Health 4.0 in the i2i Era

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ABSTRACT

The acceptance of iPhones, iPads, and iPods in medical environments, as well as the FDA approval of several diagnostic-prognostic-distant care-management applications, demonstrates the modern medicine trend to introduce mobile applications initiating the i2i era. Furthermore, Cloud and Internet applications ranging from non-quality control up to intelligent-quality-control data base management anytime, anywhere, are the basis of what is called Health 4.0. The present editorial listed approved FDA applications and future deployments, including three personal projects in iHealth: blood-pressure monitoring, iAnapath and the i-EEG control in child Attention Deficit Disorder.

Keywords: Health 4.0, i2i, i-EEG, Image Diagnosis, iPad, iPhone, iPod, Telemedicine, Vital Signs

INTRODUCTION

This century MD (medical devices) will be hand-held devices working in a pervasive environment of wireless communications and Cloud-computing. Hardware miniaturization will involve nanotechnology and alternative mechanism to provide power and/or reduce consume. For that reason, the paper brings awareness of what is already in the market and towards where we are moving.

Not only doctor initiatives (iDoctor) to assist patients (iPatients) will provide i2i medical applications, but solid quality care initiatives approved by the FDA will integrate i-devices in a renew Health IT services facing prevention and quality of live.

The paper will consider several subheadings to separate quality control (QC) versus the non-quality control (nQC) applications.

In the QC group we included those healthcare applications that in a short or long run will be integrated in what we called HEALTH 4.0, integrated by four main innovations:

- Applications that fulfill 3 criteria of availability:
  - a) Anytime connections: On the move, indoors and outdoors, day & night.
  - b) Anyplace connection: On the move, outdoors, indoors, at any PC.
  - c) Anything connection: At any PC, H2H (human to human), H2T (human to thing), T2T (thing to thing).
- Applications that include image enhancement & RFID readings to be use for:
  - a) People→by faces recognition and access to relevant information (home,

work, medical, HER, PHR, medical schedule…).

  b) Object→by use and by owner recognition.
  c) Food→by principle content & by diet requirements.
  d) Medication→by principle & by indication-contraindication.

• Application that includes quality controlled Web 3.0 items such as:
  a) HCQ Health Care Quality: ISO 13485-ISO 2700 or security.
  b) 3S: Social-Semantic-Services
  c) Cloud accessing (SAAS, pCloud or personal cloud were the iPhone can be included).

• Applications taking Web 4.0 items such as:
  a) KBL o Knowledge base learning, including literature base learning (LBL), Evidence Based learning (EBL), trial base learning (TBL), Image based learning (IBL) etc…
  b) QBE o Query by example, including query by image (QBI) etc…
  c) CoLD or Cloud of link data with Artificial intelligence.

Examples of the IV.a and IV.b, are our group developments on optical biopsy data base content retrieval from smartphones published elsewhere.

In the group of nQC applications we include mainly the Web 2.0 applications without control o regulation, and particularly iDoctors and iPatients.

Extending the definition of iMedicine, we should include as stated in the definition of the WHO any medical environment at distance with iPhones or any other pervasive and personalized hand held device that provide tele-control, tele-prevention, tele-management, tele-learning etc… in Medicine. In the latter the iLearing application developed inside of the medical students training of pathology, will be the developing show case of our group in the iAnaPat application.

Interesting enough is that since the OS-3, Apple has a specific class of services directly linked to MD that allow to developed applications and synchronize them with the MD through Bluetooth or USB.

Right now there are nearly 1,500 smart phone applications for health care professionals are already available for downloading and the Plug & Play busses the iBUS are arriving to the market (http://catai.net/blog/2011/03/md-bus-vs-ibus/) approved by the FDA transforming the hospital into smart rooms that integrate mobile phones, and not requiring any more connectivity specifications telemetric devices.

