Hand Held Devices for Nursing

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I. A Day in the Life of a Nurse:

Imagine starting your shift by accompanying Mr. Right to MRI before even seeing your other patients. He has to be accompanied by his nurse because he has a cardiac monitor and it is hospital policy that any patient being monitored should always be accompanied by a Registered Nurse. As soon as you return you have to accompany Mrs. Smith to X-ray for a swallow evaluation that takes an hour to complete. By now it’s 1030 a.m. and all your morning medications are due, you print the list for each patient and individually go through the six rights of medication administration. Mr. Right has two new meds that you are not familiar with, so you have to stop and find a computer to research what the indications for the particular drugs are.

This is how the morning starts for most nurses. Not to mention between all of this the nurse may have two other patients that need pain medicine. So in the middle of trying to juggle all these tasks, he or she may have not yet documented on how the patients were received, nor on the pain assessment and interventions carried out. To further complicate things, Mr. Right starts to show symptoms of a stroke and the Orthopedic residents are trying to figure out what was given to the patient in pain because nothing has been documented and they want to make changes to her medications.

Now imagine a nurse with handheld device. While she is sitting in MRI with Mr. Right, she could be recording his physical assessment which would immediately upload to the chart. The residents who just showed up to his empty room can know his status by checking the assessment that was just voice recorded and uploaded to the chart. Also imagine that on your way back from MRI, you get a page that Miss Williams needs a
pain pill. On the same handheld device you can pull up Miss Williams’s medication profile and see what she may have for pain. You retrieve the drug from the med room, scan the barcode on the pill, scan the barcode on Miss Williams armband, you are then prompted by the handheld to rate her pain on the pain scale and then you may sign off the med as being given. Now when you are in the middle of a stroke code, Miss Williams’s residents can see in the chart what she received for pain because the handheld automatically uploads information to the chart. The nurse may also check the indication for the two meds that were unfamiliar to her right there at Mr. Right’s bedside, she could do this by selecting the reference icon that is on the handheld.

Nurses often do not have time to sit and document, or find a computer to research simple things like the time the next pain med is due. That is why nurses need a do-it-all device that they may carry around all day that would enable them to do their tasks more efficiently and effectively.

II. Problem Statement:

*Percentage loss with documentation:*

Electronic devices, hand held or mounted devices, are used in every industry to improve the productivity. Loss of documentation is attributed as one of the key criteria in poor quality of healthcare services. Most of the time nurses work from memory to perform next steps and the care provided is assumed to be complete when the final step of the care is completed. Studies have found documentation is a key issue in the healthcare service. Here are some examples,

1. 38% documentation error in surgery
2. 11% documentation error in pediatrics
3. 13% documentation error in primary care

There are many handheld devices used in the health care environment that addresses the issues surrounding documentation. Many of the devices are based around the day to day activities of physicians and not nurses. Also, most of the handheld devices are not flexible enough to support the different applications out there for nursing.

**Rate of nursing shortage:**

A recent article from American Association of Colleges of Nursing reports nursing shortage in 2025 will be 500,000. Even though the enrollment in nursing programs had increased, the number of RNs employed in the hospitals had significantly reduced because of high stress levels and low job satisfaction. Thus the quality of the patient care had reduced. A survey reported in the December 12, 2002 issue of the New England Journal of Medicine found that 53% of physicians and 65% of the public cited the shortage of nurses as a leading cause of medical errors.

**Medication Errors:**

Errors in medical records can be very serious if undetected and prevention measures are not made in the process. Medication errors are the most common errors that occur. Medication errors can happen at prescription, preparation, dispensation, administration and monitoring. Nurses play an important role in administering and monitoring the medications. Proper documentation and knowledge are vital for a nurse to provide a quality care to the patient. Reliable solutions using technology will provide nurses with additional tools to make the complex nature of health care delivery safer.
III. Goals for Improvement:

*Improve Patient Care and Safety*

With the publication of “To Err is Human” by the Institute of Medicine (IOM) came the attention onto healthcare safety like had never been seen before. The media, the public, and, to a large extent, the medical profession, seemed to become aware all at once that the problem of patient safety—-injuries to patients from the care that was supposed to help them—is pervasive. Since 1999, when the report came out, we have seen a plethora of information technology innovations introduced that claim to augment and enhance healthcare documentation, which in turn will provide for better quality of patient care. Much of this technology has been aimed at the physician. Although the physician is the team leader in patient care, the discipline of nursing is also recognized as a key partner in the provision of care. Our product, the Handheld Nursing Device (HHND) is designed specifically with nursing care in mind.

