What Difference Does a Form Make: Redesign and Evaluation of a Form for Documenting In-Hospital Cardiac Arrest

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A dissertation
submitted in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy

University of Washington
2013

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Program Authorized to Offer Degree:
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Abstract

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The real-time documentation of medications and procedures is an essential part of managing patient care during in-hospital "code blue" cardiac arrest emergencies. Care providers have voiced dissatisfaction with the existing code blue documentation form. To address this problem, a mixed-methods needs assessment was used to describe the problems of usability and completeness. Based on the results, the documentation form was redesigned and then assessed through an evaluation study.

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Acknowledgements

This dissertation has been a long process, and it could only have happened with the help of the many people who supported me along the way. This includes everything from research assistance and funding to moral support.

I want to thank the members of my graduate committee who made sure that the process kept moving forward. Fred was the anchor who kept me pointed in the right direction, and Brian reminded me that you just have to do things and not overcomplicate them. David C. provided the extra bit of informatics focus that helped bring the whole thing back on topic. David F. reminded me that the project had broader implications beyond just the emergency medicine realm, something I sometimes forgot in my single-minded focus on cardiac arrest documentation forms. Special thanks to Lynne who stepped up at the end, reminding me that the academic purpose of the dissertation was well-bounded and within reach.

In addition to my committee, there were many folks within the academic community who were essential to making sure this dissertation happened. These people include my collaborators in the nursing department, particularly Sheryl and Kim. From the Biomedical Informatics & Medical Education department, Craig and Matt provided assistance regarding everything from the IRB process to statistical analysis. Karen in the design department was critically important, both for her design input and for motivating me to get the project written up in a way that tells a complete story. I also want to thank the patient safety folks at the UW Center for Clinical Excellence who helped me with access to historical records and included me in the code blue review process.

The faculty, staff, and students of the BHI division were also incredibly supportive through the whole process, reminding me that I wasn't alone in my graduate school experience, and that the triumphs and

hardships are a shared part of the academic process. The faculty and staff at the Institute for Simulation and Interprofessional Studies (ISIS) were also a key part of this project. They provided the facilities and expertise needed to create the materials for the evaluation study.

Partial funding for my research was graciously provided by the National Library of Medicine (Training Grant #T15 LM007442), and from the University of Washington Department of Surgery via ISIS. This funding helped alleviate some of the anxiety of being a new graduate student and allowed me the flexibility to initiate my research without the overwhelming worry of how to fund it.

Last but certainly not least, I want to thank my family and friends who were there to keep me happy and healthy despite the rigors of graduate school. They were always there to keep me grounded whenever things became stressful and helped me celebrate each milestone along the way. I truly could not have done it without each and every one of you.

Chapter 1 – Introduction

Physicians and policy-makers hope to improve patient care and reduce health care costs through the use of medical informatics. In the hospital setting, information systems assist with many aspects of care, ranging from diagnosis to record-keeping. This project deals with the documentation forms used to record patient care in real-time during in-hospital cardiac arrest emergencies, also referred to as “code blue” events.

The information requirements during code blue events are different from the information required during regular medical care because code blue emergencies are chaotic, high stress, and time-sensitive. The real-time record of medications and procedures is an essential part of managing patient care. Documentation records also serve an important secondary purpose by supporting administrative functions like patient safety and risk management.

This research also brings into focus the tradeoff between structured and unstructured data which underscores the tradeoff between rapid data entry and flexible data entry. It was hoped that visual design improvements would results in improved usability and a simplified the data entry experience. While the redesign effort succeeded in creating a more usable form, the overall impact on data quality and completeness was limited.

Overview

This research project was conceived in 2008, after the University of Washington hospitals (UW Medicine) had just responded to legal challenges regarding the care during cardiac arrest emergencies. Complaints were leveled in response to patients who were injured as a result of in-hospital cardiac arrest while in-patients at UW Medicine facilities. The hospital risk management staff believed that the physicians and nurses had done everything possible to provide the best care. However, the medical

documentation was incomplete. As a result, the documentation could not be used as a comprehensive record of treatment during the resulting medical-legal dispute.

In response, physicians, nurses, patient safety representatives, risk management, and hospital administrators people at all levels of the hospital organization began to investigate the question of documentation quality. UW Medicine was in the midst of reviewing its code blue response policy, including an overhaul of its recommended care practices, provider training, code cart equipment, and documentation forms. The code blue documentation form served as the focal point of this research project, which consisted of a needs assessment, a redesign, and an evaluation study.

A mixed-methods informatics-based needs assessment, utilizing both qualitative and quantitative methods, was used to thoroughly describe the problem of incomplete documentation. Once the specific problem was described and its underlying causes investigated, the documentation form was redesigned. The redesigned form was then assessed through an evaluation study. Because the later parts of the project relied on the results of the previous sections, this project has been divided into three distinct research activities, each with its accompanying manuscript.

Needs assessment

The first manuscript provides details about the records review, field observations, user survey, and focus group meetings used to assess the existing code blue documentation form. The needs assessment quantified the problem of missing information. The needs assessment also explored some of the reasons why information was incompletely documented, including a mismatch between the flow of a code blue emergency and the layout of the documentation form. Based on the results of the needs assessment, the most promising solution was a redesign of the code blue documentation form. This redesign would

be able to address usability and workflow concerns, while also satisfying institutional interest in updating the form contents to match the current standards of care.

Redesign

The second manuscript describes the iterative participatory design process used to create a redesigned documentation form. Based on usability principles and visual design principles, prototype forms were created and presented to stakeholders during a series of focus groups. These focus groups were conducted to ensure clinical utility and maximize end-user acceptance. The redesign included changes to the layout of the documentation form, which were implemented to better reflect the way a cardiac arrest event unfolds in real-time. In addition to modifying the layout of the documentation form, the redesign also incorporated feedback from a visual designer. The inclusion of a visual designer was based on literature which indicates that improving the readability of a form can affect the form's overall usability. Given the real-time nature of these high-stress cardiac arrest emergencies, improved readability was expected to result in more efficient usage of the documentation forms.

Evaluation study

The third manuscript describes the evaluation study process, including the creation of study materials and the experimental design used to recruit participants and analyze their use of the forms. The results of the evaluation study showed that the redesigned form was more readable, and it demonstrated improved usability. This addressed some of the major complaints attributed to the old code blue documentation forms, such as workflow mismatch and ease of use. Despite this improvement in form usefulness, the quality of the data remained largely unchanged. Some types of data were collected more reliably, but other types of data were still missing. This can be attributed to the tradeoffs when trying to construct a standardized form to collect information about an unstandardized emergency event.

Conclusion

This research set out to identify a problem, devise and implement a solution, and then evaluate the effectiveness of that solution. The needs assessment highlighted the use of both qualitative and quantitative methods to obtain a complete description of the problem, as well as highlight potential solutions. The redesign portion of the project served as a case study to demonstrate the interdisciplinary nature of design, including feedback from clinical domain experts as well as visual design. Finally, the evaluation study demonstrated how the redesign form could be evaluated to assess both its usability and its effect on the accuracy and completeness of data collection during a real-time emergency. In the end, this research employed a wide variety of research and design techniques, from qualitative data collection and participatory design, to experimental design and quantitative analysis of data. Ultimately, this research showed that a redesigned form can improve the real-time usability of documentation in the clinical setting, but a redesign effort is not a complete solution to the problem of incomplete data.

Chapter 2 – Identifying the need for optimizing usability & information capture during code blue events

Abstract

Background: Documentation of in-hospital "code blue" cardiac arrest emergencies supports real-time care, process improvement, and legal accountability. However, existing code blue documentation forms do not capture critical pieces of information, resulting in incomplete documentation.

Methods: This study included a thorough review of the information elements collected on 161 cardiac arrest documentation forms received during the 2008 calendar year. These cardiac arrest events took place at a 450 bed regional teaching hospital in the Pacific Northwest. This was supplemented with qualitative data collected through 22 field observations, 36 surveys, and 3 focus group sessions with nurses and members of the patient safety and risk management staff.

Results: Critical data elements, like patient identifiers, were consistently collected on code blue documentation forms. However some pieces of important clinical information, such as the patient's initial heart rhythm, were provided less consistently (only 75% of the time). Supporting details were reported even less frequently, sometimes as low as 45% of the time. Qualitative data revealed that the mismatch between the documentation and the event flow was a primary obstacle to collecting real-time information. In addition to the assessment of current data collection practices, this needs assessment also collected stakeholder recommendations about potential improvements to the documentation form. Although subjects expressed interest in computerized documentation, this study found that paper-based emergency documentation was considered more accessible, reliable, and faster than existing computer-based documentation systems.

Conclusions: Many stakeholders within the hospital organization rely on information collected during in-hospital cardiac arrest emergencies. In particular, real-time data collection at the bedside has an important impact on patient care. However, this study confirmed that current cardiac arrest documentation is woefully incomplete. This was partly because of the time pressures and chaotic environment during these stressful code blue events. A better alignment between the documentation form layout and the event flow might improve the real-time data collection process. In addition, a stronger emphasis on providing appropriately structured data elements might ease time pressures and highlight the importance of critical data elements. A paper-based redesign of in-hospital cardiac arrest documentation forms is recommended as a straightforward solution to improve the accuracy and completeness of data during these time-sensitive emergencies.

Objectives

During an in-hospital cardiac arrest, often referred to as a "code blue" emergency, the documentation record provides a real-time account of the medications and procedures used at the bedside. It also fulfills a patient safety role and supports financial and legal accountability. Consequently, inaccurate or incomplete clinical documentation can hamper patient care, interfere with efforts to improve patient safety, and impact hospital operations financially and legally. [1–3] Therefore, it is essential to assess the quality, accuracy, and completeness of code blue documentation and how it accommodates the information needs of the people who rely on it.

This needs assessment hypothesizes that there is an information gap caused by incomplete cardiac arrest documentation. This study further hypothesizes that the primary causes of the information gap can be identified and measured through field observations, a records review, a survey, and focus groups with selected stakeholders.

Background

Within the United States, more than 200,000 cardiac arrest events occur within the hospital in-patient setting. [4,5] Hospitalized individuals are at increased risk of cardiac arrest because they are often in poor health when admitted or while recovering from a surgical procedure. Therefore, the need to recognize and properly treat cardiac arrest within a hospital setting is a critical part of safe and comprehensive patient care. These in-hospital cardiac arrest emergencies are commonly called “code blue” emergencies and require treatment by a “code team” comprised of trained healthcare providers.

The code team is frequently follows a set of guidelines released by the American Heart Association (AHA), collectively known as the Advanced Cardiac Life Support (ACLS) algorithms. [6] These algorithms are regularly updated to reflect best-practices, particularly for factors known to improve patient outcomes, such as the timeliness and quality of chest compressions, electric shocks, and medications. Unfortunately, the national survival-to-discharge rate for in-hospital cardiac arrest events remains relatively unchanged despite advances in medical care. [7] Therefore, efforts to improve patient outcomes have begun focusing more on improved communication and documentation. [8,9]

The most critical function of real-time code blue documentation is to track the information needed to determine which medications and procedures should be used. Access to real-time information allows physicians to make informed decisions that can influence patient outcomes. It also serves as an ongoing record for follow-up care and quality improvement, as well as providing a retrospective record of care in the case of an adverse outcome.

The paper forms are based on the Utstein-style template, which outlines the data elements to capture during and after a cardiac arrest event occurs. [10] Despite the availability of the Utstein-style template and previous literature discussing its use in reporting in-hospital cardiac arrest, there has been little

reported work into how the paper record accommodates the information needs of those who use it to record data. Instead, the literature focuses on the role of documentation in supporting practices known to affect patient outcomes. [11–15] The literature also confirms that in-hospital emergency records are often inaccurate and incomplete. [16,17]

The literature on emergency documentation is limited to outcomes measures, discussion of form content, and the potential of technology-based solutions. Prior work in the literature primarily examines the potential of technology-based replacements for documentation, including desktop-based computers and alternative technologies such as electronic clipboards. [18–20] The literature also includes research into automated voice capture as documentation method. However, the literature also cautions that automated documentation systems may not be well-suited for the emergency setting. [21] Specifically, the literature cites difficulties with using automated voice-recognition systems in an emergency setting, since ambient noise can interfere with the ability of an automated system to capture data correctly. [22] In contrast, this research seeks to understand the root causes responsible for gaps in real-time data collection.

Materials and methods

Research setting

This research was conducted at the University of Washington Medical Center, a regional teaching hospital for the Pacific Northwest region with 450 patient beds. During the 2008 calendar year, the facility admitted more than 19,000 patients, who were housed in various in-patient hospital units throughout the facility. The facility included 21 separate patient care areas, each with their own assigned care staff. Each of these units housed a code cart containing medications and equipment, including a set of paper-based documentation forms used to record events during a code blue

emergency. The documentation form was kept within the locked code cart, and so it was only accessible when the cart was unlocked during an emergency. When an incident did not require the use of a code cart, no code blue documentation was generated.

Subject populations

To better understand the role of code blue documentation in the clinical setting, this research began by identifying the groups of stakeholders who use information from the documentation form. These groups were identified as the physicians who use documentation to direct real-time care, the nurses who record information on the documentation forms, the patient safety staff who review each form to assess system-wide quality of care, and the risk management staff who relied on documentation forms to provide legal accountability in the event of an adverse outcome. All of these groups had expressed dissatisfaction with the quality and completeness of existing code blue documentation.

Physician information needs were driven by best practice guidelines such as the advanced cardiac life support algorithms. These algorithms provided the basis for the required clinical content of the forms, such as the time that specific medications were administered. This prompted a records review to determine whether or not essential pieces of information were incomplete and to what extent.

Because the recording nurses were directly responsible for recording the information in a timely manner, they comprised the next group of stakeholders. This research focused specifically on the “STAT” nurses, a sub-group of highly-trained nurses who regularly responded to cardiac arrest emergencies and retained a large amount of institutional wisdom.

Patient safety personnel comprised another important stakeholder group. They collected the forms and reviewed them to assess institution-wide performance. While they did not use the information in real-time, the patient safety staff relied on accurate real-time documentation to support patient safety

initiatives. This use of documentation to support patient safety goals was a driving force for this research.

The risk managers were the last set of stakeholders specifically identified for this research. Although furthest removed from direct patient care, the potential impact of their work on the overall care system made their information needs an important factor in assessing the current documentation form.

By conducting a formal needs assessment of existing documentation tools and processes, anecdotal dissatisfaction was identified and measured. This needs assessment was based on triangulation between multiple complementary methods, including a medical records review, a series of field observations, a survey with qualitative and quantitative questions, and stakeholder focus group activities. This study employed all of these methods to compensate for weaknesses in any single data collection method, allowing for a comprehensive understanding of the documentation process. [23,24]

Records review

A medical records review was conducted to review every code blue record (n=161) during the 2008 calendar year. The entire 2008 calendar year was chosen to compensate for potential seasonal variations in documentation. The documentation forms were made available through the patient safety office, and the records review was conducted there to ensure the security of private patient information. To further safeguard private patient information, identifiers such as name and date of birth were examined but not transcribed.

The presence or absence of data elements was transcribed onto a computer spreadsheet so that the completion rates could be tallied. Completion rates focused on the standardized checkbox elements recommended by the Utstein-style template. These checkbox elements were applicable to all documented cardiac arrests despite differences in patient condition and treatment. The checkbox

elements include administrative information, such as time, date, location, and patient identifiers. The majority of situational data elements were presented as binary choices, so either “yes” or “no” should have been marked during every event. These standardized data elements were tallied to determine completion rates.

Some data elements were presented as fill-in-the blank responses, such as the time when the first electric shock was administered. Unlike the checkbox discussed above, these unstructured fill-in-the-blank items were not applicable to every emergency event. To compensate, the results were normalized to measure completion rates only for applicable events when that information was available. For example, documentation about endotracheal tubes was only examined when the patient care algorithms suggested its use. When applicable for a particular patient, these data elements were tallied to determine completion rates.

