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The Meaning of Information Technology (IT) Mobile Devices to Me, the Infectious Disease Physician

Jin-Hong Yoo

Division of Infectious Diseases, Department of Internal Medicine, The Catholic University of Korea College of Medicine, Seoul, Korea

The devolopment of mobile devices such as smartphone or tablet has revolutionized our quality and way of life. As a specialist of infectious diseases, various aspects of information technology on our professional fields were reviewed and lots of useful medical applications were also presented in this review.

Key Words: Smartphone, Cloud, Medical applications, Apps, Tablet, Information technonolgy, IT

Now I have a smartphone and a tablet computer (iPad, actually) as well as two desktops - the old friends of mine (one is at home, the other at my hospital). Since I bought these mobile information technology (IT) devices in 2011, I have seldom used printer, universal serial bus (USB), or compact disc (CD) for the data manipulation. The mobile devices work altogether with my two desktops like one machine, that is, they synchronize. How can it be possible? - Cloud service has made it.

Changes we had not imagined just two years ago are now facing us as reality.

Since the 80s with the introduction of the personal computer (PC), I think the desire of users was mainly in two areas: networking with other users, and portability. The former was achieved with the Internet, and the latter passed through the period of laptop computers and palmtops to be recently realized as smartphones and tablet PCs. These two areas - networking and mobile devices - have combined to bring enormous innovations in the quality and way of life at present.

This revolution is not only for personal hobbies or amusement, but it is an important issue, especially in terms of how well it is utilized for our own professional fields [1-3].

The purpose of this review is to discuss the proper usage of IT devices from the viewpoint of an infectious disease (ID) physician.

The brief history of mobile IT devices

The first smartphone was produced in 1992, but it took 10 years before it could properly perform the functions of a mobile PC [1]. The Blackberry was launched in 2002, Windows Mobile in 2006, and the first-generation iPhone was launched in 2007. In Korea, the iPhone and Android phones were intro-
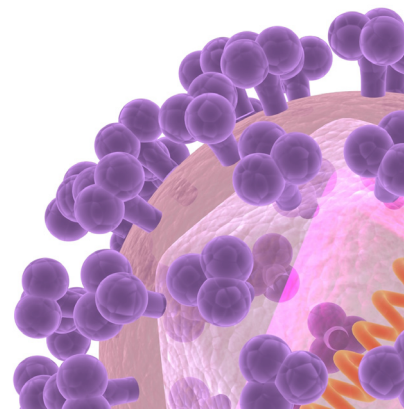
Figure 1. Life with information technology (IT) device and cloud.

Figure 2. Synchronized data manipulation via cloud service (Dropbox).

Figure 3. An example of ebook reader (Goodreader®) of author itself. Anyone can register their favorite Cloud server and either download or upload articles.

duced in 2009, starting the smartphone generation.

In 2010, the iPad was launched, which activated the tablet PC market; the Galaxy tablet and others were also successively launched, and mobile IT devices were further universalized. These devices combine with clouding and various applications (apps) to become very useful.

The meaning of the IT device to an ID physician - To produce more or to consume?

When a smartphone or tablet PC comes into one's possession, the first concern will be "Where will I use this?" The bottom line is as follows: we have to select whether the purpose of the device in our hands will be for 'production' or 'consumption'.

We are familiar with the use of the PC; therefore, in principle we pursue 'production', but these IT devices are somewhat uncomfortable for 'production' purposes due to problems such as the lack of a keyboard or their small size.

However, from the perspective of Apple, the smartphone (iPhone) and tablet PC (iPad) are primarily made for the purpose of 'consumption'. As far as this goes, 'production' is the responsibility of a PC. However, this is not an absolute rule. For example, Samsung, the self-proclaimed rival of Apple, has 'creativity' as the motto for its Android phone (the Galaxy Note). For this reason, they brought out the stylus pen and are now emphasizing that 'creation' is achieved by drawing and working with this pen. However, despite the argument that using a pen is 'production', there are opposing views stating that it signifies a type of 'regression' of the IT device interface.