IPHONE HEALTH CARE QUALITY APPLICATIONS

The FDA has recently approved several applications controlled with iPhones listed here. Nevertheless it is important to consider that the Verizon version of the iPhone is different from the AT&T version of the iPhones. They are separate devices. Therefore, it will be necessary to test those separately for iPhone FDA applications.

1. iPhone Ultrasound

The first smartphone capable of record and send ultrasound medical images is the MobiUS from Mobisante®, approved in USA by the FDA (Food and Drugs Administration). The price is at the moment 10,000 $, much less than the regular US station (from 20.000 $ – 100.000 $) (Figure 1).
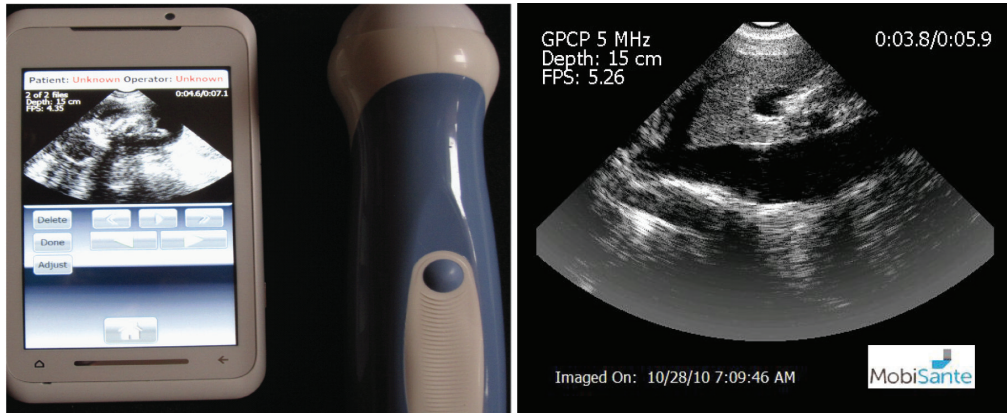
To our understanding too much, considering that the hand-held version of an US, the so-called VSCAN from General Electric cost 6000 Euros (Tous et al., 2011).

There are novel applications of a hand-held ultrasound device in Obstetrics and Gynecology (Troyano Luque et al., in press).

2. iPhone Radiology

A number of companies have DICOM compliant applications that can be installed on the iPhone. As OsiriX (http://www.osirix-viewer.com/MobileOsiriXWorkflow.pdf)

Figure 1. MobiUS. US scanning system with an USB probe connected to a smart phone (http://mobisante.com/Documents/Mobisante%20Product%20Brochure.pdf)

The DICOM visor of OsiriX had two versions.

I) Osirix-X

The free open-source software (FOSS), is not certified as a commercial medical device for primary diagnostic imaging, and therefore, OsiriX is not FDA/CE-1 certified.

In USA and Europe, you can only use OsiriX as a reviewing, research or teaching software, not for primary diagnostic, used in clinical workflow and/or for patient care.

For these reasons, several commercial versions of OsiriX certified as medical devices for primary diagnostic imaging exists.

II) OsirixMD

Distributed also by OsiriX is the FDA-Cleared version called OsiriX MD. Therefore Osirix-MD can be used in the iPhone for primary diagnostic, in clinical workflow and/or for patient care.

This is the one integrated in many of the systems that allow handling medical images through mobile phones such as the View1 from Global Care Quest en cooperation con Karl Storz. Major players such as GE Healthcare are also getting involved.

III) MobileMIM

The display performance of mobile devices can experience significant variations in luminance levels even between mobile devices of the same model. The Mobile MIM application includes sufficient labeling and safety features to mitigate the risk of poor image display due to improper screen luminance or lighting conditions. The device includes an interactive contrast test in which a small part of the screen is a slightly different shade than the rest of the screen. If the physician can identify and tap this portion of the screen, then the lighting conditions are not interfering with the physician's ability to discern subtle differences in contrast. In addition, a safety guide is included within the application. to commercially available MIMvista's Mobile MIM with the commitment to get the FDA clearance (http://www.mimvista.com/iphone).

