Using Technology to Support Clinical Pharmacy Practice

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Purpose

I have worked as a clinical pharmacy specialist in the Child and Adolescent Mental Health (CAMH) programs at BC Children's Hospital (BCCH) for the past five years. In this article, I would like to share some of the ways I have incorporated technology into my practice in order to become more efficient and to better contribute to achieving optimal patient medication outcomes.

Approximately three years ago I was given the opportunity to integrate technology into my practice via the purchase of a notebook computer by our mental health program. I have always considered myself tech-friendly, and for many years had thought about how technology like this could benefit my practice if the opportunity became available. Previously, I had used various handheld devices including a Palm Pilot and even my iPhone for certain applications, but getting the notebook computer was a game changer. Presently, my notebook is a vital tool in my practice day-to-day as a clinical pharmacist and as my colleagues would tell you, I rarely go anywhere in the hospital without it.

I am responsible for managing the drug therapy of approximately 25 inpatients on a weekly basis. Some of our inpatient units have a rapid turnover with a constant influx of new patients via the emergency department. On others units, patients are admitted for several months. I attend inpatient rounds on at least one of our units on a daily basis. On some days, rounds can last over three hours in duration, but I find the patient care rounds to be the most efficient place to discuss medication changes with the psychiatrists and team. After follow-up work and patient or family counseling is completed, this often leaves little time for administrative or research activities, or preparation for the next day's rounds. I also provide drug information services for all of our inpatient and outpatient mental health programs and am a provincial resource for child and adolescent mental health drug information.

Discussion

In order to maximize what you can accomplish with technology in your practice, cooperation between the pharmacy and the information technology department (IT) at your facility is crucial. However, at some institutions, IT can be a rate-limiting step. The existing information systems and network infrastructure will usually determine the hardware, operating system (OS), and software that you are able to use at the site, and the level of access you are granted to the various applications supported by the hospital network. Ideally, a coordinated and consistent approach by the pharmacy department is best when planning to integrate technology into clinical pharmacy practice. Maintaining confidentiality of patient information is of critical importance, and access to networks and patient data must occur via secure password protected systems. I store patient information only on a secure hospital network drive, and never on the local notebook hard drive itself. If my notebook is ever lost or stolen, the patient information will remain secure with this setup. At BCCH, we are fortunate to have wireless access to the hospital network and internet throughout the mental health building. While less convenient, on days when the wireless access goes down, access is still available via wired 27thernet cable in almost every meeting room within our building. My notebook runs on Windows XP, an older Windows OS first released in 2001. Use of this OS remains necessary in order to access our Centricity inpatient pharmacy software. Development of a good relationship between the pharmacy department and IT can help facilitate the granting of user administrator rights, which is important in the network environment to be able to install the third-party software and browser extensions discussed below.

Network systems I access on a regular basis include the laboratory system, the admission discharge and transfer (ADT) system, the hospital-wide Cerner clinical information system, the Centricity inpatient pharmacy software, and various drug information resources (for example, UpToDate, Lexi-Comp, Micromedex, DynaMed, and the online electronic Compendium of Pharmaceuticals and

Specialties (e-CPS)) that are made available to all BCCH staff via the hospital intranet. External systems used to support my practice include the BC PharmaNet drug database via our provider Medi net (www.medi net), and external laboratory systems like Excelleris and CareConnect, which provide laboratory data from community laboratories and other hospitals within our geographic region respectively. I frequently access the University of British Columbia (UBC) Library resources, especially the National Library of Medicine's PubMed database, which offers indexing and full-text access to primary medical literature (downloadable as Acrobat Portable Document Format (PDF)).

This wide level of access provides a rich database of patient information, laboratory information, and medication-specific information, which allow me to efficiently monitor for, identify, and quickly resolve drug-related problems. I have a patient medication profile template created using Microsoft Word which I use to store collated patient-specific demographic information, diagnoses, laboratory and medication information, and progress notes. Each patient medication profile is stored on a secure network drive in a folder by patient name, in addition to the month and year of their admission. Other documents that I store in this folder include the patient's PharmaNet profile (as a PDF) from the time of admission, any admission or consult notes recorded in the clinical information system, along with any completed forms required for continuity of pharmaceutical care. Examples include Pharmacare Special Authority form, Clozapine patient registration, or Health Canada Special Access Program forms, which are all available online as PDF templates and can be rapidly completed electronically. I also store a copy of any full-text PDFs of articles from the medical literature that pertains to a patient's care in their respective folder. Patient care rounds in mental health can run for a long time, and staff and physicians will generally not wait for the pharmacist to close down, logout, reopen, and login to multiple applications and folders before discussion about the next patient begins. Collation of all this information in one rapidly accessible location makes my ability to capture, synthesize, and relay information and recommendations during rounds much more efficient during fast-paced patient care rounds. Storing patient profiles and medication lists electronically significantly reduces the volume of paper I consume (and have to store) on an annual basis. Some patients within our programs have multiple admissions over time, and patient profiles and information from previous admissions can be retrieved and stored together with the information from the current admission.

