APPENDIX

Part 1 – QR codes

A QR (Quick Response) code is one type of 2D matrix bar code developed by the Denso Wave Company, a Japanese manufacturer of automotive components, for creating parts labels capable of holding more data than conventional bar codes.[1] It can hold one hundred times the amount of data stored by a conventional one dimensional linear bar code. Figure 1 (a) illustrates the basic anatomy of a QR code conforming to ISO (International Standards Organisation) 2005 (revision 2014).[2] The data is held in a square dot matrix surrounded by a white border called the "quiet zone". Text or icons can be printed in this area that do not interfere with the readability of the code such as the "QR code Medical Alert" in our example. The QR code reader of the smart device's camera "locks" onto the code with the help of the three large square dots at the three corners of the code square (finder pattern). The code can be read horizontally or vertically as long as the smart device (Android, iPhone) camera is held at right angles to the code. QR codes are likely to become an exciting and popular way of accessing digital information because users like their interactivity.[3] QR codes are free to use without copyright restriction as Denso have waived their patent rights on it. Some disadvantages of QR codes are that they do not work where there is no Wi-Fi™ (wireless local area network internet connection) such as an aeroplane or deep underground railway station and a QR code reader app has to be downloaded from the web to enable the smart device camera to read the code unless one owns the latest Apple or Android smart devices which have built-in QR code scanning software.

Part 2 – Creating and printing QR codes

Figure 1 (b) illustrates how a web-based freeware program called "QR Code Generator".[4] creates QR codes. The multi-functional nature of the QR code is revealed in the six choices labelled horizontally in the figure from left to right, "web site", "phone", "SMS"(short message service), "e-mail", "text" and "mp3"(a compressed digital audio format). A QR code can be configured to make a phone call, send a pre-entered SMS text message or e-mail or play an mp3 audio file. Our Addison's Disease Information System (ADIS) web app only uses the "web site" function of the QR code. It encodes the web address of the ADIS web site in the QR code so that when it is scanned, it loads and displays the ADIS in the smart device's web browser.
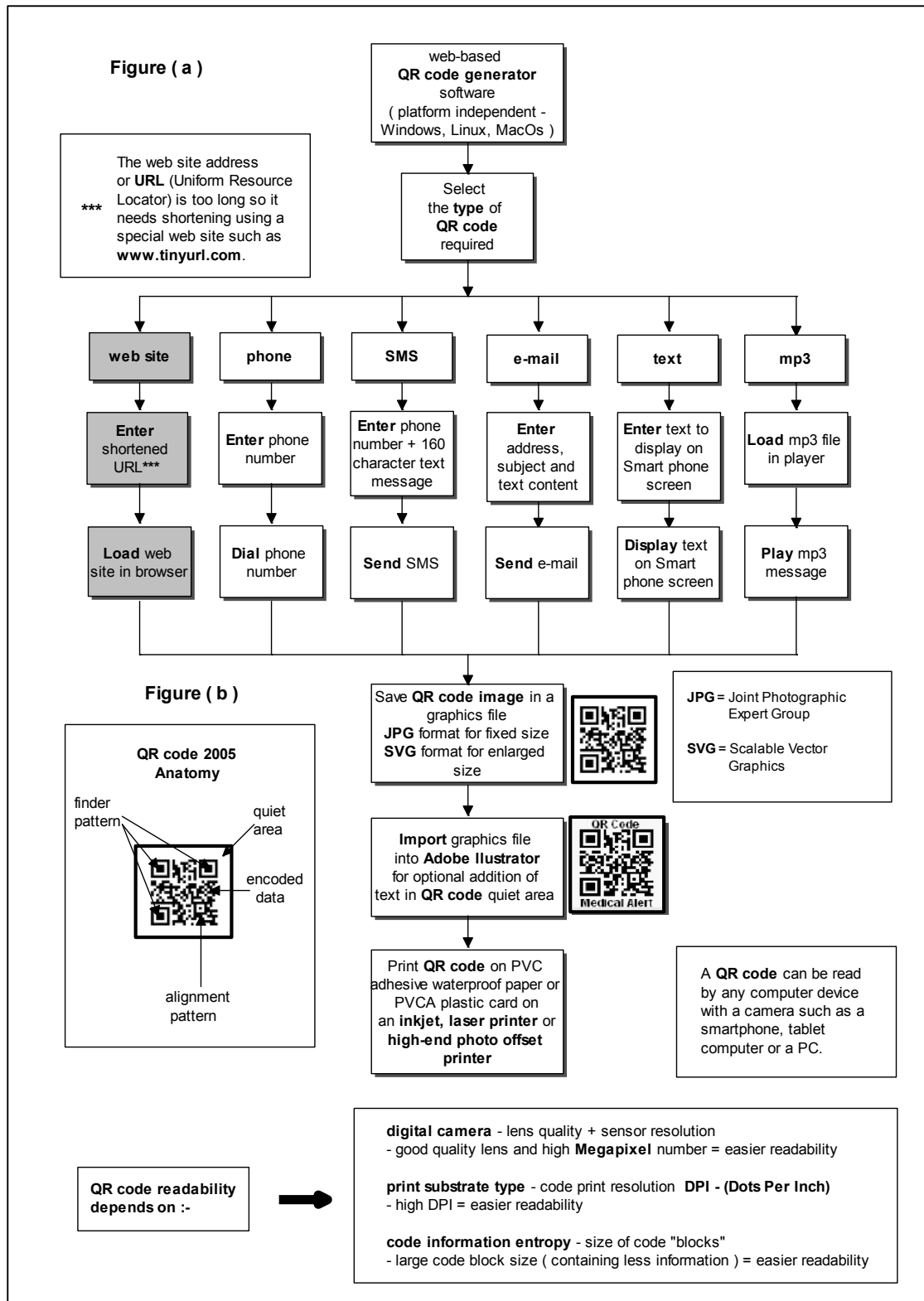
Figure (a)

