Medical Student Appraisal

Electronic Resources for Inpatient Pre-Rounding

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Summary

Background: Pre-rounding is essential to preparing for morning rounds. Despite its importance, pre-rounding is rarely formally taught within the medical school curriculum and more often informally learned by modeling residents. The evolution of mobile applications provides opportunities to optimize this process.

Objectives: To evaluate three options available to medical students while pre-rounding and promote adoption of mobile resources in clinical care.

Methods: Six medical students formed the evaluation cohort. Students were surveyed to assess pre-rounding practices. Participants utilized paper-based pre-rounding templates for two weeks followed by two weeks of the electronic note-taking service EvernoteTM. A review of mobile applications on the iTunesTM and Google PlayTM stores was performed, with each application informally reviewed by a single student. The application ScutsheetTM was selected for formal review by all students. Data was collected from narrative responses supplied by students throughout the evaluation periods and aggregated to assess strengths and limitations of each application.

Results: Pre-study responses demonstrated two consistent processes: verbal sign-out of overnight events and template use to organize patient information. The paper-based template was praised for its organization and familiarity amongst residents, but perceived as limited by the requirement of re-copying data into the hospital's electronic medical record (EMR). EvernoteTM excelled due to compatibility across multiple operating systems, including accessibility from clinical workstations and ability to copy notes into the hospital's EMR. ScutsheetTM allowed for retention of data across multiple hospital days, but was limited by inability to export data or modify the electronic template. Aggregated user feedback identified the abilities to customize templates and copy information into the EMR as two prevailing characteristics that enhanced the efficiency of pre-rounding.

Discussion: Mobile devices offer the potential to enhance pre-rounding efficiency for medical students and residents. A customizable EvernoteTM-based system is described in sufficient detail for reproduction by interested students.

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1. Background

In the practice of medicine the daily process of evaluating patients, reviewing overnight events, gathering information, writing progress notes, and preparing presentations prior to the start of morning rounds is commonly referred to as "pre-rounding"[1]. Although essential to the process of timely decision-making and efficient patient care, pre-rounding is rarely, if ever, formally taught within the medical school curriculum. Indeed, many medical students often find that they must learn this vital skill through observation or informal instruction from residents. While the specific manner in which pre-rounding is performed may vary among different hospitals, services and sub-specialties, there are many common elements such as trending vitals, writing down lab values, and reviewing results of imaging studies [2], all of which are amenable to optimization.

To facilitate this morning routine medical students and residents often utilize templates and electronic medical record (EMR)-generated rounding lists to organize patient data. Such templates have been shown not only to reduce the time needed to pre-round [2] but also to improve documentation of pertinent patient information [3].

While paper templates and rounding reports have been shown to improve the pre-rounding process, the role of the mobile technology in this activity remains poorly defined. Although many studies have reviewed the use of smartphone applications as both methods of improved communication and sources of reference [4], the role of the smartphone as a tool for rounding has not yet been studied. We conducted a preliminary study to acquire feedback from a small group of medical students, utilizing subjective impressions to propose a novel electronic pre-rounding system to improve efficiency in preparing for morning rounds.

2. Methods

The medical student authors of the study – six third-year medical students rotating in various specialties at a large academic medical center – formed the evaluation cohort. An electronic Google survey (Google, Inc. Mountain View, CA) was administered to all third and fourth year medical students to evaluate their current methods of preparing for morning rounds. This survey asked students to identify which option most closely identified their current pre-rounding methods: blank paper, paper template, electronic application, or "other," with the ability to provide a free-text description.

Participants were self-selected for the project via an email to the medical school class, and consisted of five males and one female between the ages of twenty-four and twenty-eight. No computer science or specific "tech-savvy" skills were required other than expressing an interest in the topic, and none of the evaluators had any formal training in information technology. The evaluation process consisted of an initial pre-study survey asking students to describe their current approaches to pre-rounding, including their stepwise process, perceived benefits, and limitations. This was followed by three formal trial periods, each two weeks in duration. The trial periods involved utilizing a paper-based rounding template, an electronic note-taking system, and electronic pre-rounding applications. Each student evaluated these methods in the same order.

Medfools.com is a popular website for resources tailored towards medical students and residents [5]. The site offers an array of free content submitted by students and residents designed to be helpful in clinical care. This includes a number of paper-based templates, more commonly known as "scutsheets," designed for different aspects of patient care, such as admission intake forms and daily progress notes. "Medicine Scutsheet Style 2" [5] was the form selected for the paper-based template trial (▶Figure 2).

The second trial was intended to evaluate electronic, cloud-based access and simultaneously allow students the freedom to customize or personalize their note in the way they found most efficient. For this method we chose Evernote™ (Evernote Corporation) [6] due to its availability across multiple mobile platforms, including both iOS™ and Android™, and numerous web-based interfaces. All students created an Evernote™ account and downloaded the application to their smartphone or tablet. Two weeks were allotted for students to become familiar with the basic functions on

both their mobile devices and web interface. Evaluators were then instructed to formulate their own system using Evernote™ when pre-rounding on their patients.