Some technology implementations are so focused on giving all disciplines everything that they need, that they become too burdensome to use. Training is too difficult, the device is unwieldy. What we are focusing on with this product is specifically how can we increase the efficiency of nursing documentation to the point that it provides them more time for hands-on-care of the patient. More time for charting. More time for communicating with the rest of the care team, and, of course, with the patient. Although nursing personnel shared in a review of portable devices that “if it really saves time or helps give better care, they would spend the time using it, we still want that training time to be at a minimum.
Creating a device to ease the process of charting for nurses will enhance the delivery and outcome of healthcare. A majority of a nurse’s time is spent completing paperwork. So much emphasis is placed on accurate documentation that it takes away from hands on patient care. A device that can actually make the documentation process faster and more complete may revolutionize healthcare. One of the issues that creates incomplete or inaccurate documentation is the fact that nurses are so busy going from room to room responding to different patient needs that by the time they sit down to document the days events or a change in a patient’s status, they may have forgotten what took place and the time it took place. If they are able to record an assessment the minute it took place, then this could be immediately commit to the electronic health record. That would eliminate the risk of important observations not getting recorded. Or getting recorded, but not immediately shared with the rest of the treatment team. If documentation is being completed at the end of the shift, which is what happens in most cases, then the doctor may not see the nurses’ progress notes until the next day. However if he or she is able to voice record a change in patient status, or task carried out, closer to the time of the encounter, then that physician would have access to that information the minute it happens and be able to act on it if action is required.

In the past several years, The Joint Commission has developed National Patient Safety Goals (NPSG’s) that relate specifically to high-focused areas of improvements in regard to the outcome of patient care. Patient care has been proven through research to be suffering because of inadequate or ineffective healthcare services. We believe that the hand held nursing device (HHND) will address many of the NPSG’s that The Joint Commission has identified as warranting a focused attention by the healthcare industry. One of the first patient safety goals is improving the accuracy of patient identification
through the use of two patient identifiers. The HHND will contain the functionality of bar coding. All patient hospital identification bracelets will be bar-coded. At times of medication pass, the nurse will scan the medication and the patient. The device will contain a RFID scanner that enables nurse to scan the ID bracelet while the patient is sleeping without waking them up.

Another focus of the NPSG’s, is to improve the effectiveness of communication among caregivers; specifically when the nurse receives telephone orders from the physician. The nurse will dictate the telephone order into the HHND, read back the order she just dictated, and when through with the patient encounter, she can commit the order and have it uploaded directly into the EMR so when the physician is ready, he can sign off on it. Also, the order will upload into the pharmacy module of the EMR as well. This will reduce transcription errors. And all of this can be down away from the nursing station, thus not tying the nurse to one area and allowing them freedom for mobility.

Patient hand-off, when staff are changing shifts, is another very important goal identified by The Joint Commission and is a feature that is included in the HHND. The HHND will be programmed to take certain dictated items and hold them in a queue that will be uploaded at the end of the shift to a change of shift document. That document could be then read off at the end of the shift. This would save the nurse from having to remember certain details about encounters or having to write them in a separate report format. Have you visited a hospital room recently and seen a leaf on the outside of the door. The leaf may be there as part of a hospital’s falls prevention program which is another Joint Commission requirement. The HHND would be used to capture assessments in various areas, risk for falls being one of them. This would improve the capture of the risk for falls documentation and communicate it to all care providers. This
could be one of the areas that would load into the hand off communication queue for the next shift. There is also a requirement for hospitals to identify safety risk inherent in it patient population, specifically to identify individuals at risk for suicide. This would be another area that could be monitored by nursing and information could be uploaded to hand off communication nursing report at the end of the shift.