IV) Telestroke ResolutionMD

The vascular neurologist remotely interacts with patients, their families, and emergency department staff and is able to observe diagnostic brain imaging using ResolutionMD™ (http://www.calgaryscientific.com/), cardiac monitors, and patients' performance on a structured neurological examination (the National Institutes of Health Stroke Scale). This is the Mayo Clinic

Stroke Telemedicine for Arizona Rural Residents (STARR) Network. Ubiquitous access to 2D, 3D, and MIP/MPR viewing of CT and MR images and delivery of high-quality, interactive video. Support for both Wi-Fi and cellular data networks (3G & 4G) allows for cost-effective delivery of world-class care to even the most remote patient populations.

The ResolutionMD image viewing solution is FDA, Health Canada and CE Mark approved. The same server software that provides ResolutionMD Web with browser-based advanced visualization functionality provides images directly to mobile devices in ResolutionMD Mobile.

The details of the ResolutionMD conformance statement can be studied in http://www.calgaryscientific.com/assets/files/common/ResolutionMD_2.5_DICOM_Conformance_Statement.pdf.

3. iPhone Vital Signs

AirStrip Technologies provide all type of Applications on mobile phones including Android OS for Obstetrics that include the cardiac analysis of the fetus, together with Vital sign monitoring at distance connecting with hospital monitoring devices to view and control on line the patients (Figure 2) (http://catai.net/blog/2010/11/iphone-con-signos-vitales/).

i. iPhone Diabetes Control

There are many diabetes management control systems at distance approved by the FDA (http://catai.net/blog/2010/09/medidor-de-glucosa-de-i-phone/).

The iBGStar device developed by Sanofi-Aventis in cooperation with AgaMatrix is a new glucose device detector linked to an iPhone or to an iPod touch that not only showed the values of glucemia in an immediate manner, but store measurements and allow sending them at distance for control purposes.

The BGStar® and iBGStar™ use Dynamic Electrochemistry® to assure the exact measure-

ments as well as its DSS (Decision Support System) (Figure 3).

ii. iPhone EHR

I) PrimeMobile

Greenway medical technologies, Inc., facilitate an EHR-Electronic Health Record (http://catai.net/blog/2010/07/i-phone-ehr/) integrated in a unique data base handled by the PrimeSuite® solutions. The Prime suite is certified since 2008 for connectivity by CCHIT and is available for iPhone through its PrimerMobile.

II) GE-EHR

The EHR of GE- General Electric for iPhone obtained the CCHIT certification in 2011.

iii. iPhone Auscultation

I) TeleSteth

The TeleSteth On line consultation by Zargis (http://zargis.com/index-2_3.php) is linked to a Libman Stethoscope, not to a mobile iPhone and it is HIPPA compliant.

Together with the StethAssist® heart and lung sounds visualization software, allow the on line diagnosis and teleconsultation. TeleSteth permits patient sounds to be remotely evaluated in real-time (synchronous) or store-and-forward (asynchronous) mode.

II) RNK-PCP-1

RNK Products, in February 2011 announced that the FDA has approved its newest telephonic stethoscope. The PCP-1 Stethoscope, combines state-of-the-art sensor technology (patents pending) with PC based communications software to provide an economical telephonic stethoscope. It includes Streaming Stethoscope Over IP (sSOIP) software to securely transport the stethoscope signal from a patient at one site over the Internet to a clinician at another site for an auscultation exam.

Figure 2. AirStrip vital sign control on iPhones (http://www.airstriptech.com/)

iv. iPhone Blood Pressure Monitor

Two systems are now in the market, both are based in the usual blood pressure (BP) cuff and not in the wrist sensors (Figure 4) (http://catai. net/blog/2011/01/tensiometros-para-iphone-ipad-y-ipod/).