The code blue documentation forms also contained a semi-structured “timeline” area for recording medications and procedures. The timeline was labeled with suggested category headings, such as a patient vital signs and administered medications. Because each event was unique and dependent on patient responses, the completeness of the timeline could not be assessed based solely on the records review. Instead, the timeline was examined to see what types of information were consistently collected. In addition to examining the timeline for clinical content, the utilization of space on the forms was examined to detect patterns that might explain documentation workflow practices. This included information noted via free text entry in designated comments areas, as well as undesignated whitespace areas such as margins. The analysis of timeline elements was qualitatively noted and used as the basis for questions during the survey and focus group activities.

Field observation

Field observations were conducted to provide familiarity with the clinical setting and obtain first-hand experience with the workflow processes governing the documentation of patient care. The literature indicated that the majority of code blue emergencies took place during the daytime hours and were equally likely to occur on weekdays and weekends. [25] During the observation activities, efforts were made to blend in with the hospital staff to avoid attracting attention or otherwise disrupting the care process. [26,27] However, it was important to avoid conveying expectations of being able to administer direct care. To balance these needs, the observations were conducted while dressed in a similar manner to hospital administrative staff, and not wearing hospital scrubs or other clothing associated with bedside care providers. A field observation form was developed and used to collect observation notes, including data about interactions between the care providers and the designated event recorder in charge of documentation. The observation data was used to inform the survey design and prompt questions during the focus group activities.

Survey

To supplement the records review and field observations, a survey was employed to collect data about care provider motivations and attitudes towards the documentation process. The survey included qualitative components in the form of short-answer questions. The survey was constructed to gauge user attitudes towards the current documentation process using a series of short-answer questions. The questions were designed to measure the perceived utility and usability of the current paper documentation form, to identify which aspects might be candidates for redesign. In addition to the short-answer questions, the survey included a series of Likert-scale questions. These questions were used to measure stakeholder attitudes towards the importance of accurate and timely hospital documentation (Figure 1). The survey was intended to be completed quickly, to minimize the impact of

this research activity on a subject's work schedule. Therefore the initial draft of the survey was limited to a single demographic question and seven short-answer questions.

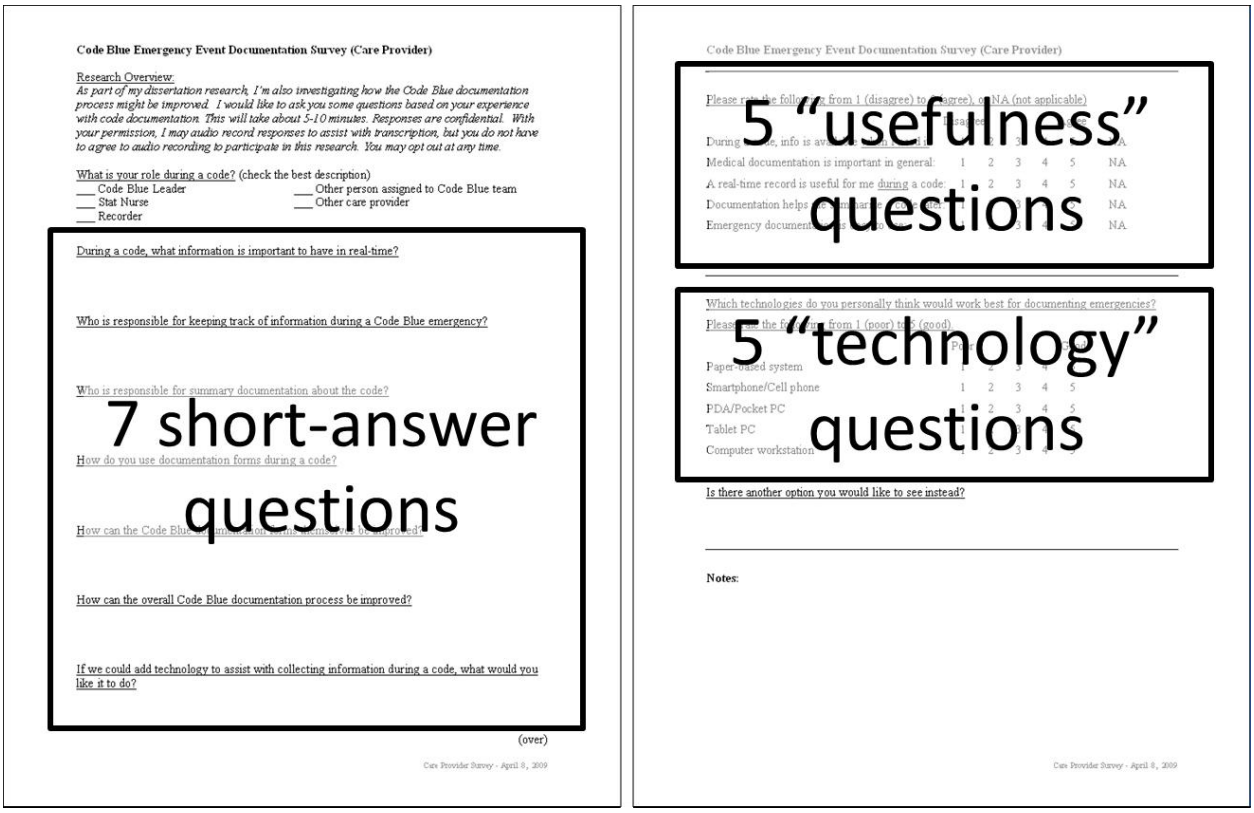

Figure 1: Needs assessment survey consisting of seven short-answer questions, a series of Likert-scale questions about documentation usability and effectiveness, and a series of questions about technology preferences.

The survey was administered to a convenience sample of nurses determined to be most likely users of the documentation forms at the bedside. This included the 12 highly trained STAT nurses, who are registered nurses with extensive critical care training. Rather than being assigned to a single location within the hospital, these STAT nurses respond to emergency events in a roaming capacity. This includes seeing at-risk patients as part of a proactive rapid response team, as well as administering emergency care during cardiac arrest and respiratory arrest events. [28] Because of this, STAT nurses have extensive knowledge and experience dealing with code blue emergencies. The survey was also targeted towards the 300 ICU nurses. Because ICU patients were at greater risk of cardiac arrest, the ICU nurses were

more likely to have experienced a code blue event. Consequently, ICU nurses were likely to have experience using the code blue documentation form.

The survey was pilot tested with two nurses while attending code blue events. The purpose of the pilot surveys was to test the feasibility of conducting surveys within the hospital setting. Specifically, the pilot survey was implemented to examine recorder accessibility, as well as survey length and format. Although the pilot surveys were administered in-person, the survey was converted into an online survey. The reasons for this will be covered in the discussion section. The online version was administered using an access-controlled University of Washington website for security and privacy, and to prevent duplicate entries.

The qualitative survey questions were modeled on the validated Post-Study System Usability Questionnaire (PSSUQ). [29] Originally developed for evaluating the usability of computer-based systems, the PSSUQ survey tool was modified by removing computer-specific questions and rewording them for paper-based documentation. The survey asked participants about attitudes towards the documentation forms and process, to investigate whether socio-technical reasons might explain why the forms were not thoroughly completed. This was accomplished through a combination of open-ended qualitative questions with an accompanying set of Likert-scale questions.

Results were collected as typewritten responses through an online survey tool. Once collected, a basic thematic analysis was conducted for the responses associated with each of the survey questions. This analysis was initially conducted as an open coding exercise. Representative keywords were extracted verbatim from the text responses. These keywords formed the basis of an initial coding scheme. The responses were then axially coded, and related keywords were combined into larger coding categories so that thematically related responses could be clustered.

To supplement the qualitative results, a set of quantitative Likert-scale questions were used to assess user attitudes towards documentation. The questions were formulated to determine how user attitudes and information availability impact the completion rate of the documentation forms. Questions also assessed receptiveness towards technology-based documentation tools. The technologies selected were chosen from previous examples in the literature as well as technologies being tested at other local hospitals. Once the surveys were completed, the results were tallied, and basic statistical analysis was conducted to assess the mean, standard deviation, and confidence interval.

Focus groups

A set of three focus group meetings was held with the STAT nurses (experienced nurses), the nursing practice council group (floor nurses), and a combination of patient safety and risk management staff. The purpose of these meetings was to assess the validity of findings from the records review and field observations by discussing the findings and asking for verbal clarification. This was accompanied by an open solicitation for stories about rare, unusual, or undocumented practices otherwise not captured through the observations or surveys.

Focus groups were chosen to maximize participation among care providers, who are busy and difficult to recruit. The group format also encouraged discussion and provided multiple viewpoints about each discussion topic.

Focus group responses were not audio-recorded, and therefore were not transcribed verbatim. Instead, responses were paraphrased using field notes. These field notes were analyzed to look for patterns and recurring themes, which are presented in the discussion section below.

Results

Records review results

A records review of documentation forms was used to determine which information elements were recorded or omitted. This review was conducted on all 161 records for the 2008 calendar year. Presented here are the most and least available data listed with the percentage of forms containing those pieces of information (Figure 2).

Date of Event	98.76%
ETT intubation	98.67%
Patient name	98.14%

Time of first assisted ventilation	50.89%
Team leader signature	50.31%
Reason resuscitation ended	45.34%

Figure 2: The most and least often supplied pieces of information on the 161 code blue forms collected during 2008.

Although each emergency event unfolds differently, the fields shown above are standardized elements and should contain data for every emergency event documented. Some data elements were administrative details, such as the date and patient name. Other data elements were used to track patient treatment and whether specific procedures were performed. For example, the use of an AED device should have been marked in all cases, to indicate whether it was used or not. A few data elements were situational and are marked with asterisks, indicating that those data elements were normalized and only tallied in situations when that information was provided as a part of patient care. For instance, the time of ETT intubation was only included when records indicated that an ETT was used on the patient.

Field observation results

A total of 22 field observations were conducted between March 2008 and March 2009. Observations revealed that the beginning of an emergency event was difficult to document in real-time, because formal documentation only started once the code cart arrived. To compensate, recorders often retroactively documented the initial care steps, and recorders would often spend time after the conclusion of a code blue event finalizing the record. This was corroborated by feedback provided during the focus group sessions.

Recorder duties were typically assigned to a nurse as directed by hospital policy, but other care providers (such as the pharmacist) sometimes performed documentation duties instead. This indicates that the pool of recorders is potentially quite large, extended even beyond the nursing staff.

The observations also highlighted consistent problems with crowds and noise, with as many as twenty people in attendance. Overcrowding interfered with verbal communications due to excess noise and simultaneous conversations occurring around the patient. It also interfered with the collection of field observation data, because little space was available in the room for non-participants and observers.

Survey results

The survey generated a total of 36 responses from among the 12 STAT nurses and approximately 300 ICU nurses. These subgroups were the nurses most likely to be involved with the emergency documentation process. The response rate was a small (10%) compared to the subject pool, and this will be considered in the discussion. This sample shows the range of responses for the question about improving the documentation forms (Table 1).

	Mean	SD	CI (95%)
Information is available	3.78	0.80	(3.52, 4.04)
Records are important	4.61	0.77	(4.36, 4.86)
Useful in real-time	4.54	0.78	(4.29, 4.80)
Helps summarize	4.43	0.88	(4.14, 4.72)
Forms are easy to use	2.97	1.11	(2.61, 3.33)
	Mean	**SD**	**CI (95%)**
Pen and paper	3.33	1.17	(2.95, 3.72)
Cellphone	2.80	0.93	(2.50, 3.10)
Pocket PC	2.72	0.85	(2.44, 3.00)
Tablet PC	3.23	0.91	(2.93, 3.53)
Computer workstation	3.11	1.30	(2.69, 3.54)

Table 1: Survey responses on a scale of 1 (disagree) to 5 (agree)

Five of the survey responses indicated that documenters were unhappy with the layout of the existing documentation forms. Responses cited "flow" and "workflow" as points of contention, particularly regarding the large block of checkbox elements near the beginning of the documentation form.

> *"First, the checkmarked sections need to be placed at the end. I realize data collection is important for review, but not helpful during an event. … The forms are very cumbersome and not at all well organized for flow documentation. Most of the information must be filled in after the event." – Subject 36*

When asked about missing elements on the written record, five survey respondents commented that the initial set of checkboxes were often skipped or postponed until after the event had finished. Survey responses indicated that the information in the checkbox section did not always apply to every emergency, nor was it necessarily time-sensitive.

> *"It's different every time and is NOT always predictable. Sequence of events are NOT always the same, it's hard to have a paper with pre-determined lines and boxes for meds." – Subject 22*

The survey results also highlighted the need to identify the information elements that were needed immediately and separate them from the elements that could be filled in after the event. This also suggested that the arrangement of data elements might also affect the way that the forms were filled, and the ease with which recorders could find an appropriate place to write down information.

In addition to issues with the existing forms, the survey also asked participants about the role of technology in the documentation process.

> *"It would be great to have some electronic recording, but the computers are too slow. It would HAVE to be extremely fast and specifically for codes - otherwise paper and pen are the best bet." - Subject 17*

Survey respondents expressed favorable attitudes towards technology-based documentation options. Nine individual participants were particularly interested in directly linking the code blue documentation to the electronic patient record. When specifically asked about technology preferences, nine participants suggested the inclusion of automated recording capabilities, such as audio recording of information, or automated capture of data from patient monitoring equipment.

> *"Voice activated would be cool but realistically, the technology should not be too complicated to make the documentation process more complicated." – Subject 7*

Despite this widespread interest in linking computer-based documentation and automated data collection, five subjects also expressed concerns that existing computer systems were too slow and bulky to be used during an emergency. One subject commented that portable computing systems might bridge the gap between paper forms and desktop systems. However, other subjects specifically mentioned that paper was preferred to computer-based systems. Reasons cited included familiarity with existing forms and processes, as well as availability and reliability.

Participants also cited usability as a problem with existing code blue documentation forms. Specifically, there were two types of comments that focused on usability issues with the existing form: those asking for a simplified form, and those asking for additional space. Those asking for a simplified form preferred the addition of structured elements such as checkboxes, as they reduced the overall amount of writing required.

> *"Revamping the form to make it more user friendly. An example would be to have check boxes where you can add a line for stopping CPR to check for pulse." – Subject 28*

> *"Less writing more check boxes for what has been attempted and times." – Subject 31*

In these sorts of comments, participants felt that the addition of structure checkboxes would streamline the data entry process and improve their ability to capture data in real-time. However, other comments were mixed, asking for more simplicity while emphasizing the need for added whitespace.

> *"Boxes for yes/no or quick questions for example; Intubated? CPR preformed? Did pt have a heart beat? etc. The area for writing meds should be left open. It's not easier to document drugs on lines when you don't remember or aren't familiar with the sheet. It's easier in my opinion to scribe per sequence of events as they happened." – Subject 22*

Taken together, many participants (27%) were dissatisfied with the existing forms but were unsure about how best to fix them. An equal number (27%) wanted improvements to usability, asking for a simplified layout and additional space for data entry. A handful (11%) suggested a computerized documentation alternative, but only if the computers were faster and more accessible.

Focus group findings

The nursing focus groups were scheduled immediately following regular group meetings and were well attended, with a dozen participants at each session. Because of their increased exposure and involvement with code blue emergencies, these sub-groups were considered representative of the potential recorder population. The patient safety and risk management meeting was smaller with a half-dozen participants. Those organizations were smaller and draw from the set of stakeholders who make secondary use of code blue documentation.

The focus group findings were complementary to the qualitative survey results, confirming the concerns about workflow the role of documentation in the care process. The feedback was mostly qualitative reports about critical events and workflow practices, used to identify unusual or undocumented factors that influence the information collected during code blue events. Specifically, nurses said that the checkbox information was routinely skipped until after the event. Nurses also suggested reordering some form elements, such as blood pressure, heart rate, and heart rhythm. This would better meet

expectations about the order of information. Nurses valued the availability of space for free-text comments, but they also expressed interest in minimizing the amount of writing they had to do, such as pre-written medication names. The patient safety and risk managers were more interested in the way that the forms are used after the event, and so they deferred to the real-time information needs of the recorders responsible for capturing information about the types of clinical treatment and the times when they occurred.

Although the initial pool of potential recorders included the entire nursing staff, the relatively low number of events per year (161 events in 2008) and distribution throughout the hospital meant that only a handful of individuals would have direct experience with documentation. This means that training-based efforts to improve documentation would only benefit the small percentage of the nurses who were eventually tasked with recording responsibilities. Policy changes to pre-assign recording duties or otherwise reduce the pool of potential recorders would make a training-based solution more effective. Otherwise, a redesign of the documentation form might be effective if it could reduce the need for specialized training. A redesign might accomplish this by providing more thorough instructions for these uncommonly encountered forms, or by improving workflow compatibility between the form layout and the typical sequences of clinical events during a cardiac arrest event.