Also, if the desktop is used as the center of production and IT devices are used as means for gathering resources for production, then it has the purpose of 'production'.
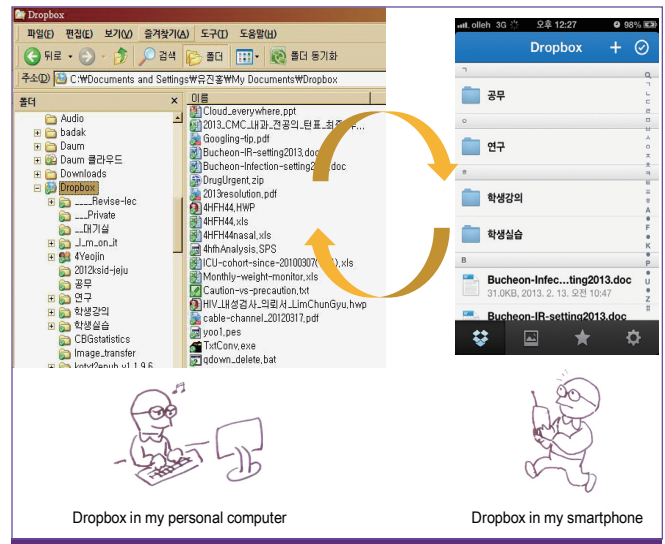
In an analogy, the PC is the aircraft carrier and the smartphone or iPad roam the surrounding areas and collect materials for the carrier. The medium for the process of using the gathered materials for production is Cloud technology (Fig. 1).

In conclusion, the primary purpose of an IT device for ID physicians is 'preparation for production.'

Integrative usage of eBook Reader and Cloud service

The first step in this case is to install and use an app with the
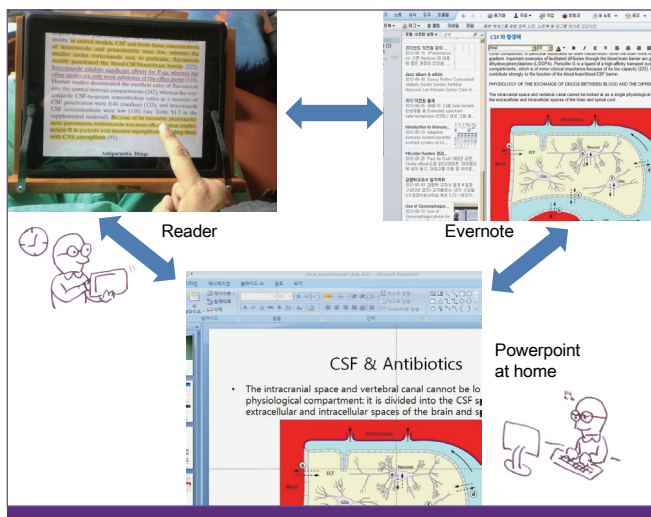
Figure 4. Synchronization of three different software in three different devices via cloud service.

function of an eBook reader. These reader apps do not stop at simply viewing PDF files but make it possible to underline, highlight, or annotate text. Another small advantage is that the font can be enlarged, making it beneficial for old aged readers. Popular reading apps are GoodReader and iAnnotate.

Also, the concept of 'synchronizing' the IT device and the PC is very important. To do this, a Cloud service or apps are utilized. As a Cloud service, Dropbox is most popular, while SkyDrive connects with Windows 8 and Google provides GDrive. In Korea, Naver nDrive, Daum Cloud, uCloud, and others are in service.

For example, if Dropbox is installed on my PC and IT device, the data in both devices are synchronized (Fig. 2). This enables me to view and use materials anywhere without any type of media, such as a USB device or CD. Also, folders can be shared with others, so I share a research data folder with my colleagues to establish a group work structure. This Cloud service is available also in nDrive, Daum Cloud, uCloud, Google drive, and SkyDrive.

This can be utilized further when apps supported by these types of Cloud services are used in combination.

For example, GoodReader can be connected to various Cloud services. Using the 'connect to servers' menu, I can register my primary Cloud server; in subsequent connections PDF files to be read can be downloaded into my GoodReader. I can also upload edited PDF files (Fig. 3).