I) Withings

Is a cuff connected with the iPhone (Figure 4A). The application of Withings is common with the Weight scale, and allows creating in the web site several users, listed in the device.

The blood pressure system is synchronized with Health Vault ® and Google Health ® in a Health 2.0 environment. The quality control specifications are: 0-285mmHg with an accuracy of ±3 mmHg or 2% of reading. Pulse: 40-180 beats per minute with an accuracy of 5% of reading.

The company provide a free, private and secure online account (requires an up-to-date browser and an Internet connection), free app for iPhone, iPad and iPod touch, together with access to health coaching online services and secured data sharing with patients´ physicians.

The company does not show a specific interest to get FDA approval, but the system has already got CE-Label following the 93/42/EEC MD directive: • IEC60601-1: 2005 + CORR. 1 (2006) + CORR. 2 (2007); EN60601-1: 2006; ANSI/AAMI ES60601-1: 2005: Medical Electrical Equipment - Part 1: General requirement for basic safety and essential performance. • EN1060-1: 1995 with Amendment A2: 2009: Non-invasive sphygmomanometer, Part 1: General requirements. • EN1060-3: 1997 with Amendment A2: 2009: Non-invasive sphygmomanometers, Part 3: Supplementary requirements for electro-mechanical blood pressure measuring systems. • EN55011: 2007 + A2: 2007; EN60601-1-2: 2007; FCC 47 CFR PART 18: Electromagnetic Compatibility. • ANSI/AAMI SP10:2002 Manual, electronic, or automated sphygmomanometers; safety and performance requirements.

II) iHealth

iHealth app is free in the Apple store and the blood pressure arm cuff and corresponding docking station is available at iHealth99.com (Figure 4B). iHealth system did not showed FDA approval but the iHealth Labs' parent company, Andon from China that has FDA, CE, and ESH (Euro Society for Hypertension) approvals (http://www.accessdata.fda.gov/

Figure 3. iPhone with the iBGStar device (http://ibgstar.com/web/ibgstar)

cdrh_docs/pdf10/K102939.pdf). They are using an approved non-invasive blood pressure (NIBP) device like the SunTech module. Technical specifications include: 0-295 mmHg with ±3mmHg accuracy; Pulse rate 40-180beats/min, accuracy: ±5%. Oscillometric method. IEO 60601-1, Medical Electrical Equipment - Part 1: General Requirements for Safety, 1988; Amendment 1, 1991-11, Amendment 2, 1995. * UL 60601-1, Medical Electrical Equipment - Part 1: General Requirements for Safety, 2003. *IEC 60601-1-1, Medical Electrical Equipment - Part 1: General Requirements for Safety - 1. Collateral standard: Safety Requirements for Medical Electrical Systems, 2000. * EN 60601-1-2, Medical Electrical Equip-ment - Part 1-2: General Requirements for Safety - Collateral standard: Electromagnetic Compatibility - Requirements and Tests, 2007. * AAMI SP1O0:2002, Manual, electronic or automated sphygmomanometers. *AAMI / ANSI *SP1O:2002/A1:2003* --, Amendment 1 to ANSI/AAMI SP1O0:2002 Manual, electronic, or automated sphygmomanometers.* AAMI / ANSI SP1O:2002/A2:2006-, Amendment 2 to ANSI/AAMI SP1O0:2002 Manual, electronic, or automated sphygmomanometers.