Discussion

Taken together, the results of the various research activities combine to create an overall picture of the current state of in-hospital cardiac arrest documentation. The records review reveals that the existing cardiac arrest documentation forms are often missing important pieces of information, including physician signatures, patient survival, assisted ventilation, and endotracheal tube placement and confirmation. This prompted further questions about why those pieces of data were not recorded.

To begin answering this question, a series of field observations was conducted. The field observations highlighted some of the challenges with recording information during emergency events. In particular, the observations revealed that there was a delay between the start of care and the start of recording, which limited the ability of recording nurses to document the care process. This demonstrated that recording nurses must be able to start transcribing information without delay. This is one of the reasons why recording nurses complained that existing computerized documentation systems were too slow for real-time emergency documentation.

Observations also highlighted problems with overcrowding, which created a noisy environment that interfered with data collection. Noise problems would limit the potential use of automated data capture systems that rely on audio-recording. This includes verbally announced medication orders, or verbal confirmation of medical procedures such as intubation or placement of a chest tube. Some types of data can be collected electronically, such as telemetry from monitoring equipment. For example, patient vital signs are monitored electronically for patients in the intensive care units. Some brands of readily available equipment can capture this data electronically right now, but it is limited to proprietary tools and data formats. In addition, there is no single system that currently captures all of the recommended types of data. While the automated collection of patient data would assist with documentation during a code blue event, existing systems are not comprehensive enough to collect all of the currently requested information.

The records review and observations were supplemented with a survey of care providers who were involved with the documentation process. Initial pilot surveys were conducted in-person at emergency events. Unfortunately, a limiting factor was gaining access to subjects, because nurses and physicians were often in a hurry to return to their regularly scheduled clinical duties. This time pressure also explained difficulties in capturing signatures and other post-event information, since care providers

quickly dispersed once the emergency was concluded. The high-stress environment of an emergency situation was also emotionally draining, particularly when the patient could not be resuscitated. As a result, some recorders did not want to be interviewed. In addition, the exact timing of code blue events was unpredictable, and this presented problems with administering surveys in-person. These difficulties necessitated a change in survey methodology, prompting the development of an online survey in lieu of in-person surveys. While less dynamic, they allowed access to a greater number of respondents. The online survey also provided the additional benefit of allowing for lengthier and more detailed free-text responses.

Survey results indicated that recorders treated documentation as an important task, and that they recognized the availability and usefulness of real-time clinical information. This showed that recorders were interested and motivated to capture real-time information, suggesting that problems with incomplete documentation records were likely due to problems transcribing information onto the code blue documentation form. To deal with this, participants suggested workflow improvements, such as moving sections around or rearranging the data elements to conform to expectations about information flow. These conclusions were supported by participant comments about workflow compatibility and ease of use.

The survey and focus groups also asked participants to rate their preferences for a computer-based documentation solution. This was done in response to previous efforts in the literature to develop electronic replacements for pen and paper. Participants expressed interest in reducing the amount of work required to transfer records from paper into the electronic record. However, recorders expressed frustration with the speed and availability of existing desktop computer systems, and a lack of familiarity with portable computing options. This indicates that existing computer-based systems are not well suited for real-time emergency documentation tasks.

For short-term storage of information, pen and paper was preferred for a number of reasons. For example, paper is "always on" and grants the note-taker essentially unlimited space. In addition, subjects complained that carrying a dedicated electronic device was burdensome, and that the ubiquity of paper made it more convenient to locate spontaneously when a note was needed. While electronic documentation can assist with retrieving information later, the literature supports the notion that pen and paper is timely and convenient. [30] However, computing technology continues to improve, and computer-based systems may eventually be able to overcome these shortcomings.

Conclusion

The overall needs assessment process highlighted difficulties with collecting data in the emergency setting, which may indicate why there is relatively little existing literature that examines cardiac arrest documentation. Therefore, this needs assessment was conducted to identify major considerations that affect the documentation of in-hospital cardiac arrest. The needs assessment described the information needs and motivations for several key stakeholders within the hospital organization. These stakeholders included care providers at the bedside, patient safety staff who use the documentation forms to assess hospital-wide care practices, and risk managers seeking to minimize medical liability.

Through a combination of multiple methods, the major themes identified include a workflow match between cardiac arrest care and the form used to document it, as well as an assessment of potential ways to improve the documentation form.

Because this research was conducted at a single institution, the feedback was focused on a particular set of work practices and expectations. This included institutional policies to determine the assignment of recording duties, which limited the potential for a training-based program to improve documentation usage. However, similarities among emergency documentation forms at multiple hospitals suggest that

the methods and findings from this research may be generalizable to other institutions, particularly concerning suggested changes to the documentation form.

The other major limitation of this research was access to care providers, both during and after emergency events. The clinical care setting is not ideal for observation research. While individuals expressed interest in research and refinement of work practices, survey and focus group response was limited to a small fraction of the potential pool of participants. As a result, only a portion of the potential event recorder population participated in this research. This is somewhat offset by recruiting high-experience users who interact with emergency documentation more frequently than the average care provider, but a larger number of responses would have helped to confirm the trends identified through this work.

Despite an interest in computer-based documentation, the results from this needs assessment show that paper is an acceptable technology for emergency documentation. Based on comments and ratings from participants, mobile computers were well-received and are becoming more ubiquitous within hospital settings. However, such systems would have to demonstrate portability, accessibility, and reliability. These issues were cited as the main problems with existing computer-based systems in the crowded emergency setting.

Automated capture of patient telemetry also offers the potential for reducing the documentation burden placed on the recording nurse. Some hospitals are also experimenting with barcode systems for tracking medications. However, for the moment, there are still many types of data that are best collected manually by a live recorder, and paper-based documentation remains an inexpensive and convenient option for collecting real-time data about code blue events.

This research lays the foundations for a redesign of emergency documentation forms. By identifying key issues with the existing forms, changes can be made that reflect the concerns about the contents and layout, particularly as they affect the workflow of individuals tasked with recording information in the emergency setting. The investigation of potential technologies also suggests that paper-based documentation is still viable. These findings form the basis for a redesign of the cardiac arrest documentation forms.

Chapter 3 – Redesign of an in-hospital cardiac arrest documentation form

Abstract

Background: The design of in-hospital cardiac arrest "code blue" documentation forms affects the ability of recorders to collect real-time clinical information. The design of medical documentation forms has traditionally focused on managing the clinical information content of the form, with little emphasis on visual design. This redesign project focuses on both clinical content and visual design, because the time-sensitive nature of emergency events emphasizes the importance of rapid data entry. In addition, the redesign must balance the need for data flexibility with the benefits of structured data entry.

Methods: This redesign effort uses an iterative participatory design methodology. The redesign also incorporated content and formatting directives from physicians and nurses, obtained during a prior needs assessment. Initial redesign prototypes were generated based on usability principles drawn from the information science and software usability literature, as adapted for use with paper-based forms. Early prototypes were enhanced through the addition of visual design feedback regarding the use of typography and visual arrangement. This included careful consideration of the specific order of data elements, and the addition of structured data entry areas to highlight and streamline the data entry process. These prototype documentation forms were presented for feedback at a series of five focus group meetings with nurses, administrators, and other hospital stakeholders who use the cardiac arrest documentation form.

Results: The redesigned cardiac arrest documentation form incorporates content changes, layout changes, and visual design changes. This redesign included the rearrangement of information elements to emphasize different pieces of clinical content. This was based on clinical importance and expectations

about the availability of medical information. Practical considerations regarding hospital form policy also affected the design process, resulting in specific design requirements to enable their use in the hospital setting. The redesign activity resulted in 10 prototype forms, which were reviewed iteratively through a series of interdisciplinary design group meetings. Prototypes were presented at five focus group presentations over the course of ten months. The final result of the redesign effort was a redesigned code blue documentation form.

Discussion and conclusion: This redesign effort serves as a case study for others who may wish to employ a similar methodology to redesign in-hospital cardiac arrest documentation forms. This methodological framework emphasizes participatory feedback and highlights the importance of using information design to combine clinical content requirements, administrative requirements, and visual design recommendations. The redesign process also highlighted the constraints imposed by the need for rapid data entry, and how those concerns were balanced against a request for more writing space.

Background

When a patient in the hospital suffers from a cardiac arrest, this triggers a "code blue" response prompting immediate medical attention from a team of physicians, nurses, and other clinical specialists. These in-hospital code blue emergencies affect more than 200,000 patients within U.S. hospitals. [4,5] Because these hospitalized people are in a more sensitive health state, the survival rate is only 17% [25,31] and remains unchanged despite advances in medical care. [7] In an effort to boost survival rates and ensure that the best care is being given, care providers rely on real-time information about a patient's condition, including the patient's response to medications and procedures. The documentation forms are used to track this real-time information so that it can be used to guide patient care. Documentation forms also enable the hospital to evaluate patient safety trends, and the forms provide a record of care

which can be used by the risk management department in case there is a legal dispute about the standard of care.

Early efforts to design code blue documentation forms were based on an informal approach of examining existing cardiac arrest literature and sample code blue forms. [32] In an effort to standardize the collection of data during a cardiac arrest, the Utstein-style template was developed [10]. However, even with clear specifications about what information was important, the documentation forms were often incomplete. Some pieces of information were unavailable or inaccessible, [12] while other pieces of information were overlooked or forgotten. [33] In response, the Utstein-style template was reduced to emphasize a smaller set of "core" elements. [15]

Although there has been much attention devoted to the clinical content of code blue documentation forms, little attention has been paid to visual design. [34] This is likely because medical forms are designed by clinicians who do not have design training. Clinicians seldom realize the importance of readability and ease of use. These principles are important because collecting information during a code blue event is extremely difficult to the high-stress nature of code blue emergencies. [35,36] This even affects individuals who have received specialized training to deal with cardiac arrest emergencies. [37] Fortunately, the literature indicates that visual design can improve the amount of information collected on clinical forms. [34] There have been some published efforts to improve the readability and clarity of medical forms. However, these efforts focus on improving the way that information is extracted from completed forms, and not how information is entered onto the forms initially. [38–40] Still, the same lessons on readability and clarity are applicable. While every form is different, there are general principles from the design discipline that serve as the basis for form design. This suggests that the inclusion of a designer can improve the overall effectiveness of a form. [41] The visual design literature includes a discussion of specific form elements, including the grid entry area [42] and the use of

typography . Even though this redesign was conducted on a paper-based form, this redesign also drew upon human-computer interaction principles. This was done to take advantage of modern design research, which largely focuses on computer-based systems and the pitfalls of introducing new information systems into the clinical setting. [43] The need to combine clinical content with visual design underscores the need for an interdisciplinary approach to documentation form design. [44]

Motivation for this research

A prior needs assessment of cardiac arrest documentation conducted at the University of Washington Medical Center revealed that existing code blue documentation was incomplete. Stakeholder feedback revealed that documentation was sometimes written on paper towels or hospital scrubs and only transcribed to the official documentation forms after the event was resolved. During the needs assessment, nurses also complained that existing desktop computer systems were too slow and inaccessible to use for computerized documentation tasks during a code blue emergency. This highlighted the need for a redesigned paper-based form.

The decision to redesign the code blue documentation form was driven by concerns at all levels of the hospital organization. This widespread support was critical for convincing care providers and administrators to participate in the design process. Even with the interest and need for an improved code blue documentation form, there is a lack of literature describing the process of creating medical forms. This suggests that medical forms are created by clinicians and administrators based on clinical experience and shared templates. Despite the clinical importance of real-time documentation, the form design process is typically allocated only minimal amounts of time or money. [45]

This article is a case study, recounting efforts to redesign the paper-based code blue documentation forms at the University of Washington Medical Center. This article guides the reader through the

operational process of taking a redesigned form from concept to deployment. Through explaining process, this article also hopes to highlight the benefits of incorporating informatics and design principles.

Design overview

The redesign was conducted by generating an initial set of prototypes based on general informatics usability recommendations. These recommendations include usability heuristics and medical content considerations. This includes Nielsen's design heuristics for user interfaces as applied to a paper-based design, including familiar language, ordering of elements, and clear directions. [46]

The initial prototype forms were then presented to end users at a series of five focus group meetings conducted with hospital administrators, risk management, the patient safety office, members of nursing community, and the medical forms committee. Hospital administrators wanted to improve patient outcomes through more effective use of real-time medical information. Administrators also wanted to standardize the forms between two hospitals in the care network to simplify training. Risk management was looking for stronger documentation as a legal record of care. The patient safety office was interested in improving the completion rate of code blue forms for external accreditation and internal quality improvement. The physicians and nurses at the bedside wanted more user-friendly documentation. The hospital wanted to review and update the entire code blue process and wanted to ensure that the form contents were consistent with updated practice guidelines. Last but not least, the hospital forms committee provided a set of design requirements based on how the forms are scanned into the patient record. Participant recommendations were then integrated into the design, and new prototypes were developed for presentation during subsequent focus group meetings. As the content

design evolved, it was supplemented by input from a visual design expert to produce a polished documentation form.

The content and usability changes were supplemented by visual design expertise from a collaborator in the visual design department. The visual design process included an evaluation of spacing and alignment, as well as selection of appropriate typography. These changes were made to improve overall readability and visual clarity, important given the time constraints during a code blue event and the need for rapid comprehension of the form.

Prototypes and focus groups

Content design was the primary consideration when redesigning the documentation form. The baseline goal of this redesign effort was to ensure that any redesigned form was at least as functional as the existing cardiac arrest documentation form (Figure 3). The existing documentation form was based on a template form published by the American Heart Association, which is itself based on the Utstein-style template for documenting cardiac arrest.

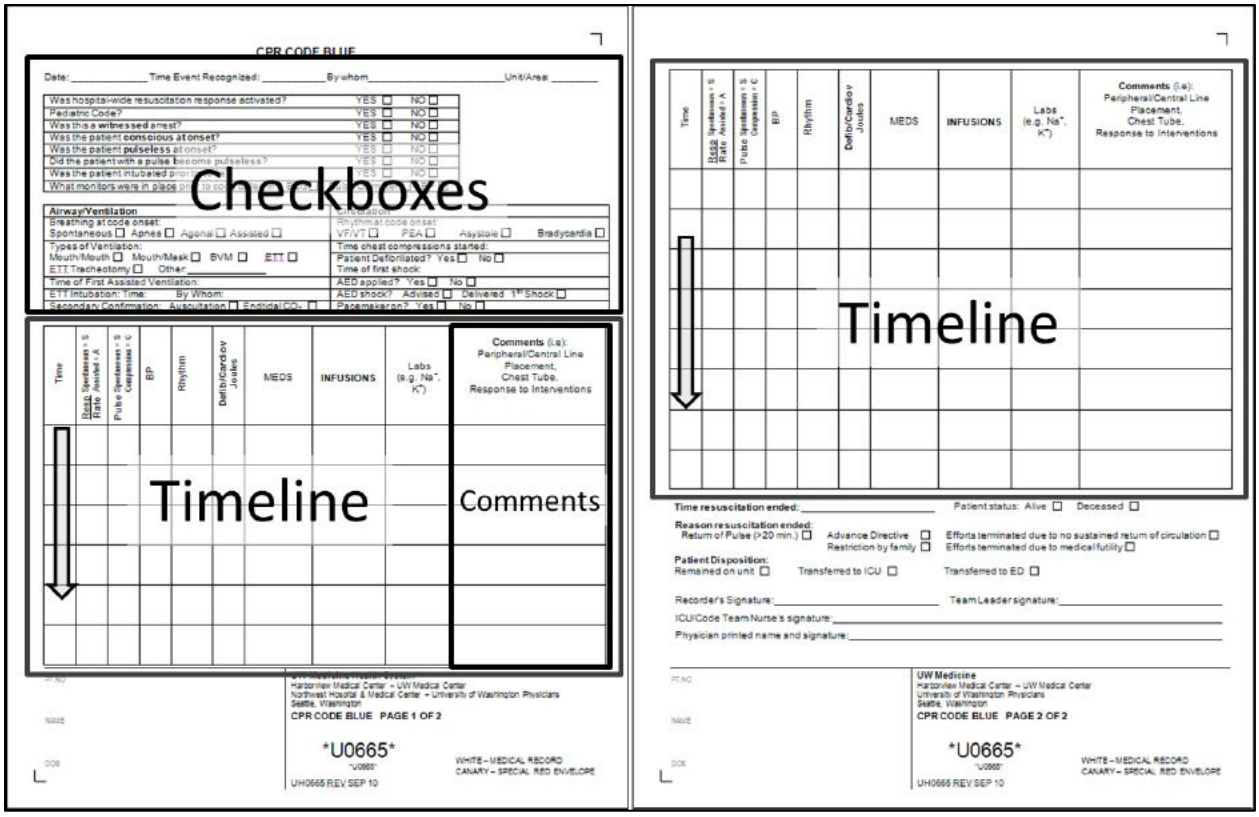

Figure 3: Current code blue documentation form, based on the American Heart Association template.