In my specialty practice area, certain topics and questions are raised repeatedly over time by different staff and psychiatrists (especially with a steady stream of new psychiatry residents turning over every 6 months). When I first started this role, I decided to save a PDF copy (for personal use) of *every* full text article I retrieved from the literature. I rename and save the PDF file by lead author, abbreviated title, and journal name and year. I then categorize and store the PDFs by disease state or therapeutic category. This allows me to rapidly find primary literature on a topic, and not have to go back to search the PubMed database each time I need to find a favorite article (though it is important to periodically review resources to determine if new literature, trials, or practice guidelines in a topic area have been published). The file names can be searched via Windows search by author, drug, year, or virtually any other keyword. Storage of information in this manner also assists in training students and residents, since I can direct them to a particular folder on my network drive for primary literature on a given drug or disease. One thing I do regret is not using reference and document management software such as Zotero (www.zotero.org) or Mendeley (www mendeley.com) to organize all this information right from the start. Unfortunately, I now find that there may be just too many articles to enter and categorize into a reference manager, although I would definitely try to incorporate articles into a reference manager if I had to start all over again.

In addition, I provide psychopharmacology seminars and training to students and residents at distant institutional sites from my office computer via use of a high-definition camera and Telehealth software (Cisco TelePresence Movi). The software provides a direct video link between myself and the participants, and I can show a Powerpoint presentation, website, or video while doing voice narration, taking questions, and holding a discussion remotely.

When a drug information question is raised at rounds that I am unable to answer immediately through use of online resources such as my publication archive, Pubmed, and the drug information databases, I am often able to send a response, pertinent articles, forms, or information to the prescriber's inbox even before they get back to their office following rounds. If an order entry discrepancy is spotted within the inpatient pharmacy system, I can correct the order entry right from rounds and then report the incident via the electronic provincial Patient Safety Learning System (PSLS). When reviewing a patient's medications, I can identify the medication while on the nursing unit and make the order entry in the inpatient pharmacy system (and can even print new labels to the dispensary if necessary). This saves delays in turnaround time, and reduces the risk of the patient's medication supply from being lost while it is being

transported to the pharmacy or back to the nursing unit. I can leave patient specific notes within the Centricity pharmacy software (i.e. explanations about unusual medication situations) which are automatically displayed to the user each time the medication profile is accessed.

Luckily, Windows OS allows multiple applications to be open at one time. Switching between windows can be done rapidly using keyboard shortcuts (which are usually much more efficient than using an onboard mouse or trackpad). Often, I will have a patient profile, a current list of medications from Centricity, the ADT data and laboratory system, the clinical information system, a PharmaNet profile, Pubmed, and one or more drug information databases open on my notebook computer at one time.

When discussion at rounds veers away from medication-related topics for an extended period of time, I am able to check the hospital Outlook system for my email inbox and schedule information. For short drug information questions or time-sensitive requests received via email, I can often respond, and if necessary send documents or links to pertinent information, right from within rounds. This means that when rounds are complete, I do not return to my office with an inbox jammed full of requests that I only then begin to process. This helps to free up time for afternoon meetings, training sessions, or project time in the remainder of my work day. It also means that I stand a better chance of leaving work on time rather than being bogged down dealing with an inbox stuffed full of emails which have no hope of ever being cleared out.

Even the ability to do a Google or Wikipedia search from within rounds to find information about an obscure diagnosis or clinical situation (e.g. what is a Capgras delusion?) is incredibly valuable. When asked by nursing staff for drug information where a picture is worth a thousand words (e.g. what does a lamotrigine-induced Stevens-Johnson rash typically look like?), a Google image search can be illustrative and shared with the team almost immediately. Similarly, when teaching students and residents, showing carefully pre-chosen YouTube videos can effectively demonstrate medication adverse effects (especially dynamic movement disorders such as tic disorders, and the increasingly rarely encountered adverse effects of akathisia and tardive dyskinesia) better than any description. During patient counselling sessions, I can print any required forms or electronic patient medication teaching sheets for common medications used in child and adolescent mental health from our Kelty Mental Health website (www.keltymentalhealth.ca/treatment/medications) wirelessly to any network printer in the building, for immediate retrieval following the meeting.