The third trial was designed to assess currently available mobile applications to assist in the pre-rounding process. A thorough review of the iTunes™ and Google Play™ stores was performed and identified six relevant applications. Each student conducted a preliminary, one-week review of a single application and advocated for or against selection of that application for formal review by all team members based on immediately identifiable strengths and weaknesses (►Table 1). Scutsheet™ (Ellipticase LLC) [7] was ultimately chosen for formal review due to its appealing user interface and template-style structure. The application mimics the paper-based templates with which students were already familiar, allowing for an apt comparison of paper and electronic template-based pre-rounding methods.

In an effort to protect patient confidentiality and comply with the Health Insurance Portability and Accountability Act (HIPAA), any electronic recording was de-identified of patient information. All evaluators had completed HIPAA training and were responsible for self-monitoring their compliance as they would in the course of regular clinical care. Data was collected from survey responses submitted by evaluators at the culmination of each trial period. Students were asked to describe in a stepwise fashion how they utilized the modality in sufficient detail to allow for replication. Additionally, evaluators were asked to identify strengths and limitations of each pre-rounding system.

3. Results

3.1 Medical Student Survey

The electronic survey was administered to approximately two hundred forty medical students and returned eighty-eight responses, yielding a response rate of 37%. Survey results (►Figure 1) revealed that the majority (52%) of students used blank paper, followed by 23% who used a paper template. The remaining responses consisted of electronic applications (6%), and other (7%), where students in the "other" category described either printing the previous day's progress note or solely using their mental recall when pre-rounding.

3.2 Pre-Study Participant Survey

Four of the six study participants used a blank sheet paper, one used Evernote™, and one did not write down anything during the pre-rounding process but began his note immediately after seeing the patient. All six evaluators reported obtaining a verbal update or "sign out" from the overnight resident or nurse caring for the patient to learn of any significant events. Four of six students said that they spent time copying down objective data, including vital signs and morning lab values. One student reported using a single sheet of paper for each patient and retained it between days to allow her to easily see trends in objective data. The other three students who used paper did not retain it between subsequent days. Two of the six students reported routinely beginning their daily notes during their pre-rounding, while the other four students wrote their notes after completing formal team rounds.

Strengths and Limitations

The perceived strengths and limitations reported by each student for their pre-rounding process are summarized in ►Table 2.

3.3 Medfools Paper Template (Scutsheet style 2)

Overview

The Medfools template (►Figure 2) is designed to be folded in half and carried in the white coat pocket, facilitating easy access throughout the day. The left half is an admission template with space for documentation of the patient's history, physical exam, admission vitals and labs, and an assessment and plan. The right half of the sheet is divided into 7 identical templates each representing a

hospital day, with space for the date, hospital day number, labs, vital signs, fluid balance ('ins and outs"), and free text. The system is a self-explanatory template intended to be retained for the duration of the patient's hospital stay.

Strengths

Organization and clarity were the most common strengths reported for the Medfools template. Students specifically appreciated that the template served as a checklist ensuring that basic information was recorded each morning. One evaluator responded, "The template is particularly helpful because we get there very early and are often sleepy performing these first tasks of the day." Additionally, multiple students claimed that the template saved them substantial amounts of time simply because they did not have to copy out shorthand diagrams when annotating lab values for each of their patients.

Multiple students also cited data trending as a strength of this modality, as students can record up to 7 days of objective data on each template form. Occasionally when presenting a patient's history students are asked about a previous lab value which may not have been documented due to non-recognition of its significance. However, with the template, trends in lab data were readily available from one day to another. Additionally, students also reported the utility of having their admission history and physical easily accessible when consulting other specialties.

Finally, one student felt that widespread familiarity with the Medfools template and ability for more senior team members to clearly see that they had prepared for rounds positively affected his experience. The student compared the Medfools template to using an iPad:

> "The paper template is recognizable and accepted, making it obvious that I have prepared ahead of time when I am reading of labs and other data in the morning. With my iPad sometimes I think the attending assumes that I am just trying to read the labs off of the EHR since they can't always see what I'm looking at."

Limitations

Three limitations stand out when using the paper template: students are required to print a new template for each new patient; students risk losing their work should they misplace it; and non-routine labs do not fit on the template, so students often must write on a separate sheet of paper, which undermines the organization that is central to any template's effectiveness. Some students with larger handwriting also found the template to be too cluttered, which reflects a lack of customizability. Variation between services means that inherently it is impossible to create a one-size-fits-all template, but Medfools does offer a variety of templates for various locations in medicine, including history and physical, rounds, and intensive care units. Students reported, however, that ideally they should be able to modify the templates themselves in order to tailor them to the preferences of different specialties. Currently the templates are available only in PDF form and consequently cannot be modified without more advanced imaging software to which some students lack access.

An additional concern reported by students was an inherent sense of inefficiency in the pre-rounding process that these templates failed to overcome. Objective data reporting is a commonplace requirement during rounds [2]. However, students were frustrated by the substantial time spent in the morning copying down this data from the computer, only to have to re-copy the data later in the afternoon when composing their daily note on the patient. One student reflected on this process:

> "The template helps cut down on the time I spend getting organized in the morning, but it doesn't save me any time writing notes because I have to re-write everything I copied down onto the scutsheet into my note for the day."