In addition, editors and online clipboards (e.g., Evernote), which can be installed on both a PC and an IT device as a Cloud service, can be used with a connection to the Reader. For example, the important sections of articles in PDF that we read through GoodReader can be accumulated in Evernote

through copying and pasting, and a presentation can easily be prepared with materials and information saved in the Evernote and PowerPoint software installed on the PC (Fig. 4).

Social network service (SNS) and its clinical application

In these days, society has changed from communicating face to face to an era in which communication can be achieved from long distances. This can be utilized not only for personal interrelationships but as a means of official interactions as well. For a physician, it can be utilized for consultations and discussions and exchanges of professional knowledge. In my case, I created a non-disclosed infectious disease forum on Facebook and registered professors of infectious

Me: A 30-year-old man presented with fever after an office dinner held 4 days ago. He showed no improvement after visiting a local clinic. Nothing special was found in his physical examination, yet his spleen was slightly enlarged. Lab opinions were not useful either. An Abdominal CT was performed following Harrison's principles. Upon looking at the CT scan, my first response was "Oh my goodness, I have never seen a case where the ileocecal area, particularly the ileum, was enlarged this greatly!" I am expecting a report from the microorganism department tonight, or tomorrow at the latest, on gram-negative bacilli grown in the blood culture. Since this is an acute course, there is very little possibility that it could be TB. Any opinions?


Doctor A's Comments;
1) I agree. Positive blood cultures are rare in such cases due to antibiotics used prior to coming to us. Yet, it would be helpful to maintain empirical antimicrobial treatment in this case when the obvious image is seen in the CT.
2) Have the blood culture results come in yet?

My Comments;
Unfortunately, there is no growth.
However, he was recovered and discharged.

Figure 5. An example of on-line consultation and discussion in the closed forum of my Facebook.
Real image (wirtten as Korean) on Facebook is shown in Supplementary Fig. 1.
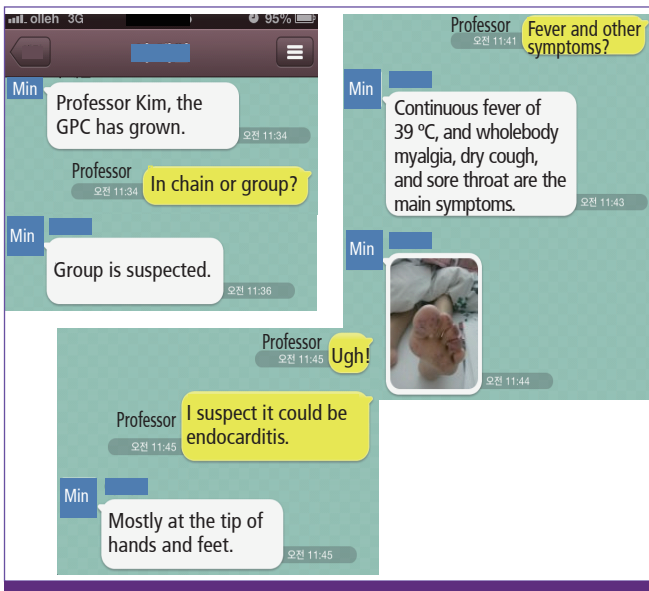
Figure 6. An example of on-line discussion using chatting app: On the weekend at home, I received this consultation message including image data from a housestaff in my hospital. We established an initial management plan via online-discussion on time.
Real image (wirtten as Korean) on smartphone is showin in Supplementary Fig. 2.