Keeping up with current medical and pharmacy literature in my specialty area is imperative. Free medical literature indexing and alerts such as Physician's First Watch and Journal Watch (www.jwatch.org) from the New England Journal of Medicine (available for general medicine as well as segmented into topics from many different practice areas including pediatrics and mental health) consistently keep me on top of the latest news in my area, often 24 to 48 hours before a story hits the mainstream medical news. These services can be either accessed online, or you can choose to be notified by daily or weekly alerts to your inbox. The full reference citation is always provided with each headline, and with access to PubMed full-text articles via UBC library, I can scan the email subject line for topics that interest me, and then retrieve the full text PDF, usually immediately. One caveat is that the service is US based, so it does refer to drugs that may not yet be available in Canada. Also helpful is the use of a news aggregator service such as Alltop (www.alltop.com). This free service can be customized to your interests or practice area, and will display top news headlines from a wide variety of medical, pharmaceutical, and even general interest subject areas, all on a single web page.

Additional software requirements beyond the standard IT issues concerning Microsoft Office Suite are minimal. I view and edit PDF documents often, and find the highlighting, editing, and annotation features of Adobe Acrobat Professional very useful. I use Adobe Photoshop for editing and customizing images for Powerpoint presentations, but this is not needed for day-to-day clinical practice, and alternate low-cost and open source image editing programs are available.

I collaborate with students and clinicians, both for work at the university and across the continent, on various research projects via use of Dropbox software (www.dropbox.com). This web-based data storage and collaboration service allows sharing of documents and files between almost any device and any user anywhere in the world for a small monthly charge. Free access can be granted to collaborators and this may be limited to specific folders. Access can be granted to anyone via a URL link to files located in a designated 'public' folder. Dropbox also makes the movement of documents or even very large files between my various devices at work or at home virtually seamless. Google Docs is another free option for document collaboration, though it does not offer quite as many editing features as found in Microsoft Word.

Though I have not needed or attempted to do so, it is possible to access patient specific information from the institution's network remotely from anywhere via use of a virtual private network (VPN), which involves additional security authentication

systems such as the use of a physical VPN key plus a password.

The major project for completion of my Doctorate of Pharmacy degree pertained to video podcasting of health information to both the public and professionals. Since graduation, I have worked to refine this process, and can now create short video podcasts at a very low cost, using nothing more than my home computer with free or low-cost software (e.g. Audacity, Photoshop Elements or various open source equivalents, Apple iPhoto/iMovie) and some royalty-free, low-cost stock photography from companies such as iStockPhoto (www.istockphoto.com). Examples of completed video podcasts are available at www.mymediapharm.com.

iDevices

Devices such as Apple's iPad, iPhone, and iPod Touch enjoy widespread popularity, and are popping up more commonly in hospitals for use as note taking devices, clinical statistics trackers, and patient counselling aids. iDevices afford access to many medical applications, often available at a minimal cost or for free. However, the inability of the user to directly access the file structure of the iDevices OS (by Apple's design) limits the usefulness of these devices for comprehensive patient monitoring as described above. For security reasons, most institutional IT departments do not support network connectivity of iDevices. If no integrated technology solution is available from your IT department, an iPad or other tablet may be better than nothing, and may provide basic internet and email access, note-taking ability, and some useful apps (e.g. one student used apps such as Instapaper (www.instapaper.com), Noterize (now PaperPort Notes (www.paperportnotes.com), and Evernote (www.evernote.com) along with Dropbox to effectively to organize and annotate various research articles, class notes, and presentation handouts). Though numerous web-based clinical calculators exist, I frequently turn to my iPhone app for rapid body mass index (BMI) percentile calculation for children and adolescents (by TactioHealth Group www.tactiosoft.com). Many other medical and pharmacy related apps are available from the Health & Fitness section of the Mac App Store. Medical Apps are also available for alternate phone and tablet platforms such as Android and Blackberry, though usage of these devices in our hospital appears to be much less common.

Recent graduates who are more technology-savvy at baseline are more likely to make the most from use of technology to support their clinical pharmacy practice. This may be in contrast to pharmacists whose use of technology has been previously limited.

Conclusion

Technology that can greatly improve the efficiency of the clinical pharmacist is readily available at a relatively low cost and is increasingly being employed by hospital-based clinical pharmacists. The broad application of such technology is dependent on favorable connectivity and setup conditions of the institutional network and health applications, and the comfort and proficiency level of the pharmacist employing the technology.