The IOM report estimates that 44,000 to 98,000 people each year die from medical errors. With this project we will take a look at how errors are caused, through legibility, worker fatigue, poor communication and show how the HHND could improve the capturing, storing, and transferring of data to improve the outcome of the patient encounter.

**Improve Job Satisfaction**

Given the ongoing and serious nursing shortage many studies have been conducted, identifying areas of dissatisfaction for nurses. One such area identified surrounds the cumbersome nature of nursing documentation of patient care. Nurses spend approximately 15%-25% of their workday documenting patient care and in some nursing areas, such as intensive care units or critical care considerably more. Many nurses have the perception that this documentation is unnecessary or redundant and takes away from their ability to administer direct patient care.

Fatigue is also another issue nurse’s face at the end of a shift if they have been on their feet and running around for half the shift and then the other half is spent straining their eyes in front of a computer to complete charting. This also contributes to issues with documentation, especially if it is left until the end of the shift when the fatigue from running around kicks in. They sometimes just try to get something on paper before they
go home, and then documentation is usually not done properly. If they are able to voice
record assessments as they go, this would allow them time to actually take a coffee break
and, in turn, eliminate fatigue.

The Article “Value of wireless personal digital assistants for practice: perceptions
of advanced practice nurses” touted many positives that were identified by nurses that
would enhance the work environment. The freedom and mobility that such a device
would provide would make the day less demanding with fewer trips to and from the
patient room to computer, or push around a “computer on wheels”. The large volume of
up-to-the-minute clinical references that would be available on such a device would make
looking up information easier; again less back and forth from room to computer. Access
to email, text/graphical messaging and web-based services “at the tip of the finger” are all
seen as positives in the eyes of the nurses.

**Increased Productivity**

As indicated earlier, with the availability of hand-held reference materials, staff
are spending less time going back and forth from patient room to nursing station. The
HHND will have an all-in-one medication administration module that will include bar
coding for efficient medication administration. If the patient asks a question related to
the medication and the nurse requires further information, he/she only needs to use the
device to look up information in the drug reference.

The built in templates for nursing assessments, with their drop-down menus
makes capturing of documentation easy and efficient. In addition to the drop-down
menus, there are text boxes to further define healthcare information captured by the
nurse.
Decrease Staff Turnover

With the reduction of overtime, worker fatigue and increase in employee satisfaction, the staff turnover rate will decrease.

Decrease Overtime Costs

In one study, more than 1/3 of the survey participants reported routinely staying beyond their scheduled shift to complete documentation and almost 2/3 of these were paid for the “stay over period”. This study also reported the overall use of electronic documentation was low at 36%. Of those nurses using electronic documentation, most felt that using electronic documentation increased redundancy and time spent on documentation while increasing completeness and quality of the documentation. If hospitals were able to decrease the overtime for the purpose of patient care documentation by ½ hour per week per nurse this could save one state $94,000,000 per year. This would also allow nurses to provide more direct care, which would improve nurse satisfaction and result in retention of nurses.

Enhance Information Technology Services

The HHND will be a great addition to the hospital’s already robust electronic documentation tool chest.
**Documentation Compliance Improvement**

Hospitals are banned from using certain abbreviations, such as, QD and QOD as they are at times, when handwritten, mistaken for each other. They mean two different things. QD means daily where QOD means every other day. That is a major difference when you are dealing with medication orders. The HHND will transcribe these abbreviations out for the nurses, which will save time and increase documentation compliance and reduce medication errors.

**Increase Communication (patient handoff, turnaround time of documentation)**

Out of the IOM’s publication of To Err is Human, came the report, Crossing the Quality Chasm. From this report is a set of six “Aims for Improvement”. Since the release of this report healthcare organizations have attempted to incorporate these into their every day delivery of services. These areas of improvement are:

- Safety: Patients ought to be as safe in health care facilities as they are in their own homes.

- Effectiveness: The health care system should match care to science, avoiding both overuse of ineffective care and under use of effective care.

- Patient centeredness: Health care should honor the individual patient, respecting the patient’s choices - culture, social context, and specific needs.

- Timeliness: Care should continually reduce waiting times and delays for both patients and those who gives care.
Efficiency: The reduction of waste and, thereby, the reduction of the total cost of care should be never-ending, including, for example, waste of supplies, equipment, space, capital, ideas, and human spirit.