This reflection highlights the template as an intermediary between blank paper and an incorporated electronic system. The templates are an improvement on paper to save time, assist in completeness and promote organization, but inherently fall short because they cannot overcome the necessary duplication of work required when entering notes in the electronic medical record.

3.4 Evernote™

Overview

The Evernote™ system (▶ Figure 3) allows a user to create individual text-based notes to which they can attach pictures, movies, and documents. Evernote™ facilitates organization through the creation of multiple "notebooks." Notes can be easily transferred between notebooks by simply changing the notebook assignment at the top of each note. Evernote™ is available for free across an extensive array of both mobile devices and desktop operating systems. Supported mobile device operating systems include iOS™, Android™, Windows™, and Blackberry™. Computer support includes Mac OS X™, both Windows Desktop™ and Window 8™, and extensions for Safari™, Chrome™, and Firefox™ Internet browsers. Evernote™ content can also be accessed via Internet browser through evernote.com without requiring installation of any software.

All students reported creating a template of some form, with 2 students using a SOAP template and 4 students creating templates that were specific to their specialties. Students did not report any difficulty in designing their own templates. All students created a separate notebook specifically for notes related to patients they were following, and one student created a separate notebook to save different templates. Five students described a process of saving time by updating their previous day's note with information for the current day, while one student chose to create separate notes for each day. All students reported increased efficiency by copying their note from Evernote™ into the electronic patient record, where they simply needed to insert patient identifying information to complete the record.

Strengths

The greatest strength of Evernote™ was universally considered to be its availability across all platforms. In particular, several students cited the ability to access their notes via Internet browser to be invaluable, as students are not permitted to install any content to public workstations. Even if this were possible, a student may use multiple different workstations throughout the hospital during the course of the day. The ability to access notes on the public workstation was praised because it allowed users to copy content to and from the electronic medical record. Additionally, one student explained:

> "I am constantly moving throughout the hospital using public workstations in different clinical areas, so the ability to have a central repository with constant access is an enormous time-saver. I can also quickly pull up a note on my phone if I get paged about a patient and am not near a computer, or alternatively can access my notes from the computers in the operating room if I need something and left my phone in my locker."

Several authors also described the cloud-based storage as a safeguard against losing information. They felt the electronic storage was more secure than a piece of paper that could be easily misplaced. One student also described the benefit of being able to instantaneously email his note to a colleague who was taking over responsibility for one of his patients.

Limitations

Despite the myriad of features offered by Evernote™, students were not completely satisfied by its customizability. Four students reported that their inability to draw shorthand diagrams for lab values directly into their note was a major limitation. However, recent updates to the drawing application Penultimate™ (Evernote Corporation)[8] suggests this feature may be available in the near future.

The time required to access a note, while admittedly very short, was also described as a limitation relative to paper-based templates:

> "One issue I've run into is when I get asked a question about a patient by a nurse or someone else. When I have my paper scutsheets I can whip them out of my pocket and look at the patient's info in about 2 seconds. With Evernote™ I have to get out my iPad, unlock it, then scroll to the patient's info, which is more cumbersome. By that time the nurse already has been talking for 30 seconds."

The final critique cited during the Evernote™ trial period pertained to keeping track of tasks that needed to be performed for each patient. Often during the rounding process, the senior team member may quickly list multiple tasks he or she would like accomplished that day before moving on to the next patient the team needs to see. One evaluator described the difficulty encountered in efficiently transcribing these tasks:

> "Speed is my biggest issue. I cannot type fast enough to really make this efficient while actually rounding – at least not when compared to quickly writing something down on a piece of paper when it is dictated to me on rounds."

3.5 Scutsheet™ (iPhone, iPad)
Overview
Scutsheet™ is available on the iTunes store for both iPhone and iPad. As suggested by the name is an electronic template or "scutsheet." Scutsheet Lite™ is a free version allowing users to track a single patient, and the full version allows for an unlimited patient census (retail price: $9.99) [7]. Users who create a new patient record are prompted for demographic data in a separate window that is subsequently minimized, revealing a template for vital signs, lab values, radiologic studies, and a free-text note section (▶Figure 4). Additional scutsheets may be added to an individual patient record and users can navigate between scutsheets via a scroll bar at the bottom of the screen. A "Timeline" tab at the top of the screen also offers the option to document significant events during the hospital stay.

Strengths

Scutsheet™ shared many of the strengths of the paper-based template, including organization and clarity. The electronic nature of Scutsheet™ allows for data retention across multiple hospital days, as students are able to add an infinite number of additional scutsheets and scroll between them rather than overwriting information from the previous day. Four students also felt that their work was more secure with the electronic format, as they felt they were less likely to misplace their phone or tablet than they were to lose a piece of paper.

The template form also increased completeness in pre-rounding assessments, and several students praised the program's prompts for times associated with studies performed. One student recalled:

> "With the paper template I always forget to write down what time the labs were drawn and occasionally have copied down old labs in the morning by mistake if the new ones hadn't been drawn yet. The prompt for the time forces me to double check this and avoid embarrassing mistakes on rounds."