Figure 7. Tools of online presentation: Prezi and Mindmap.

disease at university hospitals all over the country. This resource is used for the purpose of online consultations, discussions, and mini-lectures when there are difficult cases (Fig. 5). In the past, I agonized without the thought of consulting professors from other hospitals. Even during consultations, actual visits were difficult, and it was inconvenient to call up them. Thus, it is such a convenient and efficient system that offers space for various specialists from around the country to participate and share opinions in a short time.
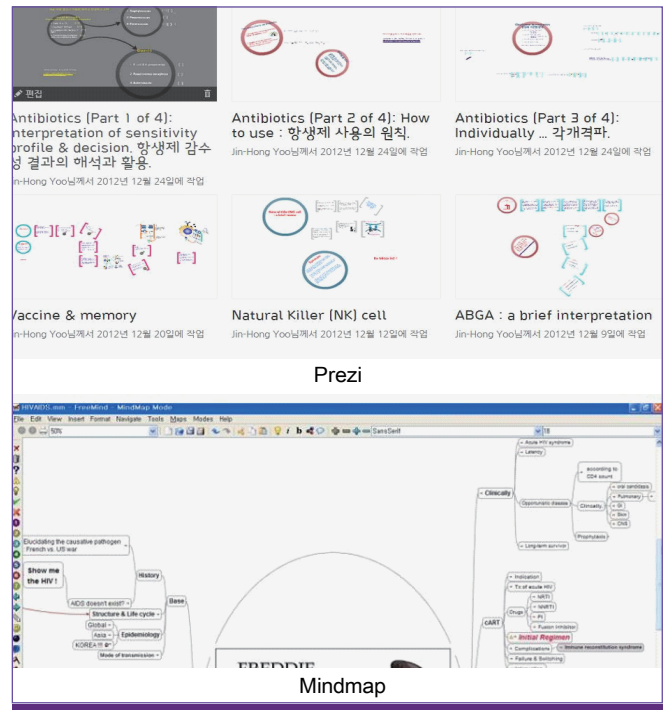
Another example of utilizing SNS is through chatting apps. I usually use KakaoTalk, which is the most popular app in Korea. When I am out of the hospital, I frequently receive consultation calls from house staffs. When KakaoTalk is used, text messages and various image data regarding the patient can be provided, allowing more detailed advice to be given.

On holidays or when I am off duty, I use KakaoTalk effectively to manage tasks with the house staff (Fig. 6).

Remote access

Teamviewer is the most common example; it is installed on both desktop PCs in the hospital and mobile devices, allowing the use of hospital PCs from outside with the mobile device through remote access.

Other than purchasing and using such apps, a virtual private network (VPN) ID can be received from the hospital to allow

secure logins to the hospital network through the Internet from outside the hospital to manage tasks such as emergency consultations.

Ubiquitous Presentation - Prezi vs. Mindmap

Nowadays, there are various ways to conduct an online presentation through the Internet without bringing a file in a USB device. The most common means is Prezi, while a type of Mindmap software, Thinkwise, also operates other online presentation arena [4, 5].

On these sites, not only presentations but also sharing through the Cloud and collaborations with colleagues are possible.

Prezi effectively uses a close-up effect and therefore has considerable strength in ensuring concentration by the audience. On the other hand, Mindmap is a map of thoughts and is more helpful for reviewing after the presentation. Prezi is a type of animation, so controllability is not always satisfactory. Therefore, it is difficult to perform selective reviews, as in Mindmap.

Prezi and Mindmap both have good connectivity through social networking service (SNS) (Fig. 7).

iStethoscope & other medical device-simulating apps

There is a continuous development of apps, which suggests that the smartphone can be used as a tool to supplement

medical devices. A very typical example is the recently developed iStethoscope, which uses the microphone function of the iPhone to auscultate and record. It is of course difficult to consider it as an official medical device, and the developer also emphasizes that it is for entertainment and not for medical purposes. However, this app is significant in that it suggests that the smartphone can be utilized as a tool capable of replacing medical devices to a certain degree in the near future. Aside from this, apps which measure the blood pressure or blood glucose are available for purchase.

Apps for the ID physician

Apps useful for ID physicians are antibiotics reference apps, medical utilities (e.g., calculators, and TDM apps) as well as literature search apps that find reference guides and review

Figure 8. Skyscape and Omnio.

Figure 9. Sanford guide (A) and Johns Hopkins antibiotics guide (B).

materials. News apps are also useful (e.g., epidemiology and outbreak news) [6, 7].