web-based **QR code generator** software (platform independent - Windows, Linux, MacOs)

*** The web site address or **URL** (Uniform Resource Locator) is too long so it needs shortening using a special web site such as **www.tinyurl.com**.

Select the **type** of **QR code** required

web site	phone	SMS	e-mail	text	mp3
Enter shortened URL***	**Enter** phone number	**Enter** phone number + 160 character text message	**Enter** address, subject and text content	**Enter** text to display on Smart phone screen	**Load** mp3 file in player
Load web site in browser	**Dial** phone number	**Send** SMS	**Send** e-mail	**Display** text on Smart phone screen	**Play** mp3 message

Figure (b)

QR code 2005 Anatomy

finder pattern

quiet area

encoded data

alignment pattern

Save **QR code image** in a graphics file
JPG format for fixed size
SVG format for enlarged size

JPG = Joint Photographic Expert Group

SVG = Scalable Vector Graphics

Import graphics file into **Adobe Ilustrator** for optional addition of text in **QR code** quiet area

QR Code
Medical Alert

Print **QR code** on PVC adhesive waterproof paper or PVCA plastic card on an **inkjet, laser printer** or **high-end photo offset printer**

A **QR code** can be read by any computer device with a camera such as a smartphone, tablet computer or a PC.

QR code readability depends on :-

→

digital camera - lens quality + sensor resolution
- good quality lens and high **Megapixel** number = easier readability

print substrate type - code print resolution **DPI - (Dots Per Inch)**
- high DPI = easier readability

code information entropy - size of code "blocks"
- large code block size (containing less information) = easier readability

Figure 1 (a) The anatomy of a QR code (type 2005). (b) The process of generating a multi-modal QR code and printing it on a card and bracelet.