Scutsheet™ also makes excellent use of its user interface to overcome the perception of overly condensed or cluttered fields, which was previously noted as a limitation for the paper-based templates. For example, patient demographic information is initially entered when creating the patient record, but subsequently hidden from view to allow the maximum size of the remainder of the template, which contains entry forms for pertinent pre-rounding information. In addition, when entering numerical data on the iPad™ a small pop-up calculator interface is shown, allowing most of the background window to remain visible.

Limitations

Scutsheet™ is a superb application that was very pleasant to use overall, but students continually felt limited by the lack of customization. When students needed to enter data for which a field was not offered, they did so in the free-text space at the top of the template. However, this space is small, relative to paper-size constraints, and not ideal for visual representation of objective data.

Furthermore, the application does not offer space for annotating a physical exam, forcing the evaluator to annotate in the same free-text section. The accurate reporting of physical exam findings is critical and can be a challenge to fully recall findings when rounding on several patients. This

would be a meaningful addition to the template, ideally implemented in a pop-up box and offering a means of documenting changes in exam findings chronologically.

The ultimate limitation of Scutsheet[TM], however, is that information is solely accessible on one device. This prohibits users from copying any notes during their pre-rounding process into their progress note in the patient's permanent electronic medical record. Additionally, if a user has the program on both iPhone and iPad, the two applications do not communicate with one another. Consequently, while the application certainly facilitates organization during the pre-rounding process itself and helps avoid data loss, it offers few advantages over paper-based templates in saving time or improving efficiency.

4. Discussion

A limited number of studies evaluating the impact of electronic medical records on the pre-rounding or rounding processes currently exist. Even fewer address the use of mobile technology in this context. A recent study by Wohlauer et al. describes the development process of an electronic system to facilitate transition of provider responsibility during morning rounds, reporting moderate decreases in time spent pre-rounding and decreased rounding errors [3]. An increasing number of both medical schools and residency programs are offering mobile devices, such as the iPad, to their trainees [9–11]. Implementation of virtual desktop infrastructure (VDI) software on these devices creates a personalized workspace for each individual and simultaneously allows institutional oversight via information technology (IT) specialists, who ensure the security of patient information and, if necessary, modify the user's workspace without physically acquiring the device [12]. While this technology enables students and residents to securely access clinical software from their mobile devices, VDI technology is inherently limited, as it is optimized for a desktop computer screen rather than the varying sizes and resolutions offered by mobile devices. At our institution, several residency programs offer iPads[TM] to their trainees, yet we often observe that they are underutilized because our EMR user interface is not optimized for access on a mobile device.

As a result of these barriers, adoption of electronic resources for the organization of daily clinical tasks has been fragmentary. The medical student survey revealed that only 6% of students currently use an electronic means of pre-rounding. This is likely explained that as pre-rounding is not formally taught in medical education and instead modeled off of resident behavior. As students and residents continue paper-based pre-rounding, which unfortunately necessitates at least some degree of duplication of work, as all documentation must eventually be entered into the patient's EMR. In the course of evaluating the Medfools template, Evernote[TM], and Scutsheet[TM] we sought to weigh the benefits and limitations of each method in order to ascertain whether an electronic system is efficient at the present time, and if so to recommend a system based on aggregated feedback.

The results of our trials identified two crucial characteristics necessary for adopting an electronic pre-rounding method. First, a recurring theme emphasized by students was that the method must be easily customizable to enable users on different sub-specialty rotations to tailor their data collection to what is most salient for their patients. Second, it is critical that the user be able to copy or otherwise import their data into the patient's EMR. An electronic system without this ability is no more efficient than any paper-based method. While many of the applications we evaluated provided elegant user interfaces and enabled students to store an endless continuum of data, none were customizable or allowed users to export their data to their EMR. In contrast, the Evernote[TM] web interface provided ubiquitous access by ensuring data was available at all public workstations without requiring installation of any additional software. With these features in mind, we sought to aggregate the feedback solicited in our trials into an Evernote[TM]-based system to store and utilize an infinite number of templates for different clinical scenarios.

The system we propose utilizes Evernote[TM] for its user-friendly organization, support for a multitude of mobile devices and operating systems, and ability to access content through an Internet browser. However, as Evernote[TM] competitors such as Google Keep[TM] [13] continue to improve, we anticipate that the same system can be applied to any cloud-based note taking service with these characteristics.

4.1 Medical Student Recommendation: An Electronic Universally Accessible Template-Based Pre-Rounding System

Overview

The system relies on an organization utilizing two notebooks. The first we entitled "Templates," which serves as a repository for an unlimited number of forms a medical student may encounter in the course of their rotations. For instance, *Surgical Recall* and *First Aid for the Surgery Clerkship* both offer suggested templates for a surgical history and physical as well as progress note templates for students on their general surgery clerkship [14, 15]. Students also have the option to create their own template from scratch or continually modify existing templates. We suggest naming templates in the format "Specialty – Purpose," for instance "Medicine – Admission Note" so that notes from each specialty are automatically grouped together in alphabetical order.

