Cost Effective Use of Free-to-Use Apps in Neurosurgery (FAN) in Developing Countries: From Clinical Decision Making to Educational Courses, Strengthening Health Care Delivery

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■ INTRODUCTION AND OBJECTIVE: **Financial limitations and the scarcity of technological knowledge are a major hurdle to good communication platforms, data storage, and dissemination of medical knowledge in developing countries. Out of necessity we used free-to-use apps in our practice. We studied the applicability and cost effective aspect of a systematic use of these apps in neurosurgery.**

■ MATERIALS AND METHODS: **We designed the Free-to-use apps in neurosurgery (FAN) module in 4 phases at Kathmandu Medical College Teaching Hospital over the last 3 years. We used free apps like Viber, Dropbox, Skype, and VLC media player on 3G and Wi-Fi network. Users were trained in ethics and measures to ensure confidentiality and privacy of patient-related data. Endpoints studied were feasibility, reliability, cost effectiveness, and overall satisfaction of the users.**

■ RESULTS: **In the FAN module, the Viber app was used to send pictures of digital images via smartphones within 30 minutes, enabling quick decisions by the consultants. Dropbox not only helped store images but also helped quick verification of discharge summaries as early as 15 minutes increasing overall efficiency. With Skype, consultants could be contacted even when they were abroad, and with the use of FAN they remain updated of their patients. By the use of Skype and VLC media player, 2 operative live workshops from abroad were transmitted live with good visual and audio reception, allowing question-and-answer sessions with the faculties. User satisfaction was more than 90%.**

■ CONCLUSIONS: **The FAN module helped in quick reliable decision making, allowing for instantaneous communication and storing data and exchange of knowledge across countries.**

INTRODUCTION

Procuring and running a hospital management information system (HMIS) requires a lot of hardware and technical support. Despite the usual economic constraints of the developing world, our hospital procured one but used it solely for accounting purposes. Further development of additional portals was found to be expensive and would take more than a year for integration with the manual system in place. The same restrictions were encountered in setting up of telemedicine systems.

As we were establishing our neurosurgical unit in 2012, we felt the urgent need for a system that not only could store our electronic data but also make it available across different portable gadgets in real time and allow for effective communication at a minimal cost. This would help us make quick decision as well make our system effective in handling large number of patients with limited health care staff.

We were encouraged by the barrage of new iCloud computing software, or rather "apps," which not only allowed for quick,

Key words
- Communication
- Free-to-use apps
- Neurosurgery
- Smart phones
- Telemedicine

Abbreviations and Acronyms
CT: Computed tomography
DI: Digital image
FAN: Free-to-use Apps in Neurosurgery
HMIS: Hospital management information system
MRI: Magnetic resonance imaging
OT: Operating theater
PACS: Picture archiving and communication system

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wireless communication but also for uploading videos, photos, and documents at a fast pace. We realized the futility of sending all scans of digital images (DIs) because there were only few relevant images in a computed tomography (CT) or magnetic resonance imaging (MRI) protocol; a well-focused photo of the relevant section of a DI would be lot simpler to transmit via the Internet, making it easy and quicker to download and interpret by a receiver on the other end.

Out of necessity and constraint, we developed the Free-to-use Apps in Neurosurgery (FAN) module, which consists of using Viber (Rakuten, Tokyo, Japan), Dropbox (Dropbox Inc., San Francisco, California, USA), Skype (Skype Communications SARL, Rives de Clausen, Luxembourg), and VLC media player (VideoLAN; http://www.videolan.org/videolan/team/index.html). The objective of this study was to evaluate how these components can be used in neurosurgery practice in our setup and test for feasibility, reliability, cost effectiveness, and overall satisfaction of the users. A part of this study on the Viber app has been published in *Neurology India*.[1]

MATERIALS AND METHODS

We launched our FAN module in December 2012 with objectives as stated in **Table 1**. It was designed and tested in the Department of Neurosurgery, Kathmandu Medical College Teaching Hospital, during a 2-year period in a prospective case control format. As a novel project with no precedence, 4 phases of development and appraisal of the module were planned (**Table 2**). The initial phase, the identification of software that meets the requirements mentioned in **Table 3**, was conducted. The second phase (preparatory phase) included loading the software on the users' smartphones and computers and teaching users how to use them. The third phase (trial phase) included using the module in a guided manner and testing the components for feasibility, reliability, and cost effectiveness in our setup. Phase 4 (advance/review phase) was designed to identify additional needs of users and develop methods to integrate the same in the FAN module.

In phase 1, 4 apps were identified (as shown in **Table 4**). Because all the apps were updated automatically while in use, the latest version has been mentioned for record. Alternative apps also were considered, but those with functionality, ease of use, and robustness of the apps were given preference in the selection for the FAN module. Because these apps were free to use, no previous registration or permission was required.

In phase 2, junior doctors as well as consultants (the users) were trained in handling these apps. Personal smart phones with camera capability (resolution at least 3 megapixels) were installed with these apps. Residents were taught to take sharp pictures of the relevant DIs, recheck, and upload them immediately using Viber over the Internet. Images were taken in close and distant modes. There was no restriction on the number of images; however, uploading a large number of images took a longer time. Images transferred included X-rays, CT scans, and MRI scans. The Dropbox app was used to file, edit, and store documents. Skype and Viber apps were used to communicate even when the consultants were outside the country. Skype and VLC media were used to transmit live feeds during teleconferences.

Table 1. Objectives of FAN Module

To help
Allow sharing images and videos of patients over the Internet
Obtain an immediate appraisal by consultants on portable devices, allowing quick decisions
Share and edit documents such as discharge summaries and presentations
Allow communication even outside the country
Transmit live video feeds and presentation slides, allowing for 2-way communication
Store data and retrieve it for research purpose

As a part of phase 3, i.e., the trial phase, the images transferred on Viber were studied by consultant neurosurgeon and later compared with the reporting done by the resident and consultant radiologist as well as on actual image interpretation. DIs reported by residents were considered as Group 1, by the consultant neurosurgeon on Viber as Group 2, by the consultant neurosurgeon on actual images as Group 3, and by consultant radiologist as Group 4.

The Dropbox app was used to share and edit discharge summaries, operating theater (OT) notes, presentations materials, and worksheets, allowing for storage and automatic syncing. Skype and VLC media player were used for transmitting videos and slides during teleconferencing.

PROTECTING PATIENT PRIVACY/CONFIDENTIALITY OF DATA

To maintain the confidentiality and privacy of the patients, certain rules were mandated for the users to follow. First, they would login using their own ID and devices and logout from the module if not in use. No personal data of the patients, including credit cards or insurance, were captured or transferred through the apps used in FAN. Users who transferred photos and documents via apps in the FAN module had to delete them after they were discussed, except for the administrator, who files and stores them in a password-protected folder on the office computer.

Strict advisories were circulated to not allow dissemination of patient data except for the FAN module in the administrator's modulated user group. If any user leaves the institution, departmental clearance is given once he is removed from the FAN user group and his devices cleared off the data stored during his use of FAN module. Dropbox was installed only on the workstation and office computer and not permitted to be used on mobile phones to avoid unauthorized dissemination of patient data. All users were asked to install and taught to use apps to lock their devices in case they are stolen. The authors believe that the most important parameter to safeguard patient's privacy is staff handling these sensitive data; hence, proper training and strict adherence can only avoid data theft.

Outcome Variables

Primary endpoints for evaluation of the Viber app were discordance of opinion between Group 1 and 2, Group 2 and 3, Group 2 and 4, and time delay in decision-making on Viber. Discordance