Part 3 – Accessing the ADIS by scanning the QR code-linked bracelet or card

Figure 2 shows how a QR code, printed on a bracelet or card, is read by a smart device. If one has the latest iPhone 7 or an Android smartphone running the Android Operating System Version 4.4 and above, QR code
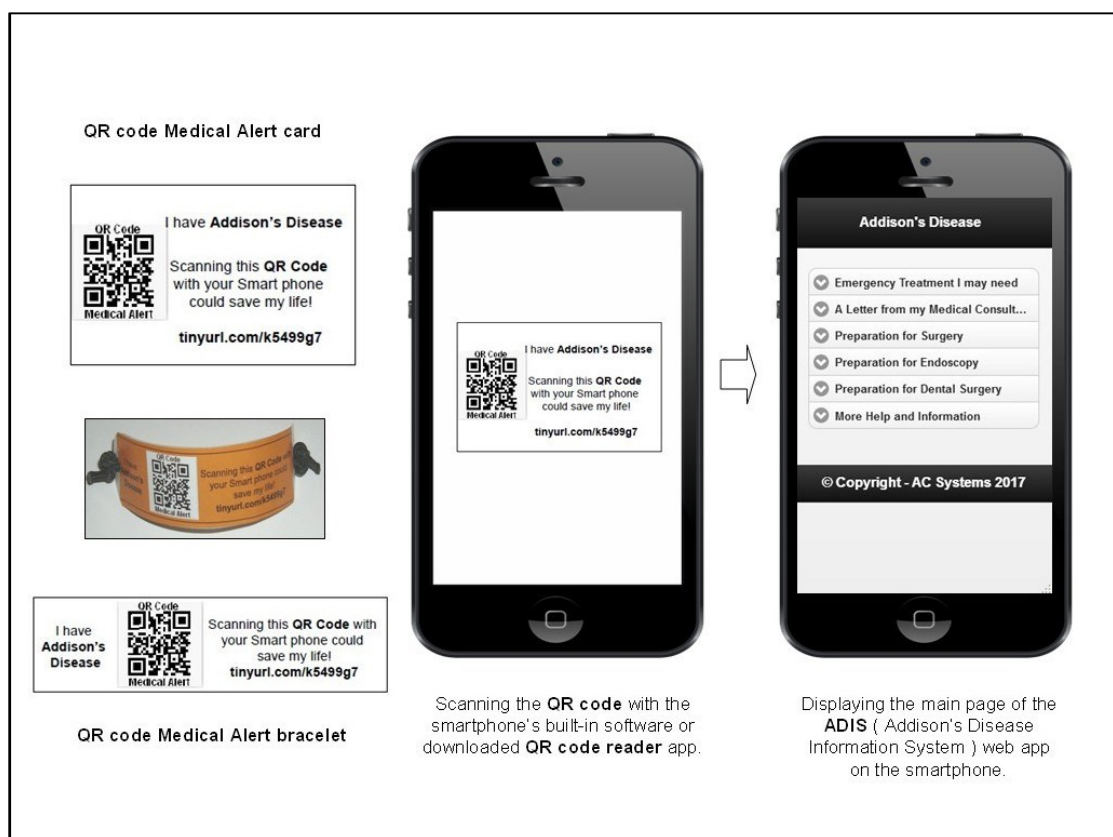

Figure 2 Scanning the QR code-linked Addison's disease bracelet / card with smartphone.

scanning software is built into the phone [5,6] and the Google Chrome browser of the Android phone respectively.[6,7] Users of older smart devices can download free QR code scanner apps such as "QR Code Reader" for the iPhone,[8,9] and "QR Droid"[9] for the Android phone from online web vendors