Visually, the existing documentation form contains a checkbox entry area at the top of the first page, where the recording nurse is asked to provide details about the time and place of the event. The checkbox area also requests information about the patient's airway and breathing status, as well as the patient's initial heart rhythm. The checkbox section is followed by a grid which uses time as the main index, as requested in the far left column. The following columns provide pre-labeled entry areas for patient respiration, pulse, and heart rhythm. This is followed by a column for medications, infusions, and laboratory values. Finally, the last column is a catch-all section for free-text comments.

Initial prototypes

A series of intermediate prototypes were generated and presented to participants at focus group sessions. The initial prototype (Figure 4) retains much of the original simplified Utstein-recommended content, but with some major modifications to the layout.

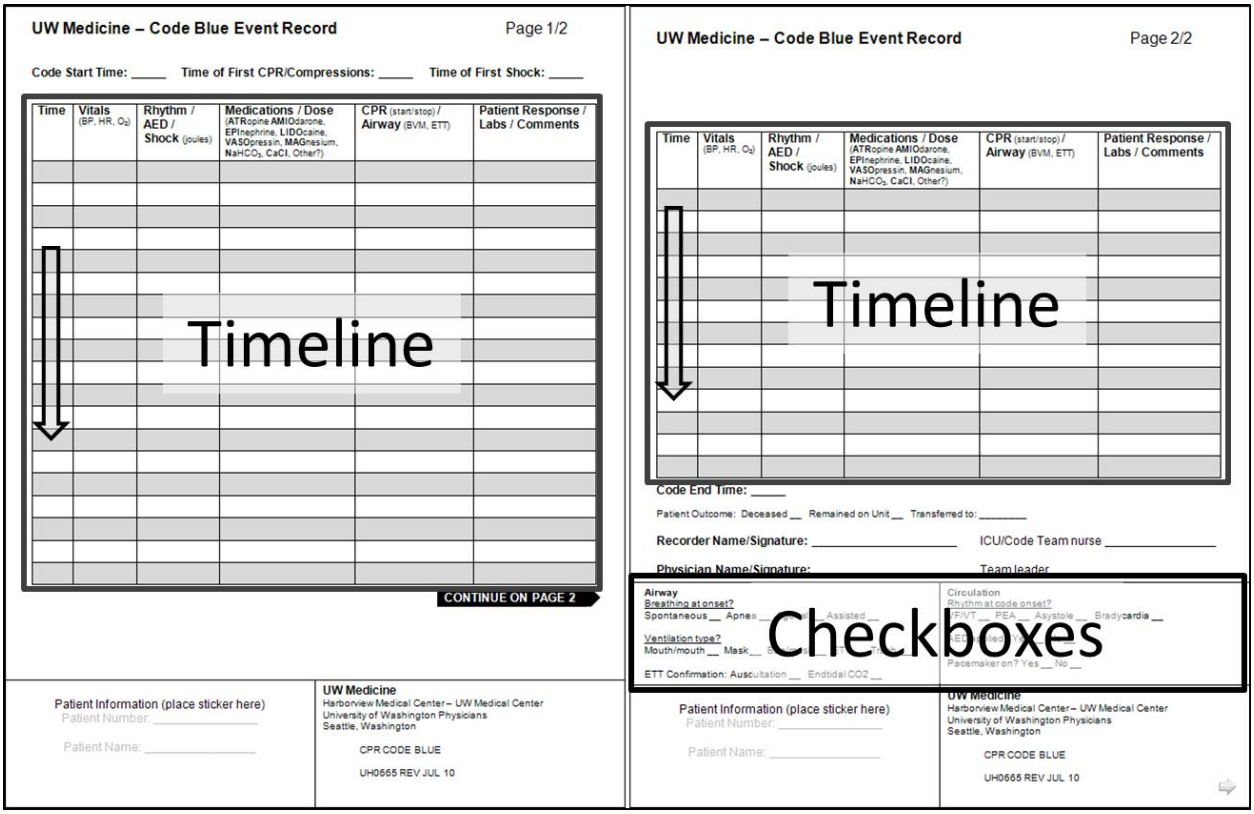

Figure 4: Initial prototype of a redesigned code blue form, based on needs assessment results and basic usability heuristics.

For the initial prototype, the most significant change was the relocation of the checkbox entry section to the end of the form. This was done in response to participant feedback during the previous needs assessment. Recording nurses liked the checkbox elements because they required less writing, but the checkboxes were often filled out at the end of the event. By moving the checkboxes to the end of the form, recorders could delay filling in that information and instead concentrate on documenting real-time events. In addition, the needs assessment feedback also highlighted complaints about unclear

directions on the form, and that recorders felt overwhelmed by the dense group of checkboxes at the beginning of the form. By deferring the checkbox section, recorders did not have to read a large amount of text at the beginning of the form.

Although information requests about the patient's initial condition were moved to the end of the form, specific time-sensitive requests were kept at the top of the first page. This included the code start time, the time of the first chest compressions, and the time of the first electric shock. The form them progressed directly into the grid entry area. The "time" column remained unchanged. However, the other headings were adjusted based on how the existing forms were used. The records review showed that recorders would sometimes ignore the suggested headings in favor of extra space for other information. The column for infusions was combined with the column for medications. This was done to make better use of space by combining similar types of information, and because the infusion column was largely unused. In addition, the "labs" column was eliminated and merged with the comments column. This is because lab values were provided infrequently, so the space was largely used for free-text comments and narrative about the patient response to treatment. Recorders also reported that they often simply attached the lab values as a separate attachment instead of entering the values manually on the documentation form.

By combining some of the categories, this allowed for wider columns. In turn, this allowed for the use of horizontal text labels on the redesigned form instead of the vertical text labels on the existing form. Prior literature showed that horizontal labels would improve the readability of the form. [47,48] To provide even more space for free-text entries, a landscape layout was proposed (Figure 5).

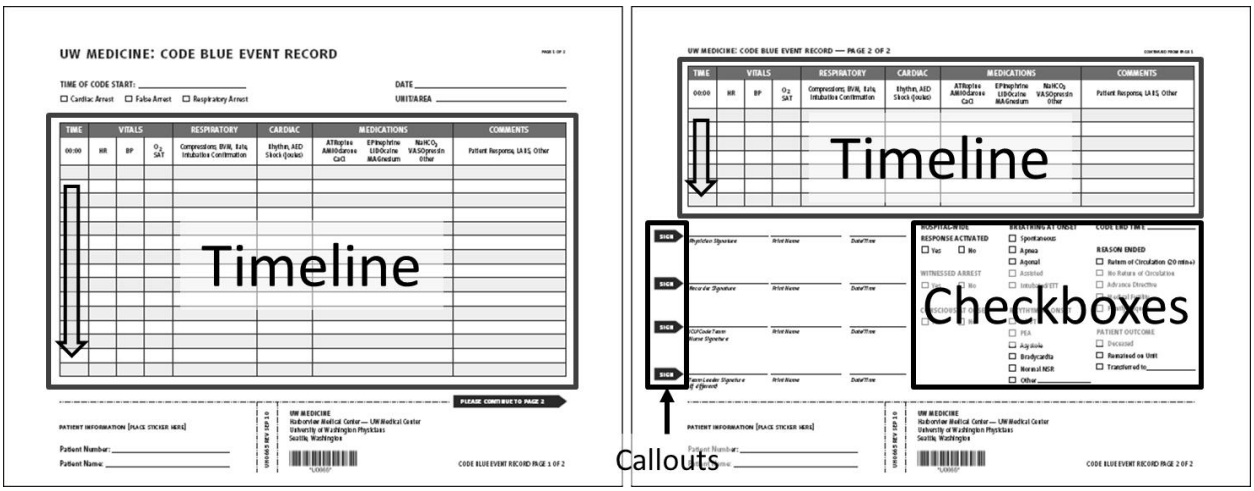

Figure 5: Landscape layout prototype, including modified column headers and callouts.

Some prototypes were constructed using different layouts, such as this landscape-orientation form. This format was chosen to maximize the amount of space available for writing comments associated with a single timestamp. This change was made to encourage greater use of the "comments" field. This was done in response feedback about recorders wanting to write comments and narratives to describe the context around various procedures. This included abridged patient histories and responses to treatment. In an attempt to further improve the on-form instructions about where to record data, additional headers were added to assist recorders in locating the appropriate place on the form to record information like patient vitals and medications. These headers used an inverted color scheme of white text on a black field to differentiate them and make them more visible. A similar callout was added to the physician signature line, emphasizing its importance and providing an additional visual cue. In this prototype, the amount of pre-grid information was further reduced, only asking for the event start time.

Focus group and interview results

Once the initial prototypes were generated, they were presented to stakeholders at a series of focus group meetings. There were multiple stakeholder groups who interact with the documentation forms, including nurses, physicians, patient safety staff, and risk managers. During this redesign effort,

meetings were arranged with each subgroup to discuss their particular information needs, and to determine whether the proposed design changes were effective at meeting those information needs.

The inclusion of multiple stakeholder groups presented a design challenge because each group uses the forms in different ways. Ultimately, because of the unique time-pressure challenges, more weight was given to the design feedback from the nursing group responsible for recording information on the forms. In situations where focus group participants had conflicting preferences about content and layout, priority was given to preferences of the recording nurses.

Nursing groups

Prototype forms were presented to nursing groups during three focus group meetings, with approximately ten participants each. Specific prototypes were introduced, and feedback was directed towards individual features of the redesign.

Initial feedback was in response to the amount of space available for recording information on the form. Nurses preferred larger boxes, particularly for comments. They also noted that space was available for writing down information like medication names and non-standard medication dosing information. The tradeoff for the additional space was a consensus that multiple pages would be required to document a single emergency event.

The need for additional writing space was constant concern. Based on example from other institutions, a potential idea included enlarging the form to a bigger paper size. However, this was ultimately rejected due to potential difficulties accommodating larger paper sizes. Printing carbonless copies would be more difficult, and the forms would not fit on existing clipboards. Other possible issues, such as scanning large-size forms for inclusion in the electronic record, were noted but not insurmountable.

An alternative to creating additional writing space was to reduce the amount of free-text entry required. To text this idea, prototypes included pre-written medication names. Participants responded favorably to changes which reduced the amount of writing required.

Focus group meetings also generated feedback about the specific order of individual data elements on the form. For example, nurses preferred to cluster certain data elements together, such as heart rhythm and pulse. This mirrors the order in which they typically collect information about the patient status. However, the patient safety group also considered moving specific data elements, such as chest compressions, into a more prominent position on the form. This was done with the intention of highlighting those aspects of the care process.

Focus group feedback was used to refine the exact language being used on the form. In some cases this became a clinical discussion about whether certain data elements were redundant. For example, the inclusion of both oxygen saturation and end-tidal CO_2 was debated. This was ultimately resolved by examining hospital practices and institutional reporting requirements. While the design of the form was not intended to drive policy change, it helped to drive that discussion and was ultimately used to reinforce those practice changes. This was done with the understanding that the form might have to be redesigned on an ongoing basis to keep pace with policy changes and medical best practices.

Patient safety and risk management

For the most part, the patient safety concerns mirrored those of the bedside nurses. However, at the suggestion of the patient safety stakeholders, specific types of information were highlighted, either by giving them a separate entry spot on the form, or by moving them into a more prominent location. This was particularly the case for timestamps involving the patient airway, and emphasizing the importance of chest compressions by moving the data request to the top of the timeline.

The risk management information considerations were relatively informal compared to the nursing requirements. In part, this was reflective of their infrequent usage, only coming into play when the legal department needed to reconstruct an event. While they insisted that clinical content and layout were far more important, the risk management stakeholders also requested information about who was in attendance. There was discussion about how best to accommodate this request, since the nursing stakeholders said that this information was difficult to collect in the crowded and noisy care setting. As a compromise, a personnel diagram was added to the design. This served a secondary purpose of reminding physicians and nurses of where they might stand around the patient, with the intention of reinforcing any training they might have received about the code blue response process.

Visual design-based prototype

Following the initial focus group sessions, a visual designer was consulted to further improve the layout and readability of the form (Figure 6).

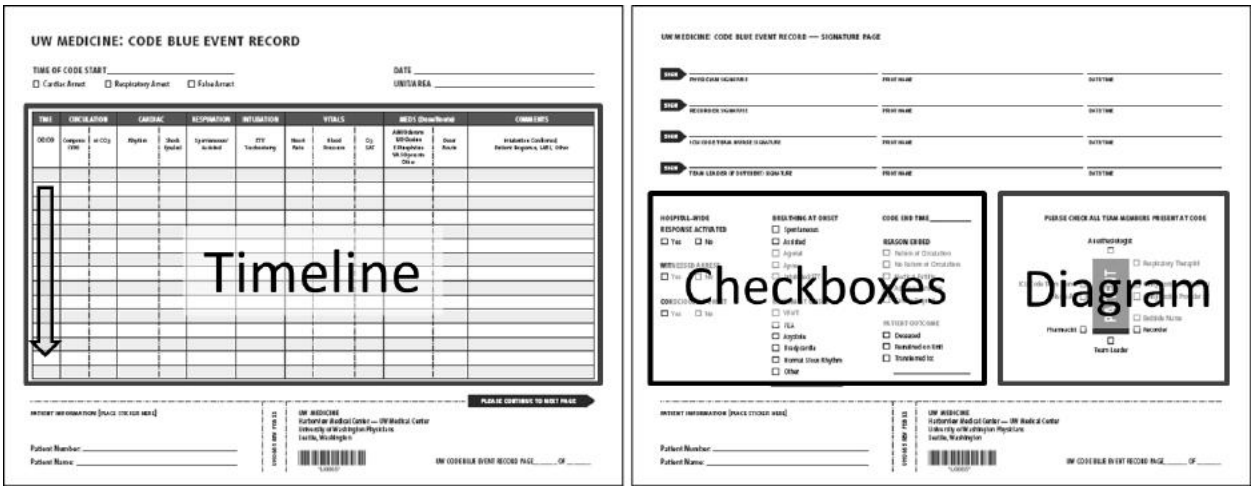

Figure 6: Visual design prototype, including alignment of elements and the addition of a personnel diagram.

A professor from the visual design department was consulted to provide expertise regarding the overall appearance of the form. Changes were made to improve the overall readability of the form. In

particular, elements of the form were aligned visually to increase readability. This included the checkbox section on the second page of the form. In previous versions of the form, each line contained multiple checkbox options. Each information element was given its own line, so that end-users of the form could quickly scan the list when looking for an appropriate choice.

A personnel diagram was also added to the second page of the form. The diagram depicted the recommended arrangement of care providers around the patient bed. This diagram was included for two reasons. The first reason was to provide an additional cue about where people should stand in relation to the patient, mirroring the training provided to physicians and nurses regarding best practices during code blue events. The second reason was to serve as a way to easily document who was present during the code blue event. Risk management had requested a comprehensive listing of attendees. However, feedback from experienced nurses indicated that exact names and arrival times were difficult to obtain. The compromise solution was to provide a diagram with individuals labeled by role and with an accompanying checkbox to confirm their attendance.

The medical contents were also altered. For example, one change was the inclusion of end-tidal carbon dioxide ($etCO_2$) as a measure of patient respiratory response. This change was intended to reinforce a policy change regarding the standard of care. This corresponds to an anticipated change in care provider training about how to measure and document the patient's response to medical treatment.