1. Skyscape application and Omnio

The Skyscape application unites the apps listed above into a single application (Fig. 8). It has Archimedes as a medical calculator, RxDrugs as a drug reference guide, and Outlines in Clinical Medicine as a reference of clinical information on numerous diseases. MedAlert provides updated medical information such as the latest trial results, clinical news, and drug alerts [8].

These are free applications, and useful apps can be purchased additionally according to need. Paid apps useful for physicians are as follows: The 5 Minute Infectious Diseases Consult, The Washington Manual Infectious Diseases Subspecialty Consult, Cochrane Reviews in HIV/AIDS, Cochrane Reviews in Infectious Diseases, The Pocket Guide to Fungal Infection, Journal Watch Infectious Diseases, etc.

Omnio is an iPad version of Skyscape. It provides the same free resources available from Skyscape. Also, direct connection to the IDSA homepage is possible in the app.
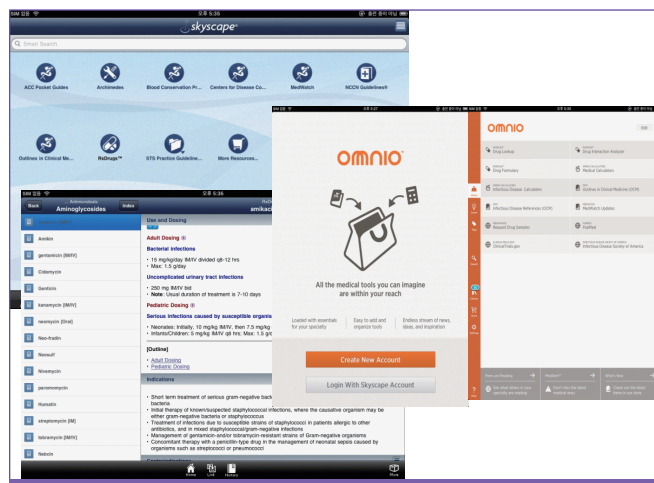
2. Antimicrobial reference apps

1) Sanford Guide
The Sanford Guide will be more familiar to physicians as a paperback manual. This guide was developed from the web edition and converted into a smartphone application to provide services (Fig. 9A). It has earned great confidence due to the sound content that has accumulated over a long period, but personally I have a single complaint regarding this paperback manual: the font size is too small and in reality I am reluctant to open the manual. Thus, the app version which can be enlarged is a very welcome development. The Sanford Guide app provides detailed information of nearly all antimicrobials, including HIV guidance, immunizations, infection in the special situation (e.g. pregnancy or post-transplantation).

The subscription is renewed every year.

2) Johns Hopkins ABX Guide
This app provides detailed information pertaining to antimicrobials and related knowledge (Fig. 9B). However, it is a textbook-like reference and thus utilities such as built-in calculator are not provided. Like the Sanford guide, it is renewed every year.

3) Epocrates
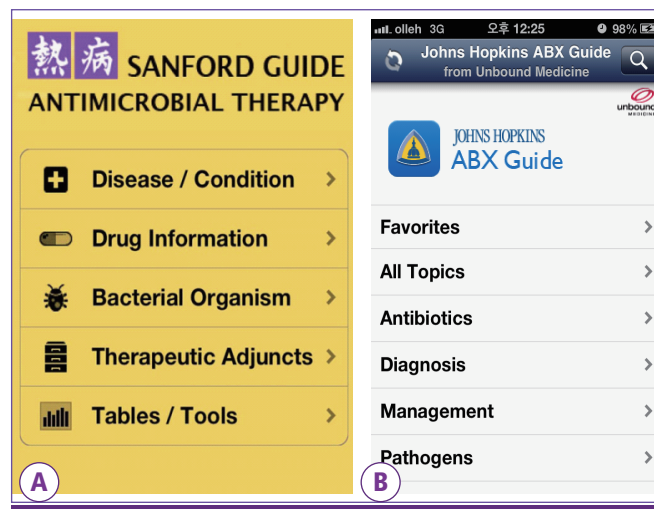This is an application from the Palmtop period. It has sub-
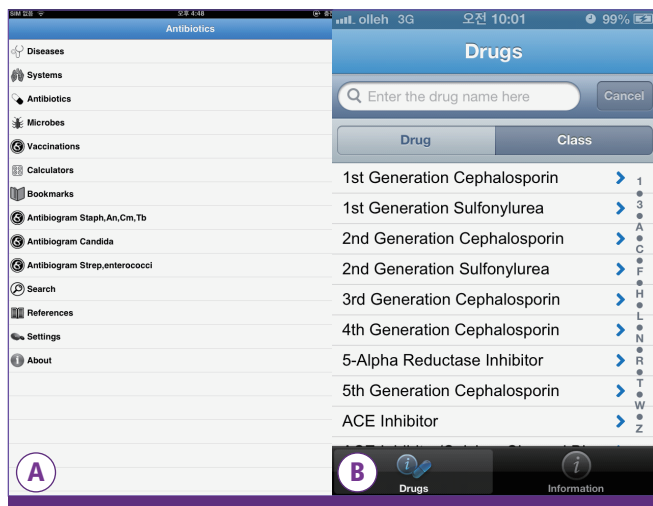
Figure 10. CDC antibiotics (A) and Micromedex drug information (B).