(Table 1). The ADIS web page can also be loaded by typing the app's web address in the web browser navigation window of the smart device, laptop or desktop PC.
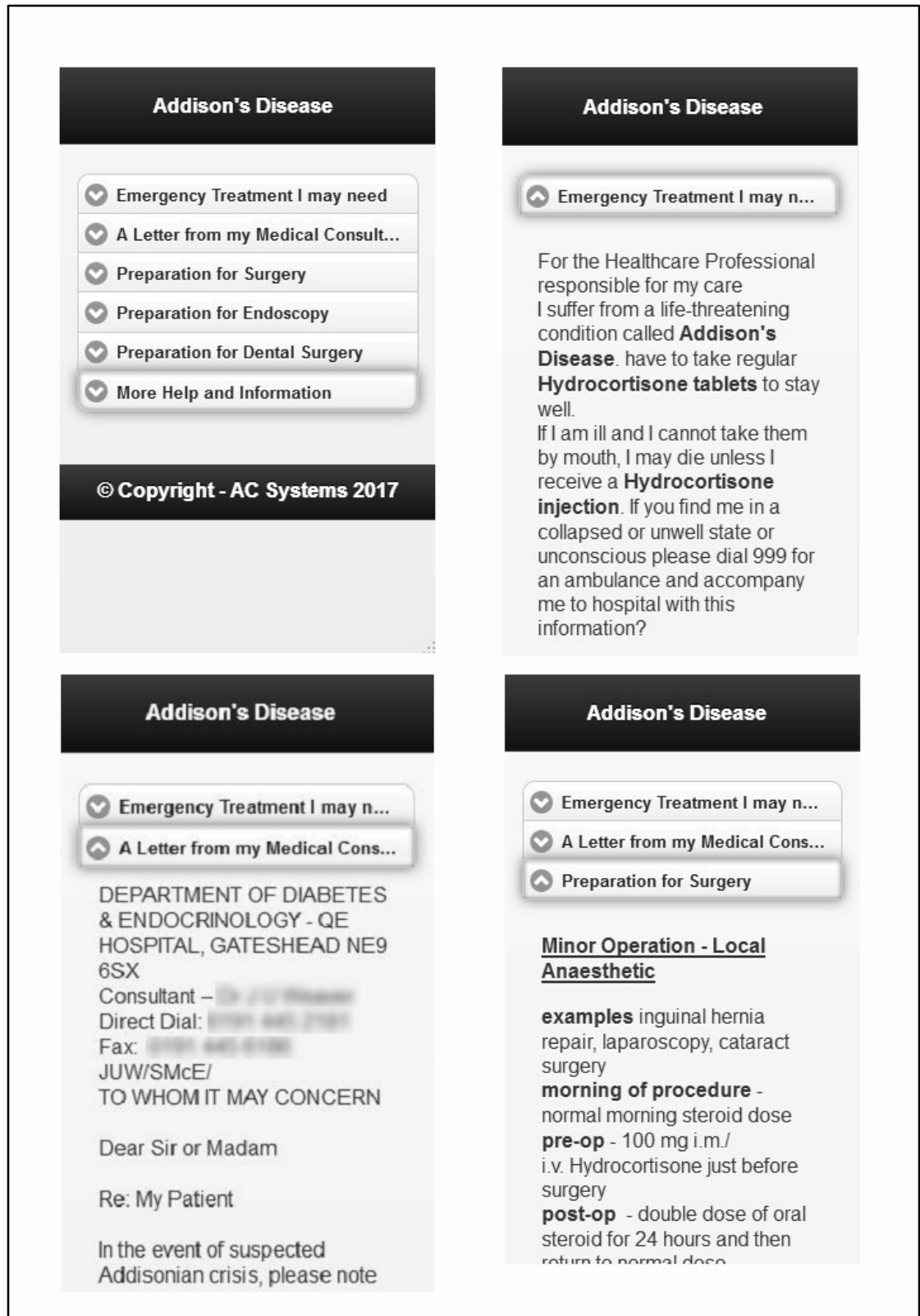
Addison's Disease

- Emergency Treatment I may need
- A Letter from my Medical Consult...
- Preparation for Surgery
- Preparation for Endoscopy
- Preparation for Dental Surgery
- More Help and Information

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Addison's Disease

- Emergency Treatment I may n...

For the Healthcare Professional responsible for my care
I suffer from a life-threatening condition called **Addison's Disease**. have to take regular **Hydrocortisone tablets** to stay well.
If I am ill and I cannot take them by mouth, I may die unless I receive a **Hydrocortisone injection**. If you find me in a collapsed or unwell state or unconscious please dial 999 for an ambulance and accompany me to hospital with this information?

Addison's Disease

- Emergency Treatment I may n...
- A Letter from my Medical Cons...

DEPARTMENT OF DIABETES & ENDOCRINOLOGY - QE HOSPITAL, GATESHEAD NE9 6SX
Consultant –
Direct Dial:
Fax:
JUW/SMcE/
TO WHOM IT MAY CONCERN

Dear Sir or Madam

Re: My Patient

In the event of suspected Addisonian crisis, please note

Addison's Disease

- Emergency Treatment I may n...
- A Letter from my Medical Cons...
- Preparation for Surgery

Minor Operation - Local Anaesthetic

examples inguinal hernia repair, laparoscopy, cataract surgery
morning of procedure - normal morning steroid dose
pre-op - 100 mg i.m./ i.v. Hydrocortisone just before surgery
post-op - double dose of oral steroid for 24 hours and then return to normal dose