Forms committee

One discovery from this research was the importance of a previously unidentified stakeholder group, the hospital forms committee. This group does not interact specifically with the code blue form, and so they were not initially considered as an information stakeholder during the prior needs assessment. However, the forms committee input has a significant impact on deployment of new documentation

throughout the hospital. To ensure that changes to the documentation could be implemented in the workplace, the forms committee was consulted during additional focus group meetings.

The hospital form committee guidelines were put into place for both operational and administrative reasons. These reasons affected the layout of the form. Specifically, the forms committee mandated the placement of a barcode in a specific location on the form. This was done to allow automated scanning of the paper documentation form into the electronic record. This restricted the potential use of a landscape-style horizontal layout, since the barcode would interfere with the layout of other elements. The process of scanning the forms also restricted the use of non-standard paper sizes. The paper size was further limited by the need to fit on existing clipboards. For this reason, a standard 8.5-inch by 11-inch sized layout was retained during this redesign.

In addition to the hospital records department, a copy of the form was also required by the patient safety office. To accommodate this requirement, carbonless copies were used to create multiple copies of the form. This was another factor that limited the size and layout of the redesigned form.

The forms committee also placed restrictions on the word processing tools used to develop the form. An electronic version of the form was requested using the Microsoft Word software to allow for ongoing updates and long-term maintenance of the form by any hospital staff member. This greatly restricted the ability to alter visual elements and employ visual design principles related to spacing and alignment. Fortunately, the forms committee agreed to a compromise solution, provided that the visual design department was willing to assume a larger role in maintaining the form and altering it as needed. This allowed for the use of the Adobe Illustrator graphic design software.

Final design

The final form was designed with assistance from a collaborating professor in the visual design division of the art department (Figure 7).

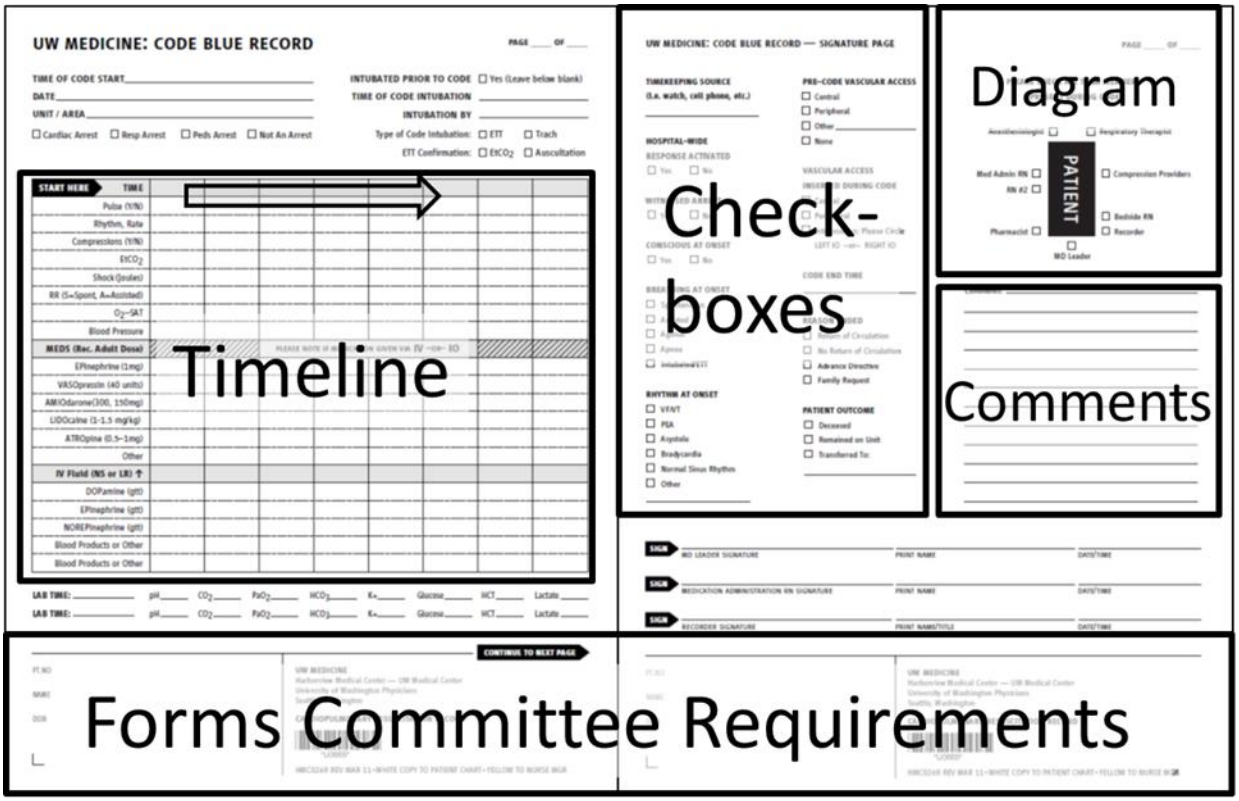

Figure 7: Proposed final design, using a left-to-right timeline and a portrait-layout orientation.

The final form design incorporates many of the changes proposed and discussed with participants during the design meetings. This includes moving the bulk of the checkbox entry fields to the end of the form. Although the portrait layout orientation was kept, the timeline was converted from a top-to-bottom direction to a left-to-right direction, which allowed more room for longer, easier to read horizontal labels.

The major tradeoff was moving the comments area from the timeline grid to the end of the form. The intention was that better use of labeled space would reduce the reliance on free-text comments. To partially compensate for this, several spaces labeled as “other” were included, providing opportunities to include free-text or other information that did not have a pre-labeled entry spot.

Some wording was adjusted, including the elimination of the term “medical futility.” This was done in consultation with clinical specialists and feedback from the medical ethics department, who advised that the term was subjective and provided no additional medical information beyond the existing choice “no return of circulation.”

Discussion and conclusion

Ultimately the redesign process was about balancing multiple stakeholder requirements and requests. These included clinical content requirements, as well as a desire to simplify the form and provide additional cues for data entry. These took the form of structured data entry fields. However, stakeholders also requested additional space for data entry, necessitating the inclusion of a second page despite a stakeholder preference for a single-page form.

Methodologically, this research provides a real-world example of combining a participatory design method with a visual design-centric approach to the design of clinical information forms. A primary theme was the importance of real-time usability with a focus on data entry rather than retrieval. The focus group meetings helped to highlight the main areas of focus, including the timeline layout and the order of data elements. Various prototypes were employed to test new layout choices, such as a left-to-right timeline as compared to a top-to-bottom layout.

Workflow practices were taken into account, both to adhere to workflow expectations, but also to influence care. This included adding and removing medications, to emphasize or deemphasize their use.

The order of elements was modified, both to highlight important aspects of care like chest compressions, and to better reflect nursing expectations about the order and grouping of medical data. Some changes were also made to ensure consistency with the latest care guidelines, such as the use of end-tidal carbon dioxide to measure patient oxygen uptake. In this way, the documentation form was intended to supplement and reinforce hospital-wide code blue policy and maintain consistency with code blue training.

Not all of the decisions about content and layout were unanimous, and each decision had its proponents and detractors. Where participant feedback was mixed, design principles were used to resolve the discrepancy. For example, a left-to-right timeline orientation was chosen instead of a top-to-bottom timeline orientation. The deciding factor in this decision was familiarity with existing documentation, since the computerized charting software used a similar left-to-right timeline orientation.

This research also explored the practical issues that must be taken into account when deploying a redesigned form. For example, the inclusion of the forms committee feedback was a surprise introduced in the middle of the design process. The forms committee requirements placed additional restrictions on the form layout, and how certain pieces of content were included. For example, signature requirements were driven by the legal necessity to authorize the use of medications. In addition the barcode had to be in a specific location to accommodate the process of scanning paper records into the electronic database.

The primary limitation of this work was that it was conducted with the specific needs of only one hospital network, and only for code blue emergency documentation. The specific requirements and preferences may vary from place to place, and the information requirements would almost certainly differ for other types of medical events.

With a redesign of the form completed, the next stage in this research is a comparative evaluation between the old and new forms, to determine if the usability and overall utility of the form has been improved. While the participatory feedback indicates that the redesign is likely to be accepted, feedback from uninvolved subjects will be required to provide a more objective assessment of whether the design effort was successful.

Chapter 4 –Evaluating a redesigned code blue documentation form

Abstract

Objectives: A redesigned documentation form was created to improve usability and capture more complete information during time-sensitive in-hospital cardiac arrest emergencies, also known as “code blue” events. This manuscript describes an evaluation study conducted to compare the redesigned documentation form with the previous documentation form.

Methods: 20 healthcare professionals each watched a pair of pre-recorded videos as part of an evaluation study. Each video depicted a highly scripted simulated cardiac arrest scenario containing 42 recordable medical events. Participants were randomized into groups and asked to fill out either the old form or the redesigned form. Each subject then watched a second video, recording events using the other documentation form. After watching both videos, participants completed a survey to measure the comparative usability and effectiveness of the two forms. Completeness and accuracy were assessed by comparing the documentation forms against the list of scripted events.

Results: The survey responses indicate that the redesigned form was considered more usable, demonstrating statistically significant improvement ($p < 0.05$) in readability and overall usefulness. Both forms displayed a comparable overall ability to capture complete and accurate data. The old form was better when used to capture free text comments about medical procedures and patient responses to treatment. The redesigned form was better when used to capture information about medication dosages and noting who was in attendance. Data accuracy was largely unchanged as a result of the redesign, but the results highlight the differences in documenting structured and unstructured data.

Conclusion: A redesign successfully improved the usability of in-hospital cardiac arrest documentation forms. However, efforts to improve data completeness and accuracy were mixed, with both the old and redesigned forms demonstrating varying abilities to capture structured and unstructured data.

Introduction

More than 200,000 in-hospital cardiac arrest emergencies occur every year in U.S. hospitals (Merchant 2011, Zheng 2001). These cardiac arrest events, also known as "code blue" emergencies, result in a patient survival-to-discharge rate of only 17% [3125]. To improve patient survival rates, it is essential that care providers have access to real-time information about the medications and procedures used to treat the patient.

The cardiac arrest documentation form is used to record information at the bedside during these code blue events. The information collected on the documentation form is also used by the hospital patient safety organization to improve hospital-wide patient care practices. In addition, the hospital risk management organization uses the documentation record to reconstruct the events in case there is a legal dispute. For these reasons, it is essential that cardiac arrest documentation form contain timely, accurate, and complete information.

Historically, code blue documentation forms have been based on the "Utstein style template" which recommends that a wide variety of data elements be collected about each code blue event [10]. The Utstein-style template was further revised to streamline the collection of data, with the hope that the revision would clarify definitions and boost documentation accuracy and completion [15].

A qualitative needs assessment of current code blue documentation forms was performed during a prior stage of this project. The needs assessment revealed that existing code blue forms were not capturing important information (Chapter 2). The needs assessment revealed that these problems were caused by

a combination of factors, including poor usability and a mismatch between the documentation layout and the flow of events as they unfold during a cardiac arrest emergency.

To address the issues discovered during the needs assessment, the code blue documentation form was redesigned. The redesign effort included a review of medical content along with visual design changes to improve readability. The goal of the redesign was to make the form easier to use in real-time. Through an iterative design process, several prototypes were developed and submitted to end-user participants for feedback. However, the form redesign process was subject to clerical requirements put in place by the hospital forms committee. Because of these requirements, the redesign was limited to alterations of form content and layout. As a result of the redesign efforts, a new documentation form was created to address clinical content, readability, and information flow (Chapter 3).

Methods

An evaluation study was performed to compare the old and redesigned documentation forms. The forms were evaluated to assess documentation form usability, data accuracy, and data completeness. The evaluation study was conducted at the University of Washington Medical Center, a mid-sized hospital in the Pacific Northwest region with 450 beds and a regional training mandate. Approximately 160 in-hospital cardiac arrest emergencies are documented at this hospital each year.

Materials developed for use during this study include administrative documents (a cover sheet, a recruiting notice, and a research information form for subjects), the old and redesigned documentation forms, two pre-recorded videos of cardiac arrest scenarios, a pre-scenario questionnaire, and a post-scenario questionnaire.

A cover sheet was created to manage subject information. This cover sheet doubled as a participant observation form, providing additional space for the researcher to write notes about unusual events and

patterns that emerged while administering the study. The recruiting notice was created to aid in the process of enrolling participants into the study. This recruiting notice was based on a research information form for subjects. This research information form was used to explain the research objectives and participant rights as part of the consent process. These materials were all created to assist with data management and streamline process of obtaining approval from the institutional review board.

Documentation forms

This research compared two code blue documentation forms: an old form and a redesigned form. The old code blue documentation form was the one currently in use at the UWMC facility where this research was conducted (Figure 8).

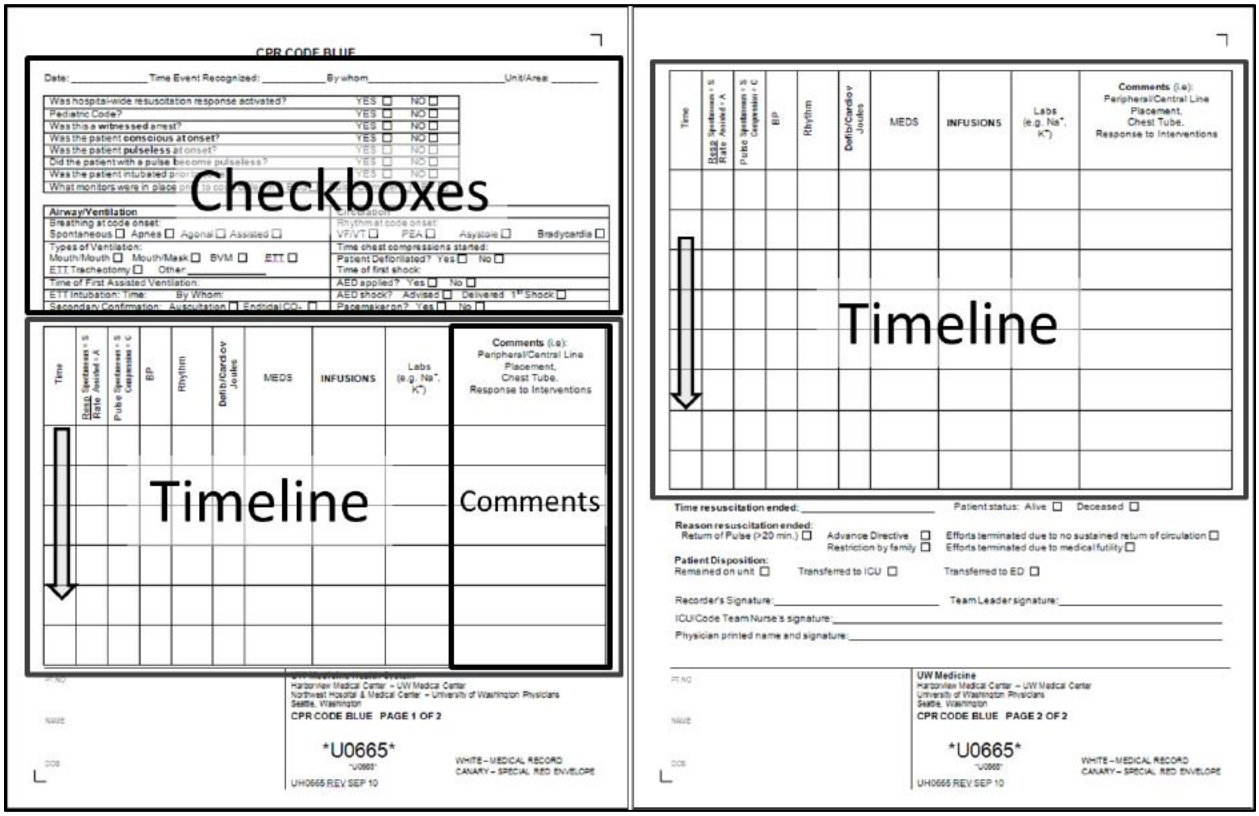

Figure 8: Old code blue documentation form with features highlighted

The old code blue documentation form closely resembles a template circulated by the American Heart Association and is based on the previously described Utstein-style template for documenting in-hospital cardiac arrest. The form is characterized by a structured checkbox data entry area at the top of the first page, followed by a semi-structured timeline data entry area with time running from top to bottom. This timeline area includes a space for comments in the right-most column. The form also contains a section at the bottom reserved for administrative information, including a space for placing a patient identification sticker and a barcode for identifying the form when it is scanned into the patient record. This old code blue documentation form was analyzed during a prior needs assessment (Chapter 2).