The second notebook we call "Patient Notes," which is a dynamic notebook containing all patients in a student's census. A document in this notebook is created by first opening the relevant type of note in the Templates notebook, copying the entire text of the template, and subsequently pasting the entire blank template into a new note in the Patients notebook. Here we suggest the naming convention "Patient Identifier – Purpose," for example, "Patient A – Progress Note." This nomenclature again ensures that each patient's notes are listed together within the notebook in alphabetical order.

We envision that most patients will acquire two notes during their hospital stay. The first note will include their admission history and physical and, once completed, will simply be retained for reference until the patient's discharge. The second note is a daily progress note that is continually updated each morning in preparation for rounds. At some point after rounds each day, the student would copy the entire progress note into the patient's EMR so that it is permanently documented before the student modifies the note the following morning.

Strengths

This system appeals to both those who desire to retain pen and paper as well as users who would like their notes to be completely electronic. The former could use this system merely as a repository for templates and print a blank template for their patients each morning. The latter will appreciate the enhanced efficiency of needing only to modify the previous day's note with overnight updates. In this way the student will not spend time re-copying the patient's problem list each morning but instead simply provides updates where appropriate. After rounds the student then needs only to log onto a workstation, copy his note into the EMR, and then move on to the next clinical task.

Limitations

The greatest limitation is the danger of "copy forward" from the previous day's note. In order to utilize this system effectively, the student must remain cognizant of this danger and make a conscious effort to ensure each of the patient's problems are fully addressed each morning. Additionally, we have found no elegant solution to implement short-hand diagrams for lab values. Despite a number of attempts to import a diagram into Evernote™ and to design one within the template itself, any marginal successes failed to appropriately copy into the EMR system at our hospital. Recent advances in Penultimate™, a handwriting application that is owned by Evernote Corporation, could hint at more advanced features that may soon ameliorate this challenge [8]. It cannot be overstated that this system is *not* designed as a replacement for the EMR systems in various hospitals. Rather, this system is serves as an *adjunct* to facilitate the daily documentation and organization involved in patient care. It is paramount, furthermore, to acknowledge that Evernote™ is not HIPAA compliant and therefore no patient identifying information should be documented in this system. A recent Evernote™ security breech [16] highlights the importance of remaining conscious of this limitation and taking all necessary steps to de-identify any patient information to ensure patient confidentiality and privacy.

4.2 Study Limitations

Several limitations were present in this study. First, the small sample size of six evaluators precluded a meaningfully objective comparison of the systems. However, the focus of the current study was not

to exhaustively assess the utility of these applications, but rather to characterize the use of current pre-rounding systems and devise a novel electronic system from the preliminary feedback generated in this study. It is consequently necessary to further assess both the utility of and limitations imposed by electronic pre-rounding systems via a prospective study incorporating a large cohort of medical students. Additionally, we did not attempt to control for variations in procedure and user requirements between different clinical services. While surveying students all on the same clerkship would have improved comparability of responses, our approach enabled appreciation of the variations in requirements across a diverse clinical environment. Finally, as medical students we are still early in the course of our training and may rely more on templates for organization and as than residents who have increased mastery of the pre-rounding process. Therefore our experiences and proposed systems may not be as applicable to more senior trainees, and future studies may improve on our initial report by incorporating a cohort of residents and senior physicians in the evaluation process.

5. Conclusion

As paper charts and orders are being phased out and replaced by electronic medical records and computerized physician order entry systems, the opportunities to take advantage of digitized patient information abound. Pre-rounding practices are rarely formally taught and therefore differ substantially between trainees. The ubiquity of mobile technology among healthcare providers allows improved access to EMR documentation and has the potential to markedly reduce time required to prepare for morning rounds, improve efficiency, and reduce errors in clinical documentation. In our appraisal of the current state of mobile applications relevant to the pre-rounding process, no single application was sufficiently suited to the task to earn a unanimous recommendation. Instead, we describe a system of electronic patient tracking using a template-based system implemented in Evernote™ and available across a wide array of operating systems. While a larger trial involving both medical student and resident evaluators is needed to assess the value of this proposed system in the pre-rounding process, it is our hope that our initial study will both assist developers in improving future mobile applications and simultaneously promote awareness among trainees of different methods available to them in their pre-rounding endeavors.

Clinical Relevance
Pre-rounding is highly variable between providers but is a crucial facet of daily patient care. A variety of methods exist to facilitate morning preparation for rounds. Providers should be aware that the advent of mobile technology offers several opportunities to improve efficiency and reduce errors in clinical care.

Conflicts of Interest
The authors declare that they have no conflicts of interest in this research.

Protection of Human and Animal Subjects
This project was reviewed and approved by the Johns Hopkins Institutional Review Board.