Figure 3 The ADIS (Addison's Disease Information System) main menu and some of the information content of the first three menu items.
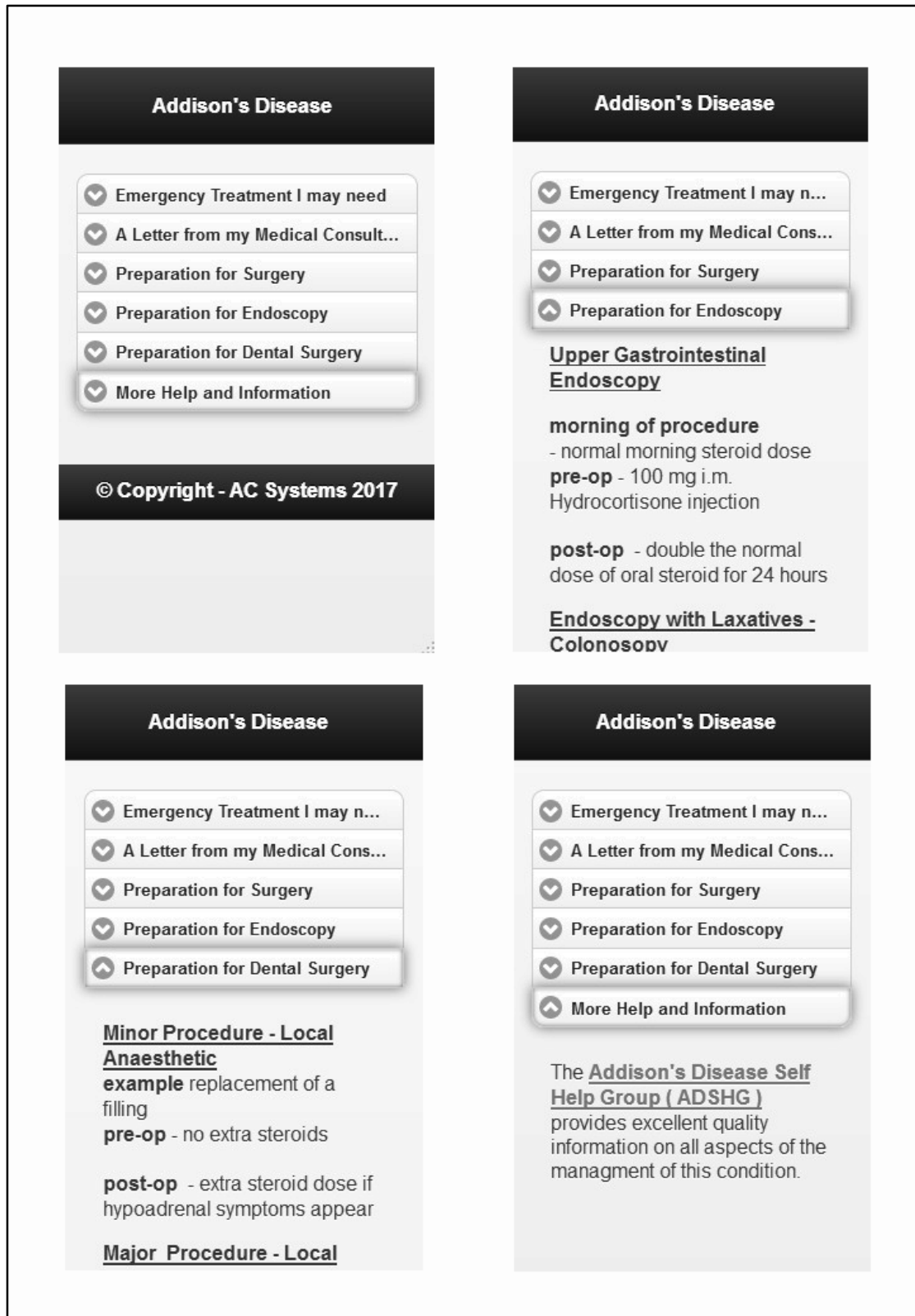
Figure 4 The ADIS (Addison's Disease Information System) main menu and some of the information content of the last three menu items.

Table 1 The range of smartphones available in the UK and the location of free downloadable QR code reader apps.

Smartphone Operating System	Smartphone Popularity	Location of free QR code Reader App	Example QR Reader App
Android	81.7%	Google Play Store	"QRdroid"
Apple iPhone (iOS)	17.9%	Apple App Store	"QR Reader for iPhone"
Windows phone	0.3%	Microsoft Store	"QR Code Reader"
Ubuntu (Linux) Phone	0.1%	Ubuntu Apps Directory	"Qreator"

According to 2016 UK sales figures, the Android phone is the most popular smartphone followed by the iPhone, Windows phone and Ubuntu phone.[10] Examples of QR code reader software and download location for all the phone types are summarised in Table 1.