Figure 11. KIMS online app for smartphone.
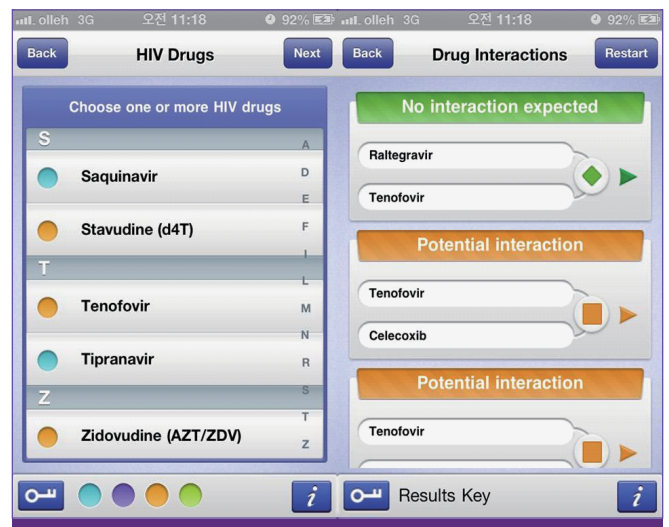
Figure 12. HIV iChart for evaluating the antiretroviral interactions with others.
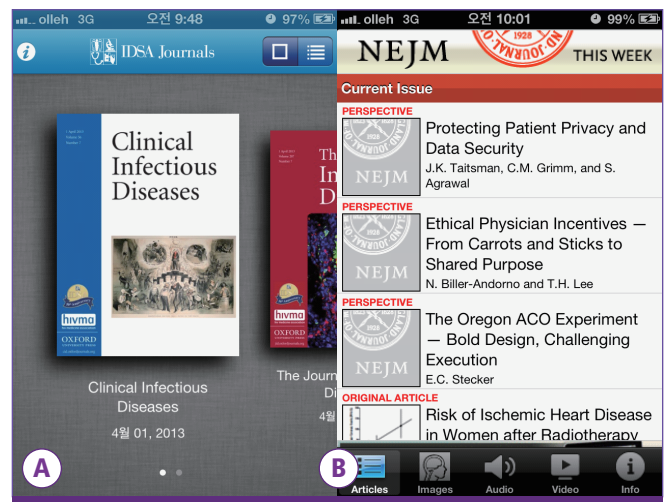

Figure 13. IDSA journals app (A) and New England Journal of Medicine app (B).

stantial content but is made for nearly all healthcare professionals. It has a drug interaction tool (InteractionCheck), a pill identification tool (with photos), and the MedMath calculator as built-in utilities.

4) CDC antibiotics

This is an app provided by the Centers for Disease Control (Fig. 10A). Rather than a detailed explanation of antibiotics, this app focuses on various clinical guidelines made by the CDC. This app also has built-in utilities such as a dose calculator.