A survey was carried out among the 20 students participating in the winter course of the CATAI 2011. They evaluated in the workshop area two iPhone NIBP systems (Withings and iHealth-BP3) on six aspects: Global evaluation,

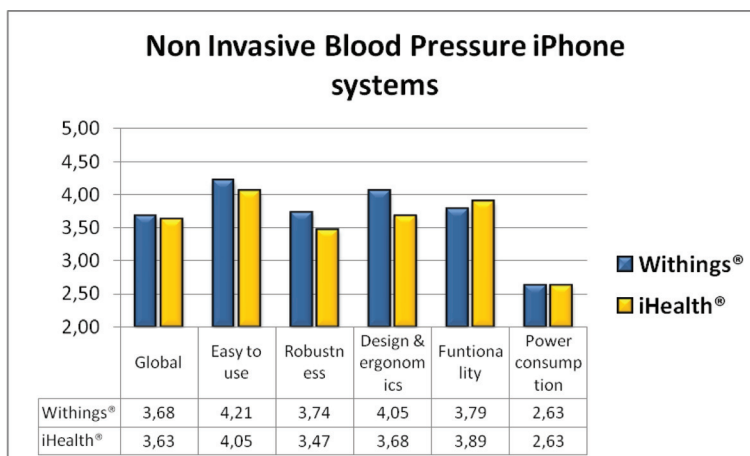*Figure 4. A. iPhone BP- Withings system; B. iHealth blood pressure cuff*

A

B

Figure 5. Opinion of medical students of the iPhone-BP systems

Easy to use, Robustness, Design and ergonomics, functionality and power consumption. Medical students should grade each item from 0 (bad opinion) to 5 (best opinion). The weighted answers can be studied in Figure 5.

The design and ergonomics was considered better (Student t-Test = 3.24; p<0.005; 19 degrees freedom-df) when the cuff was directly connected to the iPhone, being evaluated as more robust (Student t-Test = 2.53; p<0.02; 19-df).

IPHONE NON HEALTH CARE QUALITY APPLICATIONS.

Among the good iPhone applications that still have not yet passed CE or FDA approval we include:

1. iPhone Auscultation

I) iStethoscope: http://catai.net/blog/2010/09/i-estetoscopio/

It takes the heart sound through the microphone of the i-Phone. This does not work in iPod-Touch because the microphone is located in the same location of the audio entrance. Nevertheless it can be used with the earphones of the i-Phone.

2. iPhone EKG

The majority of EKG devices are compatible with ANT+ heart strip, that allow capturing and introducing the date into mobile phones. http://e-whizz.com.au/ANT-Soft-heart-Rate-Belt-for-iPhone/prod_1095.html . With an interface for the iPhone http://e-whizz.com.au/HRM-iPhone/prod_1094.html

I) AliveCor

AliveCor (http://catai.net/blog/2011/01/ecg-para-iphone-4/) is a new application for iPhone, to obtain the ECG in real time placing a metal cap on the back of the iPhone containing two electrodes. The cap records the electric potential: for example of V1 is taken holding the iPhone and placing two fingers from right and left hand in the back electrodes. The rest is obtained placing the iPhone over the chest direction on the skin (Figure 6).

Although is not jet FDA approved, it looks very simple and very useful to obtained the ECG and send it at distance. The FDA is interested in analyzing more collection data during Phase IV follow up with drugs for some atrial defibrillation patients.

Figure 6. AliveCor. Taken from Dolan 2011

i. iPhone Osirix

As explained in III-2 section, the Open software from the DICOM viewer Osirix is not quality controlled, and therefore cannot be used for diagnostic purposes.

ii. iPhone Pathology

I) Intellipath
http://catai.net/blog/2010/06/anatomia-pato-logica-en-iphone/

The systems have also been presented in our Winter Course of iPhone and Telemedicine, and tested by the students attending it. In fact they tested with the new iPAD appearing on the marked and for that reason were very much publicize everywhere (http://catai.net/blog/2011/03/practicas-en-el-winter-course/).

II) Anytime Anywhere-Nikon
With Anytime Anywhere (http://www.rmtcentral.com/) Nikon achieve an on-line vision of microscopic images for teleconsultation and display in an iPad.