In response to the results obtained during the needs assessment section of this research, a redesigned form was created during a redesign project (Chapter 3). The results are shown here (Figure 9).

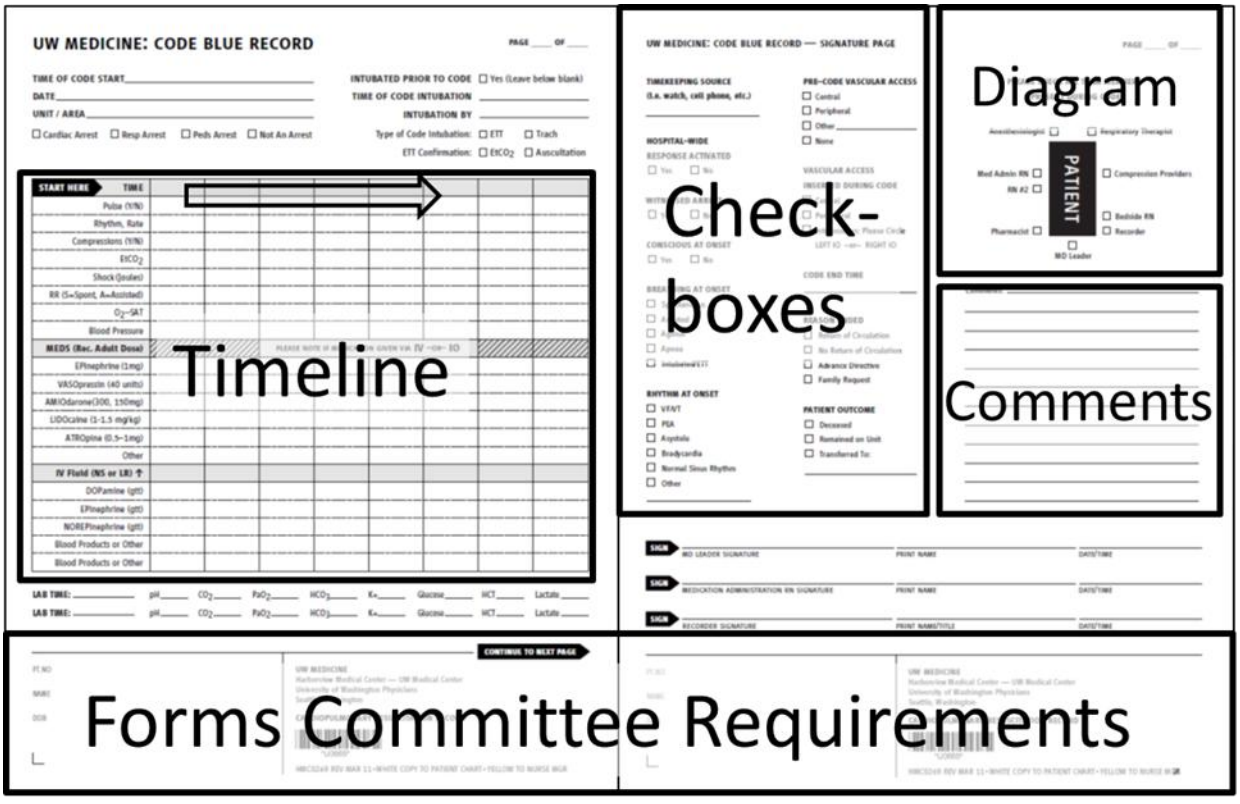

Figure 9: Redesigned code blue documentation form with features highlighted

The redesigned code blue documentation form retained the two-page format and the administrative area reserved for a patient sticker and barcode. However, the structured checkbox data entry area was moved to the end of the form. The semi-structured timeline grid was also restructured and features a horizontal progression through the timeline. In addition, a diagram was added in the upper right portion of the second page. This diagram was used to document the care providers in attendance while also providing a visual reminder of recommended placement of care providers around the patient bed. The timeline does not include dedicated space for unstructured comments. Instead a comments area was provided on the second page on the right side below the diagram.

Pre-study questionnaire

A pre-study questionnaire was created to collect basic demographic information about the subjects enrolled in the evaluation study. The questionnaire collected information about each subject's age bracket, level of clinical training, years of clinical experience, number of cardiac arrest events attended, and prior experience using the documentation forms.

The demographic information collected on the pre-scenario questionnaire was used to characterize the subject population, both to verify that participants met the inclusion criteria, as well as demonstrate to which populations these results might be generalized. Numeric ranges were used in place of exact values to maintain subject confidentiality.

Pre-recorded videos

To ensure a consistent experience for all participants, two pre-recorded videos were created. Each pre-recorded scenario depicted a simulated cardiac arrest emergency. The two scenarios were a pulseless electrical activity (PEA) emergency and a supraventricular tachycardia (SVT) emergency. The PEA and SVT scenarios were selected based on data collected by the patient safety office during 2009 indicating

that the PEA and SVT rhythms were the most common patient heart rhythms encountered during code blue emergencies, accounting for 28% (PEA) and 23% (SVT) of code blue events. The PEA and SVT scenarios were scripted differently to minimize learning effects that might occur if participants watched the same scenario twice.

The use of pre-recorded scenarios also supported the creation of a gold-standard timeline of events based on the scripted timeline of recordable medical events. Each procedure and medication was announced audibly, both to highlight recommended communication practices among care providers, and to ensure that each scripted event was recognizable on the video. The gold-standard timeline was used to measure the accuracy and completeness of the information documented by study subjects.

The PEA and SVT scenarios were scripted based on accounts of real life cardiac arrest events. Realistic scenarios were used to ensure a higher level of face validity and buy-in among study participants. To support this research study, there were some changes made to accommodate the use of these scenarios. Notably, real cardiac arrest events typically last between 20 and 40 minutes. However, for this study, the pre-recorded PEA and SVT scenarios were each compressed into 9 minute videos to reduce subject time commitments and lower the barrier to participation. The compressed scenarios each included 42 individual documentable events, roughly equivalent to the number of events occurring during a full-length emergency. The compressed time frame also introduced time pressure to simulate the stressful nature of these emergency events.

The videos purposely contained ambiguities and errors, such as unfulfilled medication orders and vague medication dosage information. These ambiguities and errors were meant to simulate the noise and uncertainty that accompanies a real emergency. In addition, these ambiguous events and errors did not correspond to structured areas of either the old or redesigned documentation forms. This provided an opportunity for this research to examine how subjects recorded unstructured data.

The scripted videos were recorded at the UWMC's simulation training facility, the Institute for Simulation and Interprofessional Studies (ISIS). Anesthesiology residents and simulation center staff served as actors, where they were asked to follow a script that outlined the specific order of events and interventions. Actors with clinical knowledge were important for ensuring the realism of the simulation, since they were able to use proper terminology and perform clinical tasks on the simulation mannequin.

Subject recruitment

The subject pool for this study included the people most likely to encounter the documentation forms during a code blue event. Officially, the hospital policy recommends that the "second nurse to arrive" take responsibility for documentation of the code blue event, and documentation tasks were most often performed by a nurse working in the area where the emergency occurred. Unofficially, other care providers such as pharmacists or physicians were sometimes assigned to perform documentation tasks as well. To account for this, the study recruited individuals with a variety of clinical training, such as medical residents.

The primary inclusion requirement was familiarity with the setting and terminology used during a cardiac arrest emergency. This ensured that study participants would be able to recognize medication names and procedures. Actual experience with the official documentation forms was not required. People who did not have familiarity with code blue medications and procedures were excluded from this study.

Recruiting was conducted using flyers posted in and around the hospital. This was supplemented with an email recruiting notice sent to the intensive care nursing population, as well as in-person recruiting during cardiac arrest training sessions at the ISIS training facility. The recruiting goal was between 20 and 30 participants, enough to support statistical conclusions and qualitative findings.

Post-study questionnaire

A post-study questionnaire was constructed to measure form usability. The questionnaire contained a set of nine questions about usefulness and usability. The first eight questions asked about specific usability elements and principles, while the ninth question was used as an overall evaluation of the documentation form.

The post-study questionnaire contained nine questions asking about: 1. perceived accuracy, 2. perceived completeness, 3. on-form instructions, 4. availability of space for writing, 5. order of data elements, 6. familiarity if form were used again, 7. real-time usability, 8. readability, and 9. a final overall question about perceived form usefulness.

The nine questions were based on the PSSUQ [29]. Originally developed to evaluate the usability of computer-based systems, the PSSUQ instrument has also been previously validated in a healthcare context [49]. For this research, the PSSUQ survey was adapted for evaluating a paper-based form, keeping the relevant portions and altering the computer-specific parts to accommodate the paper-based format. The focus on usefulness and usability was reflective of the original criteria used during the previous needs assessment stage of this project. The usability criteria were also based on literature about technology adoption [50].

The rating scales for both the old and redesigned forms were placed side by side. This was done to encourage subjects to directly compare the two forms when assigning ratings. The questionnaire asked subjects to rate each question on a scale from 1 to 6, with 1 being “strongly disagree” and 6 being “strongly agree.” The even number of options was chosen to eliminate the “neutral” option and allow for a binary analysis of “agree” vs. “disagree” responses.

Experimental design

The study was implemented as a within-subjects design, where each study participant watched both videos (PEA and SVT). Subjects filled out one documentation form while watching the first video, and then filled out the other documentation form while watching the second video. The use of this design was intended to maximize the amount of data obtained from each subject and allow for questions that compared the two forms.

Once the pre-scenario questionnaire was complete, participants were randomized into one of four conditions to determine the order in which they filled out the documentation forms and the order in which they watched the videos (
Table 2).

Condition 1	PEA scenario & Form A -> SVT Scenario & Form B
Condition 2	PEA scenario & Form B -> SVT Scenario & Form A
Condition 3	SVT scenario & Form A -> PEA Scenario & Form B
Condition 4	SVT scenario & Form B -> PEA Scenario & Form A

Table 2: Subjects were randomized to one of four starting conditions for this study.

Subjects received the forms in a randomized order in an effort to counteract order effects. This was done because of results from the needs assessment which indicated that recorders thought that repeated practice recording events might improve familiarity with the documentation forms and processes.

During the study, subjects were instructed to document the procedures and medications that they saw and heard while watching the pre-recorded cardiac arrest scenarios. The recorded scenarios were shown to participants at the UWMC facility, both in the simulation center and in quiet rooms located near the patient care areas. After viewing both scenarios, the post-scenario questionnaire was administered to each participant.

Analysis methods

Usability questionnaire results were collected and compared using a paired T-test to check for differences in the mean values for each question when comparing Form A (the old form) against Form B (the redesigned form). The results were grouped by form and not by experimental condition.

The T-test analysis assumes that the Likert scale divisions are evenly spaced and able to approximate a continuous distribution of ratings. A set of pairwise analysis of variance (ANOVA) was also conducted to check for interactions between different variables. This was done to determine whether differences could be attributed to the forms, or whether other variables such as scenario order were confounding factors.

Quantitative results were accompanied by qualitative comments, which were used to provide support or refute quantitative trends. This was done to help clarify results in cases where the results could not be confirmed as statistically significant.

Form completeness was measured by using a spreadsheet to tally responses from every form, both old and redesigned. The form contents were compared against the script used to create the video scenarios. Form accuracy was determined by comparing timestamps for entered data against the timestamps on the scenario scripts. To account for timing discrepancies, times were considered “accurate” if they were within one minute before or after the scripted event time. The accuracy analysis focused on a subset of time-sensitive data elements that impact patient survival, such as time to first chest compressions and time to first shock.

Results

Participants in the evaluation study were run in small sessions of 1-3 people who were randomized to the order of forms. The order of videos was randomized between sessions. The small number of participants at each session was an operational consideration based on availability of subjects and the physical space requirement for the study. Because audio cues were an important source of information, the space had to be enclosed so as not to disturb other people in the work environment. Proximity to subjects was also important to maximize availability. These factors ended up being limitations that restricted when and where the study videos could be shown.

The new code blue documentation form was evaluated with the participation of twenty research subjects, providing both qualitative and quantitative data regarding the effectiveness of the revised form. The evaluation results were divided into a block of Likert-scale type responses, an analysis of basic form elements such as checkboxes and signatures, and the data recorded in the timeline portion of the forms. This mixture of qualitative and quantitative data highlighted the differences between the old and new forms.

Subject demographics

Twenty subjects were enrolled to participate in this evaluation study. They were selected based on the criteria outlined in the methods. This required that they have familiarity with the medications and procedures commonly used during a code blue emergency but did not require specific experience with the code blue documentation. A complete description is listed here (Table 3).

Subject	Age bracket	Type of clinical experience	Years of experience	# Codes attended	# Times recorder
1	35-44	Pharmacist	3-5	3-5	0
2	25-34	nursing trainee	1-2	0	0
3	25-34	nursing trainee	1-2	0	0
4	35-44	registered nurse	6-10	6-10	0
5	25-34	registered nurse	6-10	> 10	> 10
6	45-54	registered nurse	> 10	> 10	3-5
7	35-44	registered nurse	6-10	> 10	0
8	45-54	registered nurse	> 10	> 10	> 10
9	35-44	registered nurse	3-5	0	0
10	25-34	registered nurse	3-5	> 10	6-10
11	25-34	registered nurse	6-10	3-5	0
12	25-34	medical resident	1-2	> 10	0
13	25-34	medical resident	1-2	3-5	0
14	25-34	medical resident	3-5	> 10	0
15	25-34	medical resident	3-5	3-5	0
16	25-34	medical resident	3-5	> 10	0
17	25-34	medical resident	3-5	> 10	0
18	25-34	medical resident	1-2	3-5	0
19	35-44	medical resident	6-10	> 10	0
20	25-34	medical resident	6-10	> 10	0
Median	**25-34**		**3-5**	**> 10**	**0**

Table 3: Summary of evaluation study participant demographics

Subject demographics show a variety of age levels and overall clinical experience. As a group, subjects also had familiarity with code blue events, with only three participants reporting no prior experience attending code blue emergencies. However, only four subjects reported having documented code blue events as the assigned recorder.

Quantitative survey responses

After participants viewed the two pre-recorded scenarios, they were asked to complete a post-scenario questionnaire to rate the documentation forms on several categories. These categories included

perceived accuracy, perceived completeness, and usability considerations such as amount of space and order of data elements (Table 4).

Evaluation Question	**Form A**	**Form B**		
	Mean (SD)	**Mean (SD)**	**t-test(df)**	**p-value**
Q1. I was able to document accurately.	3.70 (0.98)	4.21 (1.08)	-1.545 (37)	0.131
Q2. I was able to document completely.	3.55 (1.36)	3.89 (1.20)	-0.840 (37)	0.406
Q3. Directions were clear and understandable.	3.50 (1.19)	4.20 (1.06)	-1.965 (38)	0.057
Q4. I had enough space to write.	3.45 (1.43)	3.20 (1.10)	0.618 (38)	0.540
Q5. The order was logical.	3.75 (1.33)	4.30 (1.17)	-1.385 (38)	0.174
Q6. If used again, would be familiar.	4.74 (1.15)	4.95 (1.05)	-0.606 (37)	0.548
Q7. Was able to quickly document in real-time.	3.65 (1.50)	4.20 (1.20)	-1.284 (38)	0.207
Q8. Form is visually easy to read.	**3.30 (1.03)**	**4.70 (0.98)**	**-4.404 (38)**	**0.001***
Questions 1-8 (Mean)	**3.63 (0.84)**	**4.18 (0.78)**	**-2.115 (36)**	**0.041***
Overall form is useful.	**3.70 (0.98)**	**4.50 (1.00)**	**-2.557 (38)**	**0.015***

Table 4: Summary of post-study questionnaire results, comparing usability for the old (Form A) and redesigned (Form B) documentation forms. The questionnaire asks about eight usability aspects in addition to an overall rating. Asterisks indicate statistical significance (p-value < 0.05).