5) Micromedex drug information

This app is a favorite for house staffs as it is free and has a relatively simple user interface (Fig. 10B). It is very useful when searching for interactions between drugs, adjusting dosages, and for learning about adverse effects.

6) KIMS for smartphone

KIMS (Korean Index of Medical Specialties) is offered through the Internet. It was developed as a smartphone app starting in 2011 (Fig. 11). It is possible to search in Korean, and in contrast to other overseas apps it has the advantage in that various generic drugs available in Korea can be sought and viewed.

7) HIV iChart

This app is a smartphone version of HIV-drug interactions on-line utility in http://www.hiv-druginteractions.org (Fig. 12).

3. Medical utilities - calculators, TDM, and others

Related apps are Vancomycin ClinCalc Full, Softforces's Antibiotic Dosage Calculator, and MedCalc 3000 Pharmacology.

4. Outbreaks Near Me, Swine Flu Tracker Map, H1N1 Update

These are applications for epidemiology and other outbreak news.

5. Journal apps - IDSA journals, New England Journal of Medicine app.

Various journals can also be viewed through apps as well. For example, the Infectious Disease Society of America (IDSA) provides an app to read *Clinical Infectious Diseases* or the *Journal of Infectious Diseases* on a smartphone, and the New England Journal of Medicine provides the most current papers every week to read through an app (Fig. 13). However, it is rare for journal apps to provide free articles, and most have to be purchased.

Perspective

I want to witness the future prospects of IT and its utilization in the medical field from the perspective of an individual physician and as part of a group of physicians.

1. Perspective with an individual point of view

From an individual perspective, the key points are what device to own and which apps to use. Therefore, the discussion will be separated into hardware and software (or apps).

1) Hardware

As is common in all fields, knowledge in the medical field is increasing exponentially, and it has long since exceeded the limitations of existing mediums based on paper. The world is wide and knowledge is vast, but time is insufficient. Hence, academic activity is not performed while sitting in front of a desk as in the past but can be performed even while moving. Therefore, the utilization of 'mobile' devices will gradually expand. It is true that as the smartphone and tablet have entered the mainstream, the desktop and notebook PC undergo reduced standing. However, the strength of the desktop as a method to gather data in one place and produce data will not be mitigated easily. Also, it is unlikely that the notebook PC will be completely replaced by the tablet PC. Recently, as Microsoft Windows 8 was launched, notebook PCs that can be converted into tablet PCs according to need have started to

sell. If this type of utilization of the notebook-tablet PC increases, the share of tablet PCs will decline to a matching extent until a balance is achieved to a certain degree. Eventually, all will be integrated into the Cloud; hence, the smartphone, tablet PC, and notebook PC will enter into a peaceful equilibrium in the mobile IT device field.

2) Software or apps

Software is similar to a type of organism which has to evolve according to needs and technology. As in the present, the main medical apps in the future will also be apps with vast databases and prompt searching systems. In addition, I carefully predict that the development of apps which help with clinical decision-making activities will also form another mainstream. Already built-in clinical decision support system (CDSS) in web-based electronic medical record (EMR) systems are continually evolving and it is therefore anticipated that various types of CDSSs will be transformed into apps that can be used on mobile IT devices. Currently, this is at the level of consultation apps yet, but in the future this feature is anticipated to evolve into a CDSS app comprising an artificial intelligence-oriented algorithm.

2. Perspective with a viewpoint of a group (of physicians)

When 'personal' computers were introduced, they were mainly intended for the 'personal' use of each person who owned one. However, humans are social animals and thus naturally pursued networking; and such a system was realized with the Internet. This system was further promoted with mobile IT devices, and now groups with the same purpose can gather through a single network to become a unit. It will become usual for me and my colleagues to share materials through clouding and in this manner work together on important projects. As the proposition 'humans are social animals' suggests, communication can be seen as a sort of instinct. In the future, we will continue to pursue communication and group synchronization, and IT devices, the Cloud, and software will be at the center as the means to realize such purposes. We are not alone.

Supplementary material

Supplementary data including two figures can be found with this article online http://www.icjournal.org/src/sm/ic-45-244-s001.pdf.

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