Equity: The system should seek to close racial and ethnic gaps in health status.

As you can see, the HHND addresses five out of these six “Aims for Improvement”.

IV. Introduction to Handheld Devices:

Usage of handheld devices, commonly known as PDAs (Personal Digital Assistant) had increased dramatically over the recent years by medical students. A survey by MedCompanion quotes 22% of the medical students use handheld computers and the rest are leaning toward using it. The survey also notes a large amount of medical information is available in handheld format for the medical students to use.

The following are the pictures of some handheld devices. Few of them are a combination of cell phone and a handheld device.
The most common of the handheld devices are Palm and HP iPaq (previously Compaq iPaq). There were multiple versions of the devices available in the market. Some
of the earlier handheld devices like Dell Axim and Sony Clie couldn’t survive after the advent of Smartphones. The smartphones were a combination of phone and a PDA with internet browsing capabilities. iPhone, Blackberry, and some of the cell phones from Motorola, Nokia and Samsung fall into this category.

Palm’s proprietary software was one of the oldest operating systems in the handheld industry. Blackberry also has its proprietary software. Windows Mobile from Microsoft has been introduced in many devices by Samsung, Nokia and Motorola. Symbian is also a proprietary software formed by few handheld manufacturers. Android is an open source software platform available for any handheld manufacturer.

Many of the nursing applications were available in the Palm and Windows mobile operating systems. Epocrates and Skyscape are few are popular ones. These applications have various modules to support different areas of nursing.

V. Benefits and Detractors:

One of the greatest benefits of a handheld device is the added time that nurses have to spend with the patient. According to nursingmanagement.com estimate, nurses spend as little as 15% of their time on direct patient care, but 50% of their time on documentation. Documentation is cited as the core of the nursing process for planning, implementation, evaluation, and assessment of a patient. Nursing processes include well documented information, update of the care provided and what is outstanding, outcomes to care provided and responses to the plan of care, current patient status and assessments, and support decision based on assessments to drive new plans of care. The handheld device enables for documentation to take place real time as well as helping to free nursing staff to spend the majority of time on direct patient care. The reasons of
automating documentation include up-to-date, accurate information of each step of the nursing process which is the power behind safe, and high quality patient-centered care.

The benefits to patient safety and quality of care of implementing a handheld device include the following:

- Allows nurses to realign and track the care process.
- Increased accuracy and completeness of documentation.
- Improves nursing workflow.
- Improved data collection at the point-of-care and facilitates data analysis.
- Access to information and better communication between health care team members.
- Reduction in transcription errors arising from paper based documents.
- Reduction in the time of paperwork.
- Mobility and integration.
- Information for decision making at the point-of-care.
- Accessibility of information.
- Assists in the compliance to regulatory requirements.
- Improvement in the integration of information.

In the paper by Gururajan, Moloney, and Kerr, Drivers for Wireless Handheld Technology: View from Queensland Nurses, the report indicates the benefits of handheld devices for nurses and interviews nurses on those benefits for using the handheld device. These include organization and volume of data, user friendliness, reduction of documentation, quicker response, timelier recording, availability of more time, access of information, and remote monitoring of patients.

Although there are many benefits to handheld devices from the standpoint of patient safety and quality of care, there are also detractors associated with implementing a handheld device. These include:

- Financial costs.
- Security and privacy.
- Nursing workflow can be disrupted.
- User friendliness.
- Reliability.
- Flexibility.
The implementation of a handheld device for nursing staff can become costly including the upfront costs (hardware and software) as well as maintenance and updates. Privacy and security are also a huge investment especially on the liability side if information is illegally accessed or lost. Another detractor with handheld devices has been user friendliness because of the complexity for using the handheld device including keyboards being too small. Flexibility is also of great concern as new software becomes available for greater functionality or new applications and some handheld are not flexible to be able to integrate these kinds of software. For the most part you are at the mercy of the company that provides the handheld device and software. Lastly, with all electronic devices is the concern of reliability as the device goes down for any reason.