III) Olympus
The most important issue of the latest VS800 scan microscope is the optics with very sharp, clear, bright images of superb quality. It has a high numerical aperture and extraordinary flatness from edge to edge. Because virtual slide images typically comprise multiple fields that are aligned with one another, capturing the best edge-to-edge quality of each image helps ensure both optimal scanning speed and more accurate alignment. Incidentally those images can be seen in an iPad, since once digitized can be shared immediately.

IV) IXAM®
Is a zero-foot printing forensic device with warranties, but that do not mention the FDA or CE approval (http://www.ixam-forensics.com/output.asp).

iii. iPhone OR (Operating Room)

http://catai.net/blog/2010/12/los-ipads-ganan-el-quirofano/

I) iPhone Anesthesia
iPad had been progressively introduced in operating rooms, not only to handle EHR but to share and see images, in the latter with Osirix-MD, but also had been used for managing anesthesia. The McSleep, based on Skype and iPad, can be perfectly well be implemented in an i-Phone through the cloud (http://catai.net/blog/2010/09/tele-anestesia/).

II) iPod - Dash
Computer Assisted Joint Replacement with an iPOD touch. http://catai.net/blog/2011/04/ipod-touch-para-cirugia-ortopedica/ It uses a navigation systems iPOD-iTIT waiting FDA approval.

iv. iPhone 4M Microscopes

http://catai.net/blog/2009/06/microscopios-4m-y-la-telepatologia/

The 4M-microscopes (Multimodal Miniature Microscopes) based on very small lenses allow to build highly effective microscopes using iPhones as already stated (Ferrer-Roca & Marcano, 2010; Ferrer-Roca, 2010), in the same way dermatoscopes were built (see Section I).

One of such systems in the Brando (Figure 7) (http://www.mobile.brando.com/iphone-4-microscope-with-white-2-led-and-note-detector-led_p05863c0921d092.html) of about 18 $ that allow 60x augments.

v. iPhone and Weight Control

http://catai.net/blog/2009/09/bascula-wifi-para-iphone/

See Section III-7 Withings.

vi. iPhone Dermatology

That teledermatology with an iPhone is scientific evidence since 2009 with the publication of Holemn and Backe (2009) in the *British Medical Journal* (http://catai.net/blog/2009/07/tm-diagnostica-12-mpx-en-telefonia-movil/).

I) DermScope
The DermScope (Huynh, 2011) was recently added to the iTunes medical apps directory (9.99 $). It is an external iPhone case that has a dermatoscope embedded into the case. Essentially, you slip your iPhone into the case and it transforms your iphone into a magnifying glass for moles and other skin lesions. You can capture images, store them, organize them by patient, and email images directly from the application.

Still it is unknown how much the hardware will cost. But it would be a bad idea to price it that high in the US considering that the other iPhone medical peripherals are only around $100 dollars (Figure 8).

II) Handyscope
An international iPhone dermatoscope retailing for $1500 dollars (http://www.handyscope.net/)

Handyscope from FotoFinder is a smartphone accessory that transform your iPhone into a digital dermoscope 20x, for monitoring skin condition.

See also the dermatology training software in Section IV.

vii. iPhone Teleophtalmology

With available applications can be utilized as a near vision card, Amsler grid, color plates, OKN drum, and pupil gauge in non office emergency and consultation settings. These devices can also be used in the pediatric exam with novel optotypes & attention getting pictures/videos that can be used to facilitate fixation in a child.

It is conceivable that in the future Pachymetry, and A & B scans could be performed with a smartphone.

I) EyeRoute® Mobile
Topcon has introduced EyeRoute® Mobile, the first iPhone® application for ophthalmic image management (http://www.topconmedical.com/products/eyeroutemobile.htm).

II) i2i Teleophtalmology
http://catai.net/blog/2010/06/en-india-el-hospital-mas-eficiente-del-mundo/http://i2itelesolutions.com/teleopth.html

III) Near-Eye Tool
For Refractive Assessment (NETRA) on which the patient tests their eyesight by staring into a small, cheap plastic lens which fits over the iPhone's screen. Instead of just estimating which of two views is less blurry the user adjusts their own display to make a scene come into.