For each of these categories, participants were asked to rate both of the forms on a six-point Likert scale, with options ranging from strong agreement to strong disagreement. A neutral option was not included and was instead replaced with mild agreement and disagreement options.

The first eight questions were about the different usability aspects for each form, such as perceived accuracy, completeness, logical order, and familiarity. The aggregate results were higher for the redesigned form (B) as indicated by participant responses to the final “overall form is useful” question. Much of the improvement is attributed to subjects indicated that the form is visually easier to read. This seemed to be the primary contribution of the redesign and addresses the major readability problem highlighted during the needs assessment of the old form.

For almost all of the other questions, the new form received a higher rating. In some cases the differences were small but noticeable, such as responses to the questions about familiarity perceived

completeness. Both of these were trending in favor of the redesigned form, although without reaching statistical significance. The responses concerning familiarity suggest that a more readable form helps with the collection of structured data.

However, the one exception was about the amount of available space for writing unstructured information. For that one aspect, subjects preferred the old form. This finding was reflected in the results for accuracy and completeness of data, which is discussed in a later section of this paper.

The ANOVA results indicated that there were no confounding interactions between form and scenario, form and form order, or form and scenario order. Interestingly, there was an independent effect of scenario order where subjects gave consistently higher usability ratings regardless of which form was used. However, within those results, the redesigned form was still rated more highly than the old form.

Qualitative survey responses

In terms of specific form elements, responses were mixed. Participants noted that the old form provided more space to write comments and free text notes. However, the revised form provided better on-form instructions and featured a slightly better ordering of data elements. Participants also indicated that the revised form was visually easier to read.

A number of participant responses indicated that space constraints were a problem on both the old and new documentation forms. This was mentioned in two specific contexts: space for structured timeline entries such as yes/no checkboxes, and space for unstructured entries such as free-text comments.

> *"Form A was visually jumbled and disorganized to me--especially the top portion with all the checkboxes. I liked how time was on the x-axis on form B rather than on the y-axis on form A. Also, form B had a lot of Y/N questions which were easy to complete in a quick manner. I definitely liked form B better. I felt that Form B was much easier to use--it was easy to read and you could easily record numbers in the appropriate fields rather than having to record both numbers and med names on Form A." – subject 2*

Comments such as this one highlight the ability to quickly document in the timeline area, using structured entry areas of the form for rapid recording by use of a simple check mark. This reduced the amount of free-text writing required for documenting standard medications and procedures, such as chest compressions and electric shocks. However, the evaluation scenario scripts also included non-standard events, such as problems with a blocked intravenous line and difficulties intubating the patient. These are plausible problems that might occur during a real code blue event, but because they are not part of the recommended cardiac life support algorithms, they were not given structured entry areas on the form. Instead, subjects recorded those events using the "comments" areas of the forms.

> *"Prefer the layout of Form B, easier to read--wished the comment section was also on the 1st page though, had to flip back & forth."– subject 9*
>
> *"During a real code situation, Form B is much easier to read, follow & use. However, it would benefit from an events/comment section to document details not included."– subject 8*

Although evaluation study subjects remarked that the redesigned form was more readable, the relocation of the comments section to the second page of the form was cited as a deficiency with the redesigned code blue documentation form.

Timeline analysis

To obtain data about accuracy and completeness, each of the completed documentation forms was compared against the script used to create the pre-recorded scenarios. Each form was examined to determine whether the participants captured each of the 42 events for the both the SVT and the PEA scenarios.

The initial analysis checked for documentation completeness. This was accomplished by examining each form and comparing it against the script of events (Table 5).

	Meds (n=360)	Shocks (n=100)	Rhythm (n=300)	Start CPR (n=160)	Stop CPR (n=160)	Arrivals (n=140)	Airway (n=140)	Other (n=320)	Totals (n=1680)
Form A (SVT)	61.00%	76.00%	68.57%	60.00%	0.00%	2.50%	50.00%	41.67%	44.97%
Form B (SVT)	71.00%	96.00%	85.71%	67.50%	0.00%	60.00%	15.00%	41.67%	54.61%
Form A (PEA)	77.50%	n/a	51.25%	72.50%	10.00%	6.67%	70.00%	61.00%	45.24%
Form B (PEA)	71.25%	n/a	56.25%	50.00%	10.00%	86.67%	38.00%	41.00%	46.99%

Table 5: Data completeness for several categories, compared by form and scenario.

The results here report on data collected on each of the 40 forms (20 forms for the SVT scenario and 20 forms for the PEA scenario). Each of the data elements were announced using audible cues during the recorded videos. The 42 events in the SVT scenario were added to the 42 events in the PEA scenario, and then collectively multiplied by 20 participants. This resulted in 1680 potential data elements that could have been collectively recorded by all participants.

Data accuracy was measured by comparing timestamps between the scenario scripts and the forms filled out by study participants. Accuracy was measured by determining whether the timestamps for recorded elements were within 30 seconds before or after the scripted time, providing a one minute window to account for minor transcription delays and synchronization inaccuracies.

For each video shown to participants, the timekeeping began when the form was handed to the recorder, and not when the code itself began. This specifically occurred at the one-minute mark and was used to match the form timeline with the video script.

Timing was inexact, rounded to the nearest minute by 18 out of 20 participants. Only 2 of the 20 participants recorded seconds when writing timestamps on the documentation forms. All subjects combined multiple entries using single timestamps, most likely in an effort to save space and expedite the documentation process when multiple events occurred within a short time period.

The overall goal of documentation is to capture complete and accurate timestamps for all of the medical events during a code blue scenario. However, specific types of clinical information are considered clinically more important to patient outcomes. This includes the completeness and accuracy of medication records, the time of first chest compressions, the initial assessment of patient heart rhythm, timely intubation to provide the patient with oxygen, and the time of the first shock.

The completeness of medication records was comparable across both the old and redesigned forms. During the PEA scenario, participants more completely captured the ordering and delivery of medications using the old form (i.e. Form A). However, during the SVT scenario, participants filled out medication records more completely on the redesigned form (i.e. Form B).

The "time to first compressions" was examined for accuracy and completeness on both forms. During the SVT scenario, participants had a higher completion rate for chest compression data when using the redesigned form. However, during the PEA scenario, participants provided more complete chest compression records when using the old form.

Because patient treatment algorithms are based on specific patient heart rhythms, the accuracy and completeness of initial heart rhythm diagnoses was examined. Completion rates were comparable when viewing the SVT scenario, with participants correctly documenting the patient's heart rhythm 80% of the time using the old form and 70% of the time with the redesigned form. Results were mixed for the PEA scenario, with all participants correctly documenting the initial problems with the patient's slow heart rate. However, there was incomplete documentation of the patient's pulseless state, only 50% using the old form and 80% using the new form. Nor did participants specifically indicate the PEA condition by name, documenting it only 10% of the time using the old form and 30% of the time on the redesigned form.

Prior research indicates that the patient's airway status is an important part of care, and that the timely establishment of an airway can affect patient outcome. For this study, the airway data was concerned with assisted breathing through the use of a bag-valve-mask system, and the insertion of an endotracheal tube to provide additional oxygen to the patient. There were a small number of recordable airway events, only 2 for the SVT scenario and 5 for the PEA scenario. For the SVT scenario, airway information was only recorded for 50% of the events with the old form and for 15% of the events using the redesigned form. The airway data collected for the PEA scenario was more thorough but still incomplete. 70% of airway events were recorded using the old form and 38% with the redesigned form.

Accuracy was measured by examining timestamps to determine whether the recorded data was timestamped within 30 seconds before or after the scripted event time. For the SVT event, only one subject recorded an accurate timestamp within 30 seconds. For the PEA event, accuracy was slightly higher at 54% using the old form and 24% using the redesigned form. The lowered accuracy was partially due to the design of the form and the way that the airway information was requested. This will be examined in the discussion section.

The time to first shock was another factor known to influence patient survival rates. However, electric shocks were only applied during the SVT scenario. Specifically, the first cardioversion event was recorded 50% of the time using the old form and 80% of the time using the new form. This is consistent with the overall completion rate for shock events, which was recorded 76% of the time using the old form as compared to 96% of the time using the redesigned form. Timestamp accuracy was lower, and on the old form, only 3 out of the 5 cardioversion timestamps were accurate. On the redesigned form, 6 out of 8 timestamps were accurate to within 30 seconds.

Discussion

The code blue documentation form was redesigned to determine whether a redesign could address the problems with the old code blue documentation form. Specifically, the redesign was intended to address two main problems with the old forms: usability and data completeness. The discussion here focuses on the lessons learned during this evaluation study, about the documentation form redesign, and about research into the code blue process.

Subjects and recruiting

This research was conducted at a training hospital, and the median subject demographics reflect this. The median age bracket was between 25 and 34 years old, with 3-5 years of clinical experience. Among the subjects for this study, three had not attended code blue emergencies, but all of the others had attended at least 3 code blue events before. More than half of the subjects (11 of 20 people) had attended more than 10 code blue events, indicating a high level of familiarity with the terminology and patient care practices involved at these emergency events. This also shows familiarity with the practices and procedures typically performed during a code blue event.

Despite this high level of familiarity with code blue events, only four people reported having used the documentation forms before. This means that both forms were equally unfamiliar to participants and reduced the potential for skewed results resulting from preconceptions about the documentation form. Similar reactions to the documentation forms might be expected at hospitals where the recorder role is assigned at the time of the emergency instead of specifying the recorder role in advance.

The number of subjects was modest, yielding an appropriate amount of qualitative feedback, but limiting the ability to draw strong statistical conclusions about the quantitative results. The most effective method of recruiting was to approach residents and nurses in person while they were

attending code blue training exercises. In contract, flyers and email messages did not prove to be effective methods for attracting research subjects.

Recruiting difficulties were partly due to the time constraints of the study, which required 30 minutes to administer both videos and the accompanying evaluation survey instrument. This was a challenge for physicians and nurses, who work long hours and have busy schedules. As a result, participants watched the video recordings during breaks, or after their regular work hours. The requirement of a quiet location also restricted when and where the video recordings could be shown for this study. In addition, there were no funds available to compensate study subjects. This was partially because of logistical challenges involved in compensating subjects who chose to participate during breaks at work. These factors made recruiting difficult.

Usability

One of the main reasons to the redesign the documentation form was to improve form usability. This was assessed based on both form readability and functional utility. The results show that subjects rated the redesigned form as more readable than the old form. The overall impression of improved usability was reinforced by individual ratings for each different aspect of the redesigned form, except for the amount of functional space available for free text comments.

In particular, subjects rated the redesigned form as significantly superior to the old form in terms of clarity and readability. Subject ratings also indicated minor improvements in perceived accuracy, arrangement of form elements, and speed of data entry.

Subjects provided slightly higher ratings for the redesigned forms when asked about familiarity and the perceived ability to collect complete data. The old form received a slightly higher rating in terms of

functional space for unstructured comments. However, these results were not statistically conclusive, but they support the findings about the accuracy and completeness.

One of the major changes was the relocation of the checkbox entry area and the space for unstructured comments to the second page of the form. This was done to highlight the importance of real-time data, with particular emphasis on timely recording of medications, electric shocks, and chest compressions. Prior feedback received during the needs assessment and redesign process indicated that recorders often skipped the structured checkboxes and started recording in the timeline area when using the old form. The observation of recorder work practices confirmed this behavior. However, recorders often took advantage of short breaks in activity to browse and complete the checkbox entry section of the form. With the old form, the checkboxes were at the top of the first page. On the redesigned form, the checkbox entry area was on the second page, requiring that documenters flipped to a different page when they wanted to fill out that portion of the form.

Similarly, subjects indicated that they disliked having to flip to the second page of the form when they wanted to access the comments area. This occurred when subjects wanted to write about medical events for which there was no structured entry spot. This included information about things like failed intubation attempts or situational medical procedures, such as the placement of a chest tube.

Completeness

In aggregate, the completeness results were comparable for both the old and redesigned forms. This comparison holds true for important aspects like medications. The standard code blue medications, such as epinephrine and atropine, were filled out with a high completion rate in the 80%-90% range. However less common medications, such as propofol were only recorded 20%-40% of the time. Because medications like propofol are not listed as part of the standard cardiac life support algorithms, they

were not given a structured entry space on the documentation form. This demonstrates the both positive and negative consequences of providing structured space for recording medications.

There were also noticeable differences between the data collected on the two forms for "other" data such as backboard placement, needle thoracotomy, and unsuccessful airway attempts. This can be directly attributed to the layout of each form. The old form features a much larger area for comments and free text written entries. The records review conducted as part of a previous part of this research (Au 2012) revealed that recorders would often write free text comments and ignore the suggested data entry labels. With the new layout, more parts of the form were labeled for specialized data, resulting in less open space for comments. This also impacted the ability of recorders to find space for data which didn't fall into one of the labeled areas. These results may also suggest a reluctance to document unsuccessful interventions attempted by the code team, such as failed intubation attempts or difficulties placing an intravenous line.

Electrical shocks were only administered during the SVT scenario, resulting in a smaller number of data points. However, data about electrical shock activity is linked to patient survival rates, so this data was considered carefully.

Rhythm events were used to track the patient condition and help determine which medications and procedures should be used to treat the patient. Although reported frequently during the videos, recorders did not always transcribe the information each time it was mentioned. This was in spite of having a specially labeled area on the forms for recording information about patient heart rhythms.

The start and stop of CPR refers specifically to the chest compression component of CPR. Compressions were frequently paused while other diagnostics and treatments were performed. While recorders were

able to note when compressions were being performed, they seldom noted when compressions were stopped.

The arrival of the code team personnel was requested by the risk management office as part of creating a comprehensive account of the code blue event. During the evaluation study, code team arrivals were announced audibly, and that information was included in the comprehensive list of possible data elements. During the redesign process, a diagram was added to the redesigned form so that recorders could annotate which code team members were present. The inclusion of a personnel diagram encouraged subjects to include that information as part of the record. However, the diagram did not include space to record time information, so arrival times were not captured.

Airway events are important for patient care, and the results of the evaluation confirm that successful placement of an endotracheal tube was frequently documented. However, unsuccessful attempts and alternate airway procedures, such as the placement of a laryngeal mask, were often omitted by recorders. Upon examining both the old and redesigned forms, neither form provided a structured space to document real-time airway events other than intubation. This was a space tradeoff made during the design of the forms, since not all potential treatments could be given dedicated space on the documentation form.

The documentation forms, both old and redesigned, contained an unstructured free-text area to write comments and document other unanticipated events. In addition to the previously mentioned airway interventions, this might include things like issues with the placement of an intravenous line or problems with medication orders. These sorts of anomalous situations were purposely introduced into the scenarios to test for documentation completeness and accuracy.

The intent of the redesign was to highlight important data elements and reduce the overall amount of writing required. To accomplish this, more data was assigned to labeled areas of the form. For example, medication names were written out, allowing recorders to simply check a box or write dosage information. However, by providing more pre-labeled entry areas, the amount of space for free text comments was necessarily reduced. Ultimately, despite stakeholder preferences for structured data entry options for things like common medications, the qualitative and quantitative results highlighted the need for addition space to include unstructured data like airway alternatives and alternate medications, such as anesthesia medications not typically included in the advanced cardiac life support algorithms.

Accuracy

During the needs assessment, the timeline was mentioned by all of the stakeholder groups, including the recording nurses, the patient safety staff, and the risk managers. They all considered accurate timestamps to be one of the most important pieces of information to capture while documenting a code blue event. Accurate timestamps are important at the bedside when administering medications and electric shocks to a patient. Timing is also important for ensuring patient survival, so the patient safety office relies on accurate timestamps to gauge the quality of care. The risk managers use timestamps to recreate the sequence of events during a code blue. For these reasons, the timestamps were given special attention during the analysis of the documentation forms.

Because the evaluation study made use of pre-recorded scenarios, the exact timing of events was known in advance. This allowed for a comparison between the exact timestamps and the timestamps recorded by study participants. This was a major advantage over the records review conducted during the prior needs assessment.