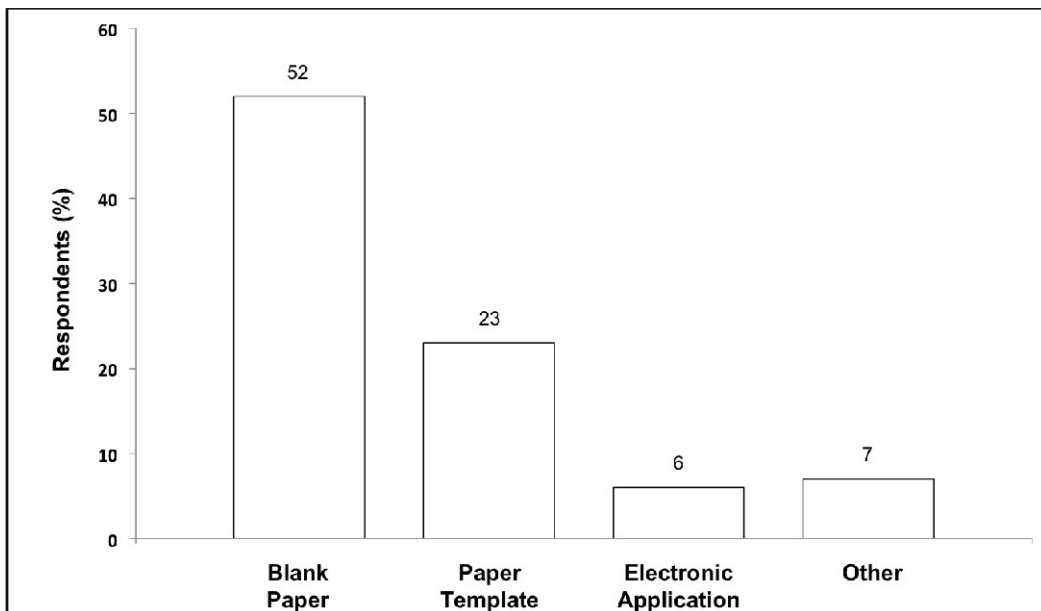**Fig. 1** Medfools.com "Medicine Scutsheet Style 2"