IV) Crystalens iClear iPhone
A free iPhone application from Bausch + Lomb to test a patient's visual acuity and colour vision, enable them to learn more about cataracts and Crystalens and to find a suitable surgeon.

viii. iPhone Cervix Cancer Screening

They take with the iPhone the images from Visual inspection with application of 4% acetic

Figure 7. iPhone adapter 60xwith a LED illumination (http://www.mobile.brando.com)

acid (VIA) for distant consultation (http://catai. net/blog/2010/07/smartphone-y-screeening-cancer-cervix/).

ix. iPhone Neurofeedback

http://catai.net/blog/2010/10/plx-xwave/

Neurosky® interface similar to a handset of brain interaction used in neuro feed-back. They specifically say that this is not designed for medical use, but in fact they are testing it in Attention Deficit-TDAH. The warning is related with the fact that still is not approved by the FDA.

It consists of a stainless alloy sensor monitors neural signals, inputting them into our ThinkGear ASIC chip, which processes the signal (Figure 9). Noise coming from ambient environment, muscle movement, chewing, etc. are digitally filtered out and eliminated. Raw brain signals are amplified and processed by algorithms—delivering concise input to the device with which the user is interfacing. Algorithms come from both NeuroSky as well as

Figure 8. DermScope, cost 10 $

research institutions and universities, and are grounded in decades of clinical research. One of those Universities is La Laguna University with his project i-EEG, experimenting with the software development package to detect the degree of child Attention Deficit together with the department of childhood psychiatry.

The system consists in a portable EEG brainwave headset (Figure 9) called Mindwave or Xwave and a free on line Developer Tools, Visualizer 2.0- NeuroBoy- MyndPlay. The system has 6dBm RF max power at 250kbit/s RF data rate, 10m RF range and 5% packet loss of bytes via wireless- UART Baudrate: 57,600 Baud - 1mV pk-pk EEG maximum signal input range with 3Hz – 100Hz hardware filter range - 12 bits ADC resultion, 512Hz sampling rate and 1Hz eSense calculation rate. The measures build in include: Neuroscience defined EEG power spectrum (Alpha, Beta, etc.)- eSense meter for Attention - eSense meter for Meditation- eSense Blink Detection- On-head detection.

x. iPhone iPrescription

I) iPrescribe

Billed as the "the first and only standalone electronic prescription application for smart phones", iPrescribe allows for easy electronic prescription using an iPhone app.

The app has 3,500 FDA approved medications including available dosages. Once a prescription is entered, the app offers you to save it as a favourite, saving steps the next time the drug is prescribed.

II) DrCrono

One of the widest applications of the iTunes-iPhone store for medicine that include an HER (electronic health record) and a EMR (electronic medical record) also provide i-prescription.

xi. iPhone iLearning

This includes all the iPhone applications for learning medicine, including our own applications in i-Anapat, developed by us.

I) iPhone Harrison

The Harrison's manual of Medicine is available for iPhone paying for it.

II) iPhone Science Direct

Science Direct can be consulted trugh the iPhone, obviously after registration (http://catai.net/blog/2010/11/ciencia-en-iphone/).

III) iPhone Vademecum

The Vademecum is a pay for it application very useful since it include al medications appearing in the Vademecum with composition, indications and doses.

IV) iPhone Surgery Books And Other Books

Medical Books of all type can be found for iPhone such as: surgery, ophthalmology, dermatology etc.

V) iPhone iAnapat

A new iPhone app is being developed at the moment by CATAI. It is dealing with an online exam for training in Pathology (Anatomia Patologica in Spanish) in Medicine in University of La Laguna. This application helps students to test practical exams with images.