In the paper by Gururajan, Moloney, and Kerr, Drivers for Wireless Handheld Technology: View from Queensland Nurses, the report indicates the cons of handheld devices for nurses and interviews nurses on the detractors for using the handheld device. These detractors include lack of user-friendly applications, unreliable technology, substandard testing, and shortage of staff, concerns for security, reliance on technology, training, and coverage of wireless links.
VI. Proposed Device

The proposed devices looks similar to some of the cell phones used by us, but has a lot of features built in to support the day to day needs of a nurse in patient care. The device features a color touch screen, a scanner, a printer, a key pad, a speaker, a microphone, a RFID reader and it is WiFi enabled.

The touch screen on the handheld device can be used both as a screen to display the data or accept input from the user and process it. The basic input that the touch screen could accept are (i) accepting the input from the scanner, (ii) respond to menu items, (iii) navigate to a different display when a certain part of the screen is touched and (iv) send
commands to print, retrieve and submit the records to EMR. The colorful touch screen also provides better visual of the content. Since we have most of the hospital records, devices and equipments bar-coded, the bar-code scanner will help in matching them with the patient accurately to ensure the correct medication is delivered or proper device is used. Each time a mismatched barcode is read; the scanner will alert the nurse and records it in the central database. The summary of those alerts can be reviewed and the erroneous practices can be fixed. At the first scan or a patient’s identification the screen will display the drug administered, allergies and recent events.

The printer would help the nurse to print a new label to be affixed to a medical record, lab investigations, specimens or devices for the patient at the bedside without returning back to the administrative office. Using the key pad at the bottom portion of the handheld device will enable the nurse to enter patient information to be saved in the central EMR system. The key pad can also be used to input text for searching the databases. The color screen and the speakers will make it possible for the nurses to view short medical videos related to procedures or therapy. At times, there will be a need to record verbal messages either received from the patient or by the nurse. A microphone at the bottom of the handheld device will support this feature.

To connect to the databases and the EMR system, the handheld device has built in secured WiFi connection. The software interface will allow the nurse to retrieve or capture the subset of the patient data in the limited screen size. There will be a dictionary browser to search all popular medical dictionaries. The interface application will be built using the open source software Android for handheld devices. This will enable future changes easier and not controlled by a particular vendor.
To minimize the medication errors, some of the drugs and devices already are equipped with RFID. The RFID scanner in the handheld device will work very similar to the bar-code scanner to ensure the drugs are administered accurately. The advantage of RFID over bar-code scanner is that it can scan out-of-sight RFIDs like ID-s attached to patient’s wrist without disturbing the patient who is sleeping.

VII. Return on Investment

Return on Investment is used to determine the point at which the new technology has paid for itself and the savings begin. With the introduction of the handheld device, a 300-bed facility would realize the Return on Investment within the first month of use by decreasing the amount of overtime per nurse required to complete documentation beyond the scheduled shift. The annualized savings for the introduction of the device exceeds $1 million.
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### VIII. Summary

Imagine the morning nurse starting her shift by getting the report and checking that her handheld device has her patient assignment and is fully charged. Immediately post report she leaves the unit to take Mr. Right to MRI, where she is able to voice record Mr. Right’s physical assessment while she waits. After signing off on the assessment it immediately uploads to the EMR. While on her way from MRI, she receives a page that
Miss Williams needs pain medication, she accesses Miss Williams medication record on her handheld device, which lets her know what pain medication Miss Williams is due to have. She then obtains the medication, scans the patient barcode and then scans the pill. The handheld prompts her to do a pain assessment which gets uploaded to the EMR.

While administering medications to Mr. Smith, she will be able to reference the medication she is unfamiliar with by touching the reference button on the medication list. Basically, the majority of the tasks that usually consumes her day may be done on the handheld device. Because she is able to voice record assessments as she goes about her day, she is able to leave work on time, and with piece of mind knowing that her risk of making a medication error has greatly been decreased and that her documentation is accurate and up-to-date.

A nurse using the handheld device would be able to chart while waiting for a patient in a diagnostic procedure room, he or she would be able to access a patient’s medication profile without having to have to wait to find an available computer, and the chart will reflect real time assessments because of the voice to text and RFID barcode scanner. With this new technology there will be less money spent on overtime salaries, there will be an increase in patient safety which would in turn decrease liability and increase the outcome of patient care.
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