Fig. 2 Survey results assessing pre-rounding systems in current use by third and fourth year medical students. Results are reported as percentage of respondents.
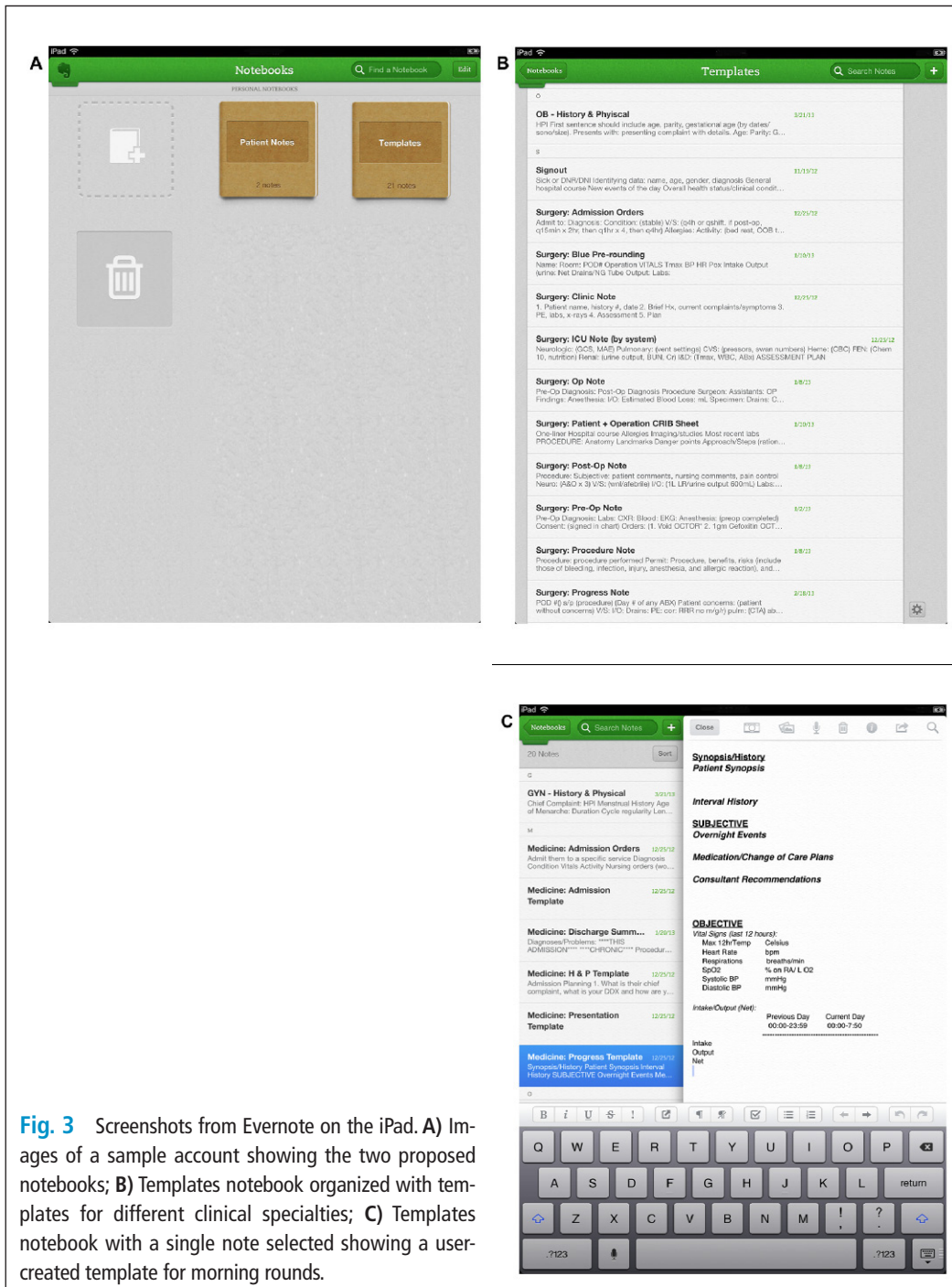
Fig. 3   Screenshots from Evernote on the iPad. **A)** Images of a sample account showing the two proposed notebooks; **B)** Templates notebook organized with templates for different clinical specialties; **C)** Templates notebook with a single note selected showing a user-created template for morning rounds.
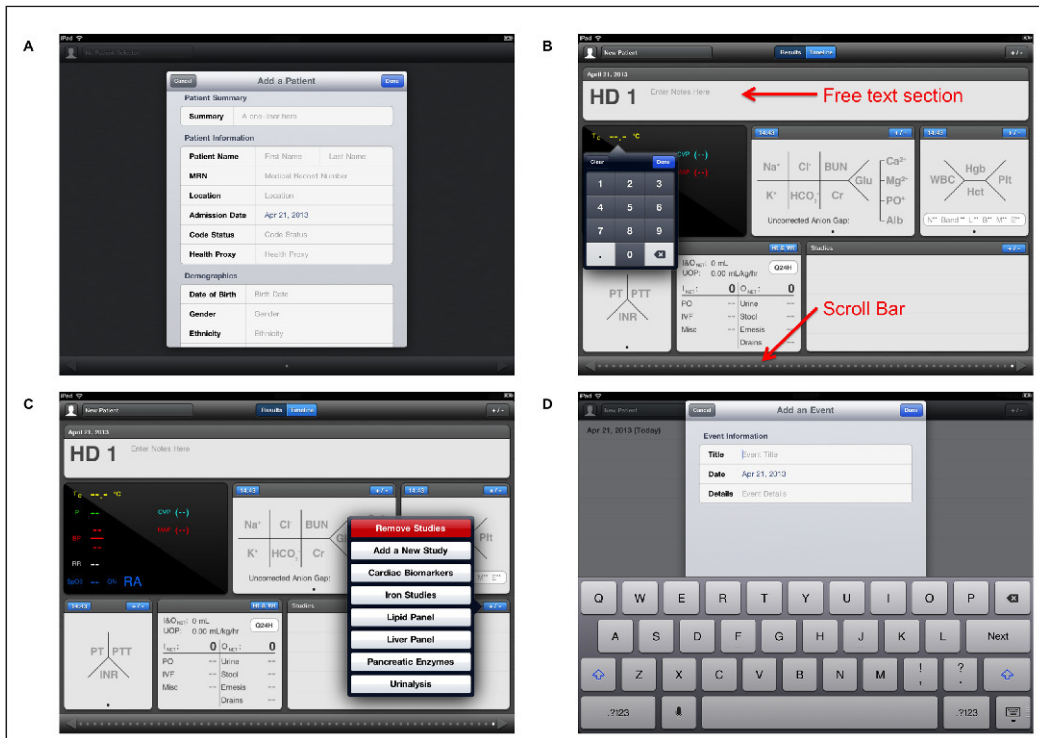
Fig. 4   Screenshots from Scutsheet on the iPad. **A)** Pop up window for new patient information; **B)** Main user interface where students can enter objective data and free text, or scroll between multiple Scutsheets created for a patient; **C)** Demonstrating ability to add new studies for a patient; D) Documenting an event pertinent to the patient's care.

Table 1   Applications on the iTunes store considered for initial review.

Appli-cation	Operating System (Devices Supported)	Developer (version)	Description Cost	Strengths	Limitations	User Comments
Scutsheet	iOS (iPad)	Ellipticase, LLC (v1.2)	Template for recording vitals, labs, studies, and progress notes. <u>Cost:</u> Lite version (free) allows tracking of single patient, full version available for $9.99.	See results section	See results section	See results section
Patient Tracker	iOS (iPhone, iPad*) *app will run in iPhone mode on the iPad, does not have dedicated iPad version	Market-Wall.com (v.1.5)	Not to be confused with a second application below with identical name, this application allows users to create a patient list, enter H&P, and record daily notes in SOAP format. <u>Cost:</u> $9.99	• Ability to quickly switch between patient's H&P and list of daily progress notes • Checklists integrated into physical exam for H&P	• Lack of dedicated iPad version • Majority of app is simply free-text boxes with a heading • No physical exam section in daily progress note • Info stored locally so can't access info between your iPhone and iPad • Inability to view the entire note at once rather than previews of each of the entry fields	"I was really excited by this app when I bought it and very disappointed when I actually started using it. The biggest downside is the app can't rotate into landscape mode on my iPad. Since 90% of the app is just text boxes for the different components of the H&P, this is a profound limitation."
Roundslist	iOS (iPhone, iPad)	Tipirneni Soft-ware, LLC (v1.1.0)	Create inpatient rounding reports and instantly disseminate and update patient data to all users subscribing to the company's encrypted portal. <u>Cost:</u> Free	• HIPAA compliant • Training video detailing application features • Ability to schedule tasks and mark completion status as red (incomplete) or green (completed) • Ability to capture a photo and send to other team members	• Limited applicability to the pre-rounding process for a single student • Requires all team members to register and install application on their device • Application aimed at facilitating communication amongst team members, but requires all team members to have an iOS device due to lack of Android support	"The ability to have red/green lights to determine when there are tasks to do for a patient is really nice and something that a non-electronic or non-app method does not offer. Also, that a patient's list changes from blue to gray once you denote that you've visited them that day is also helpful and is yet another example of how this technology nudges you to make sure all your to-do's for the day are completed"