The app was following the zero-foot printing technology using SeadragonAjax, Deep-Zoom, Silverlight and Seadragon Mobile (http://catai.net/blog/2011/05/iphone-no-image-data/) (Figure 10).

A future connection with the app iPhone Moodle is being considered for this app to improve the teaching possibilities for iPhone apps in the ULL (University of La Laguna).

VI) iPhone Moodle

The Moodle for iPhone had been used in Peru to support continuous training of health workers in 20 clinics spread all over and far from cities (http://catai.net/blog/2010/07/moodle-iphone-en-sanidad/).

VII) iPhone Dermatology- Visual-DX

A list of images to train in Dermatology (http://catai.net/blog/2010/11/iphone-y-dss/).

Figure 9. NeuroSky e-sense dry sensor with Xwave

VIII) iPhone Ophtalmology

The University of Missouri Kansas City has developed the "Eye Handbook" (http://www.eyehandbook.com/). This is a free application developed for the iPhone.

Ophthalmic Knowledge Assessment Program (OKAP) study and Ophthalmologic recertification preparation

IPHONE-WEB 2.0.

This includes the totally uncontrolled applications that provide iDoctor and iPatients.

1) iPhone iDoctor

I) Cloud Nine Development

On which an iDoctor can establish his consultation of iMedicine (http://www.cloudninedevelopment.com/).

2) iPhone iPatient

Similar to an i-Doctor, patients can create its own collectivity of patients to talk, interact and search common solutions.

3) iPhone Clinical Records

I) MedMobile

It is an EMR, with all functionalities. The i-phone Health Passport created by Easy Med-Mobile (http://catai.net/blog/2010/10/i-phone-health-passport/) allow in any place in the world allow the doctor to access to a patient clinical record and interact with the patient sending SMS reminders or any type of information to access other doctor or drug-stores.

II) MHealth Clinical Summary

It is an example of PHR or personal health records (https://store.cerner.com/items/82; https://login.cerner.com).

Although not FDA approved, we have to consider that the Cerner systems are in the Health IT the ones that facilitate connectivity

Figure 10. iAnapat from the CATAI®

with their plug & play Careware-iBus mentioned in the introduction, the first MD-bus or iBus on the market to our knowledge, facilitating the SmartRoom a plug and play hospital room (Figure 11) (https://store.cerner.com/hospi-

Figure 11. Smart-Room from CERNER (http://www.cerner.com/)

tals_and_health_systems/acute_care_elec-tronic_medical_record).

Furthermore the Cerner applications had been introduced in the Spanish Health-care Furthermore the Cerner applications had been introduced in the Spanish Health-care delivery systems particularly in Valencia as well as in Germany with the Asklepios hospitals. In fact Denia-hospital had received in 2009 the prize to the best international project by CERNER Millennium (http://networkedblogs.com/fto1i). The application is active in 22 countries in 5 continents.

4) iPhone iPatientTouch

http://catai.net/blog/2011/02/patienttouch-iphone-app/

It is developed by PatientSafe Solutions and its main goal is to reduce medical errors. With that App, medical personnel can manage and get information from a variety of work processes or work flows through the iPhone. Medical teams can communicate one each other and with other teams on duty, can receive warnings and cruzial information of immedi-ate diagnosis. At the moment this App is only available at the USA-AppStore and we could not test it yet.

CONCLUSION

The report called "Networks, Digital Health-care and the Transformation of US Healthcare, 2006-2011″ specify that in USA the HIT (Health Information Technology) related industry will increase 8.4% in 5 years evolving from $7.5 billons in 2008 to $11.3 billons in 2013. The health care expenditure will go from 6% of the IGP (Interior Growth product) to 16-18%. This means that in the very near future applications with sufficient QC will appear in all mobile devices including iPhones, fact already in place since the number of iPhone applications approved by the FDA or having CE are increas-ing per minutes.

Next generation of Health Care will be no doubt the i2i & Health 4.0.

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