Part 4 – Addison's Disease Information System (ADIS) Technical Design

The ADIS comprises a web app consisting of a single drop-down menu embedded in a page of HTML (HyperText Markup Language) Version 5 code incorporating a Javascript framework called Jquery Mobile.[11] (Figures 3 and 4) Javascript is a server and client-side programming language for enhancing web pages and its functionality can be extended by linking it to freeware libraries such as Jquery Mobile which are located on web servers, known as CDNs (Content Delivery Networks), anywhere in the world. Jquery Mobile also supports responsive design – the graphic appearance of the ADIS

looks the same on any smart device (phone or tablet) as well as the PC laptop

or desktop screen using the same coding so one does not have to write

separate code for each device to achieve the same screen appearance.[12]
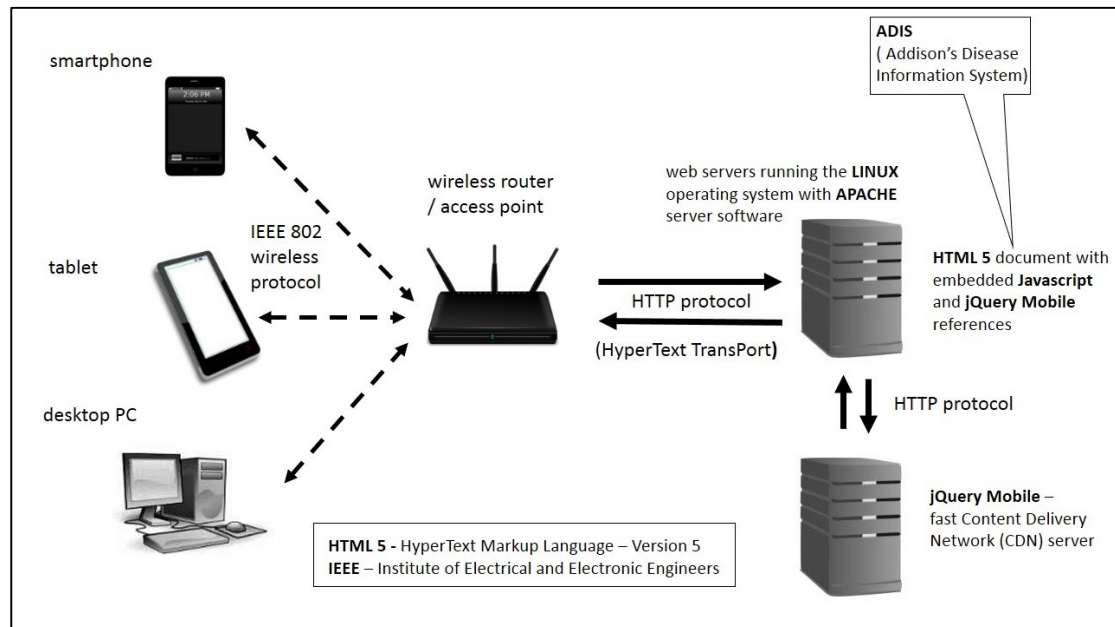

Figure 5 An illustration of how wireless smart devices connect to the ADIS
(identified by the bubble text in the top right-hand corner of the
figure).

Figure 5 illustrates how the ADIS works. It uses a "web" app as opposed to a

"native" app. There are distinct differences between the two types which are

summarised in Table 2.

Table 2 The functional differences between a "web" and "native" app.

features	"web" app	"native" app
location of app code	**web** - runs directly from web server	**device** - downloaded from web server, runs on the device
speed of app code	app may run slowly depending on the speed of the web connection	app runs quickly on the device
ease of update	**yes** – app code will always be up-to-date on the web server	**no** – app update needs downloading from the web server
needs a web connection	**yes**	**no –** unless app needs a web connection to run
flexibility	app can be saved on the device and run from it (not Iphone)	app stored on and run from the device

Part 5 – Information Content, Provenance and Security of the ADIS

The information content of our ADIS is mainly derived from the high quality educational material available to patients with Addison's disease on the Addison's Disease Self-Help Group[13] and its Clinical Advisory Panel[14] and has been checked and approved by J.W., our experienced NHS Consultant Endocrinologist. Some of its content is displayed in Figures 3 and 4. The web app does not contain any personal data except the NHS contact details of J.W for her patients with Addison's disease to access for which her consent was obtained. The ADIS web app is hidden from web search engines such as

Google by the use of special codes in the HTML document.

References

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