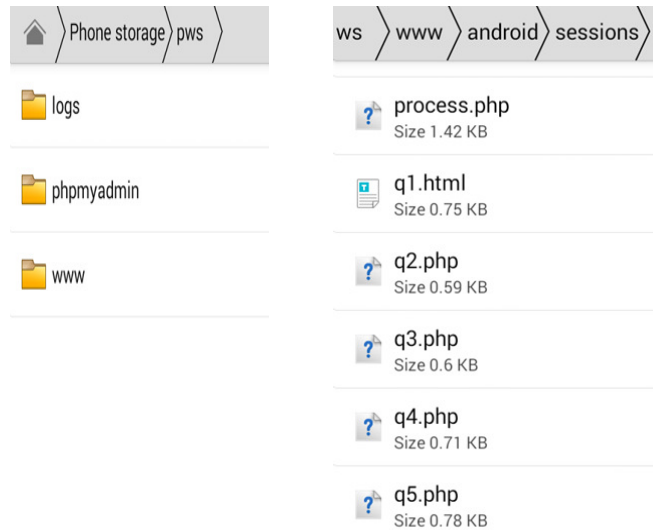
Relevant Extract from the Royal College of Physicians (UK) 'App' Evaluation Tool

a) **Is it clear who this app is for and how it should be used? Yes / No / Don't know**

b) **Is it clear which problem the app is designed to alleviate or what outcome it helps to promote? Yes / No / Don't know**

c) **Do the app developer and sponsor seem well informed about this problem or outcome, and likely to be unbiased in their approach to it? Yes / No / Don't know**

a) **Do the app screens look well designed, is text clear? Not applicable / Yes / No / Don't know**

b) **Is it clear what data the app needs from the user ?**

a) **Is the app fast and easy to use ? Yes / No / Don't know**

b) **Overall, do the benefits of using this app seem likely to outweigh inconvenience and costs to the user? Yes / No / Don't know**

c) **Is there any specific clinical scenario or patient subgroup in which using the app seems particularly likely to be useful? Yes - Which? _____ / No / Unclear**

Thank You !

Volunteers for 'phone evaluation' ?

➢thomas.hartley@utas.edu.au

➢www.medlabstats.com/seminar/q1.html
➢www.medlabstats.com/seminar/PhoneHowTo.pdf