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Table 1 Continued

Appli-cation	Operating System (Devices Supported)	Developer (version)	Description Cost	Strengths	Limitations	User Comments
Progress Notes	Android	Webpatient.net (v2.0.1)	Create daily SOAP notes on patients, trend vital signs, and send encrypted emails. <u>Cost</u>: $9.99	● SOAP note template is modifiable ● Ability to email information allows users to copy into the hospital's EMR	● No iOS support severely limits utility for medical students ● Lack of task list feature for each patient	*"It's a very complete application, with a wide variety of fields that can be modified for each patient. By far, the best feature of the software, however, is that you can email yourself the note. Not only does this save a tremendous amount of time, it helps to eliminate the redundancy of inputting patient information twice"*
Patient Tracker	iOS (iPad), Android	Weblineindia (iOS v2.0, Android v.1.1)	Create rounding lists and input vital signs and lab information. <u>Cost</u>: Lite (free), full version available for $9.99 through in-app purchase	● User interface designed to facilitate numerical entry of vital signs and lab values ● Ability to enter and organize patient medication list	● Limited utility beyond recording basic vital signs, lab values, and patient medications ● Inability to enter free-text for past medical history, physical exam, and plan	*"The application seems most suited to recording vitals. I did not seem to find valuable functionality for keeping track of daily events, imaging studies, etc. Ultimately I was not really able to use this for much on the wards and had to write out most of my rounding information by hand."*
Scutsheet Beta	Android	Anfani, LLC (v1.0)	This application is unaffiliated with Scutsheet for iOS and is limited to the Android operating system. Seems to be a preliminary version while the company develops a paid version, with a simple list of text boxes in which users can enter patient information. <u>Cost</u>: Free	● Free, with hope for future improvements in user interface and expanded functions	● Relies exclusively on free-text entry ● Text boxes do not expand to show the full text entry, and it is very difficult for users to scroll within the text entry field ● Inability to modify the patient's date of admission	*"This application is clearly a preliminary version consisting solely of text fields with very limited clinical appeal at the present time."*

Table 2   Results of pre-rounding survey by medical students

	Process	System	Strengths	Limitations
Student A	• Find nurse for overnight events • Scan objective data on computer • Go see patient • Copy previous EMR note and update with today's information immediately after seeing patient.	Mental	*"I track more things in my head which lets me spend more time with the patient, rather than spending 80% of my time at the computer."*	• Daily copy-forward of information • Information not available on person throughout the day • More difficult to see multiple patients and accurately document
Student B	• Find nurse for overnight events • Copy objective data onto paper SOAP template • Go see patient • See other patients • Write up all notes for each patient	Paper SOAP template	*"I just make little shorthand notes to myself to jog my memory for each patient so that I can come back and write notes later in the day, which saves me time to prepare for rounds in the morning."*	• Potential erroneous recall later in the day when writing notes
Student C	• Find overnight resident • Copy objective data for each patient onto paper SOAP template • Review plan for the day with the daytime resident • Go see patient • Write note after seeing patient	Paper SOAP template	• Organization • Feedback from multiple people on how patient is doing and what plan should be for the day	• Requires a lot of communication and tracking people down in the morning, consequently time consuming
Student D	• Find overnight resident • Print previous day's note from EMR • Copy objective data onto previous note • Go see patient • Review plan with daytime resident • Copy previous day's note and update plan	Print previous EMR note	• Saves time by printing off previous day's note and can simply mark up changes in the plan	• Daily copy-forward of information • Requirement to track down multiple residents in the morning
Student E	• Find overnight resident • Look through previous day's notes • Copy objective data onto single sheet of paper retained for entire hospital course for each patient • Go see patient • Write note	Paper retained for each patient	• Ability to quickly see trends in objective data across multiple days • Constantly available in white coat pocket	• Risk of losing paper in between morning rounds
Student F	• Copy objective data into Evernote document • Look through previous day's notes and copy plans for patients into Evernote • Go see patients • Update plans for each patient after seeing them • After seeing all patients, start notes in EMR and copy new plans from Evernote into EMR	Evernote note for each patient, blank form	*"The template helps make sure I don't forget to ask about certain things, and Evernote saves me time because I can just copy my note straight into the EMR."*	• Daily copy-forward of information • Copying labs and vitals is tedious • Residents/attendings may think I am messing around on my iPad

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