Despite the inclusion of 42 recordable elements, most subjects only used between 7 and 9 timestamps, approximately one for each minute of the code blue event. Only two subjects documented timestamps using seconds. Several events were bundled together under a single timestamp, and in almost all cases, the timestamps were rounded to the nearest minute. As a result, there was a loss of granularity with timing information, which reduced the overall accuracy of the timeline.

There were two types of data that were particularly unusual, and each calls attention to documentation practices which affect the way that data is recorded. The first was data about when chest compressions were temporarily halted to allow for other procedures. Pauses in chest compressions were not documented at all during the SVT scenario and were only documented 10% of the time during the PEA scenario. In summary, pauses in chest compressions were only recorded 8 times out of a possible 160 events. This may indicate that care providers do not consider this to be critical information, although it may also suggest that neither form is able to easily accommodate that type of information.

The second type of unusual information was the presence of specific members of the code blue response team. This information was not recorded on the old form. On the new form, the presence of team members was documented on a small diagram, but without accompanying timestamp information. In that respect the inclusion of a specialized structured data entry area prompted recorders to provide that information. This demonstrates that the use of structured data can influence the recording practices and result in the collection of specifically requested data. However, timestamps were not recorded using the diagram, demonstrating that the specific lack of a structured entry space may have also discouraged the collection of some types of data. In this respect, the structured data elements can both help and hinder the collection of specific kinds of data.

The completion and accuracy of airway data was a discrepancy between the old and redesigned forms depending on which scenario, PEA or SVT, was being shown. This is partly due to the design of the

forms. For example, participants were thorough about documenting the intubation of the patient. However, that information was requested as part of the checkbox-entry section of the forms and not as part of the timeline data entry section. Because of this, participants would tick the box without supplying an accompanying timestamp. This behavior was similarly repeated for information like code team attendance, where subjects would indicate who was in attendance by using checkmarks but without any corresponding timestamp data. This demonstrates that structured data entry areas can prompt recorders to document specific information. However, the structure may also constrain the sorts of data that gets recorded.

The scenarios were also scripted to include some ambiguous situations and potential errors, such as medications being administered at different dosages than ordered, and medications not delivered at all. When the dosage was changed, some subjects corrected the dosage on the documentation form, suggesting that the medication was documented when ordered and corrected when delivered. In other cases, the original ordered dosage was documented and not corrected, again suggesting that the medication was documented when ordered instead of when delivered.

Lessons about experimental design

The evaluation study was constructed to maximize the amount of data from each subject by having them each fill out both the old and redesigned forms. Because each participant would fill out two forms, two separate video scenarios were created. The use of different scenarios was intended to minimize any learning effect which might arise if a single scenario was viewed by the same participant twice. However, the use of multiple videos introduced potential interactions between the form and the scenario. Because of the effects between form and scenario, the results here show that the old form was better utilized for recording certain information during the PEA scenario while the redesigned form was better utilized during the SVT scenario.

In retrospect, a simplified experimental design would have simplified the data analysis. Specifically, if each participant only watched a single scenario and completed a single form, this would have eliminated form order effects, scenario order effects, and interactions between form and scenario. Tighter control over the other experimental conditions would allow for simpler analysis of results and how they are affected by the differences between the old and redesigned documentation forms.

However, if a single scenario were used for comparing both forms, the study design would have to account for potential learning effects for the second showing. This could be countered by randomizing the form order. Additionally, the results of a single-scenario study design might not be as generalizable to the wide variety of real-life emergency situations.

This research also highlighted the challenges with conducting research in the emergency care setting. The work responsibilities of emergency care providers are often in addition to routine care responsibilities. Participation in a code blue emergency also requires specialized knowledge and familiarity with emergency procedures, which limits the pool of potential subjects with the appropriate clinical knowledge. These challenges make it difficult to study emergency care providers as a subject population.

Conclusion and recommendations

This evaluation study set out with the intention of assessing the effectiveness of a redesigned code blue documentation form. Ultimately, the quantitative and qualitative results show that the redesigned form was deemed significantly more usable by study participants. However, data completeness and accuracy were not significantly improved overall. Instead, each form was better suited to capturing certain types of data.

During the redesign process, one goal was to improve the ordering and layout of the documentation form, so that the recording person could find a place to document each important event that occurred during the code blue emergency. The redesign was intended to improve the collection of certain critical pieces of data, such as medication dosages and heart rhythm. This was accommodated by redesigning the areas of the form that contained structured information. This changes was made based on feedback during the prior needs assessment and redesign phases of the project, where care providers expressed interest in reducing the amount of free-text writing required when documenting standard pieces of information, such as medications orders and patient status, such as heart rhythm. However, the result of the evaluation study revealed that other types of information, such as failed airway attempts and problems with IV access, were better collected via unstructured free text comments. Because the redesigned form contained less space for unstructured comments, much of this information was missed on the redesigned form.

Information with designated labels, such as blood gas results and physician attendance was recorded more completely. Therefore, the recommendation is that any subsequent redesign should take into account both the need for comprehensive labeling and continued reduction in the amount of writing for common events, such as medication dosages, heart rhythms, and chest compression status. However, additional space should be provided for writing free text notes, which offer the opportunity to capture data about patient responses and procedures for which a label is not provided.

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Appendix 1 – Needs assessment

The materials and raw data for the needs assessment (chapter 2) are contained here.

Code 199/Code Blue Field Observation Data Sheet

Date: _____ Location: _____ My arrival (time): _____

Notified by: [ ] Pager / [ ] Overhead Notified at (time): _____

Day of week (circle): M T W Th F S Su

Cart already there: [ ] Yes / [ ] No [ ] Cart arrived during code (time): _____

Cart opened: [ ] Yes / [ ] No [ ] False arrest?

Recorder identified: [ ] Yes / [ ] No

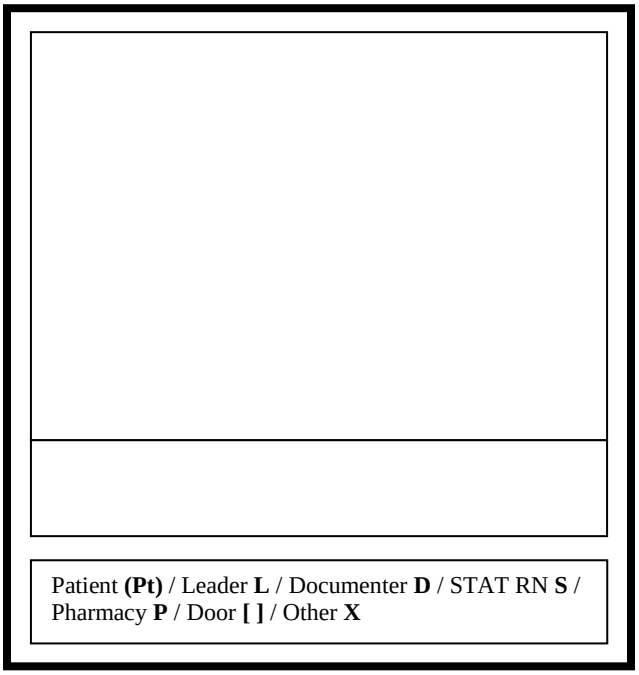
Recorder (circle): RN / STAT RN / Pharm / Intern, Student, R1 / Other: _____

Code leader identified: [ ] Yes / [ ] No

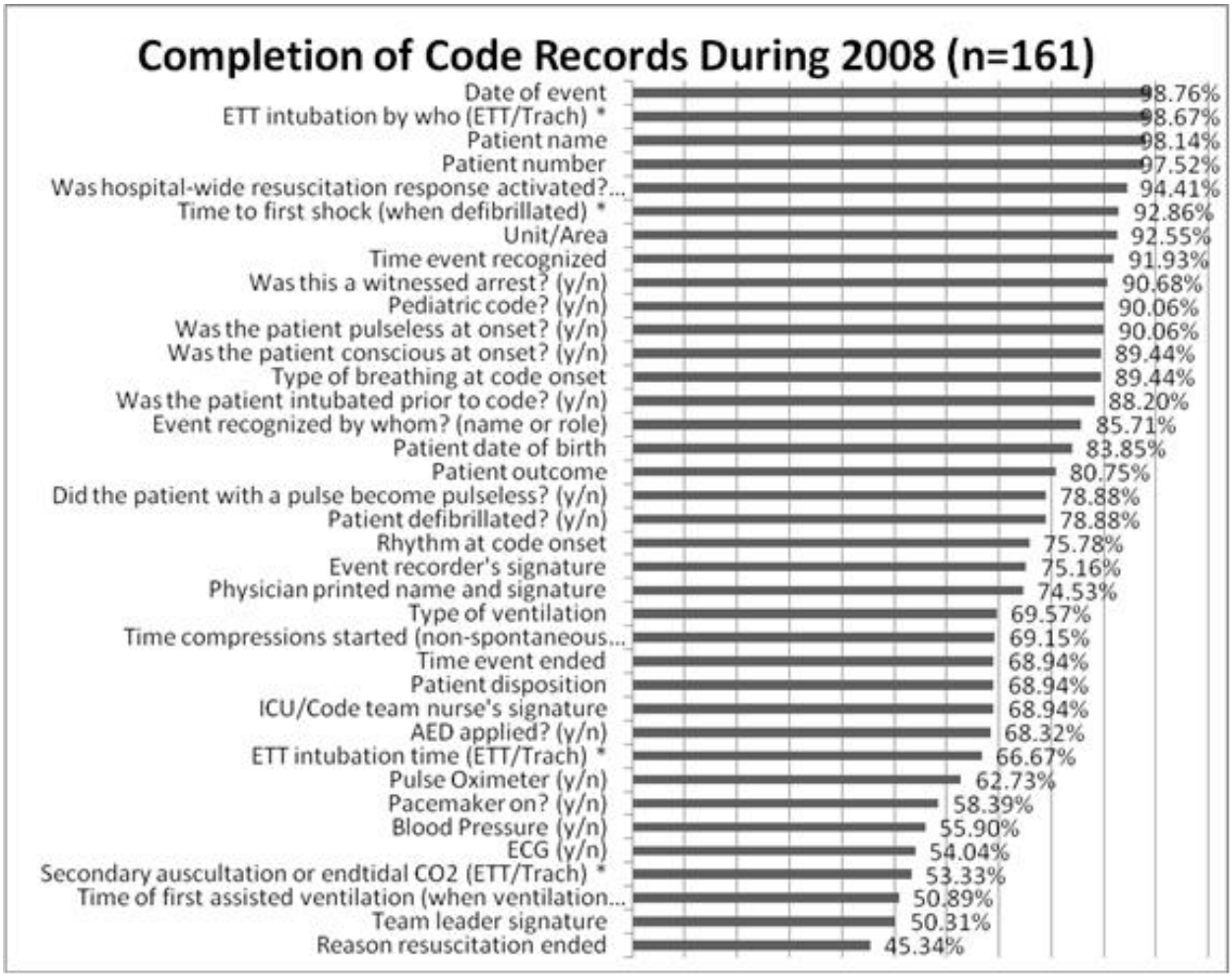
Code leader (circle): R3 / Fellow / Attending / STAT RN / Other: _____

Number of people in room (estimated): _____

Notes:



Records review results



Code Blue Emergency Event Documentation Survey (Care Provider)

Research Overview:
As part of my dissertation research, I'm also investigating how the Code Blue documentation process might be improved. I would like to ask you some questions based on your experience with code documentation. This will take about 5-10 minutes. Responses are confidential. With your permission, I may audio record responses to assist with transcription, but you do not have to agree to audio recording to participate in this research. You may opt out at any time.

What is your role during a code? (check the best description)

___ Code Blue Leader
___ Stat Nurse
___ Recorder
___ Other person assigned to Code Blue team
___ Other care provider

During a code, what information is important to have in real-time?

Who is responsible for keeping track of information during a Code Blue emergency?

Who is responsible for summary documentation about the code?

How do you use documentation forms during a code?

How can the Code Blue documentation forms themselves be improved?

How can the overall Code Blue documentation process be improved?

If we could add technology to assist with collecting information during a code, what would you like it to do?

(over)

Code Blue Emergency Event Documentation Survey (Care Provider)

Please rate the following from 1 (disagree) to 5 (agree), or NA (not applicable)

	Disagree				Agree	
During a code, info is available when I need it:	1	2	3	4	5	NA
Medical documentation is important in general:	1	2	3	4	5	NA
A real-time record is useful for me during a code:	1	2	3	4	5	NA
Documentation helps me summarize a code later:	1	2	3	4	5	NA
Emergency documentation is easy to use:	1	2	3	4	5	NA

Which technologies do you personally think would work best for documenting emergencies?
Please rate the following from 1 (poor) to 5 (good).

	Poor				Good
Paper-based system	1	2	3	4	5
Smartphone/Cell phone	1	2	3	4	5
PDA/Pocket PC	1	2	3	4	5
Tablet PC	1	2	3	4	5
Computer workstation	1	2	3	4	5

Is there another option you would like to see instead?

Notes:

Needs assessment qualitative survey responses

During a code, what information is important to have in real-time?

1	Interventions and times, drug doses and exact times
2	Documentation of assessment, interventions and timing of interventions ie intubation, meds administeres, cardiac rhythm...
3	code status, allergies / adverse rx to code meds in past (amio), rhythm, labs, what and when each med has been given pt history that would effect the code, both recent and medical e.g. liver failure, narcotics on board, difficult intubation, last meal / stomach contents, hx anxiety, chronic pain use, sepsis, R vs. L sided heart failure, baseline alterations in perfusion that would effect SaO2 and BP readings
4	
5	VSS, airway status, medications given, shock, compressions, and pt response to all
6	Labs
7	Diagnosis, Recent vitals, Recent therapies and medications, Recent labs, Last time patient was visualized, Code vitals, Code labs, Code interventions/times and reminders
8	time of arrest, time drugs are given, time shock was delivered, time CPR was started and time ended, time code ended, time death pronounced
9	Heart rhythm, heart rate, BP, oxygenation status, IV gtts, labs, meds given
10	Cardiac rhythm, pulsation or pressure, and SpO2
11	labs, medications given and how long ago they've been given, pulse/vital signs, rhythm is the patient in, defribillation (how many joules/times) if applicable, chest xrays
12	Vitals, Rhythm, Drugs given, Labs. Identify who is running code. Discuss causes of code. Discuss goals early on.
13	Pt's history, what may have happened to cause the code, what cardiac rhythm the pt is in, what IV access is available, any labs, pt's code status.
14	dont quite understand the question. heart rate, rhythm, o2 saturation, etc
15	What event or episode preceded the code, current vital signs, current drugs given, number of shocks given.
16	pt's heart rhythm, heart rate, blood pressure, RR, oxygen saturation, presence of a pulse, what meds are pushed when
17	what is the primary problem of the patient, what exactly happened preceding the code, what are the vital signs, did they lose consciousness, what is the current rhythm, what drugs or interventions have already happened/been given
18	Lab values mainly (ABG, HCT, K, Ca+, INR, ptt), vital signs, medical history, allergies, Advanced directive wishes
19	Pt. history, events that lead to code, what's been given, what has been done, labs, vitals signs, primary team, who's running the code, DNAR status
20	meds, labs, VS, O2 status, cardiac rhythms
21	medications given, VS
22	Meds given, CPR cycles, Reassessment of spontaneous circulation, People at the code, Pt history and problems, when someone is intubated,...etc
23	When code started, meds given, When shock given, When regained pulse/code declared

24	Diagnosis, MD team, VS, lab, pharmacy, Code Status, family whereabouts, IV access
25	HR, BP, Resp Rate, SpO2
26	rythym, BP, O2 sat
27	
28	All activity minute by minute including drugs, CPR checks
29	rhythm, access, airway
30	vitals, meds given, cariac rhythm
31	Heart rhythm, BP if able as well as lab values-electrolytes, CBC, and medications given
32	Current LABs (BMP, CBC, ABG), Current relevant meds, Relevant Hx, Short Hx of events leading up to code
33	Medications, IV Infusions
34	vitals, meds, actions,
35	When drugs are given, vital signs, when shocked, When cpr started or stopped.
36	Acute changes (ex. drop in saturation, change in LOC, change in rhythm), major interventions (ex. intubation, defibrillation, CPR), medication administration

Who is responsible for keeping track of information during a Code Blue emergency?

1	Recorder - esspecially for times, as in when to shift off compressions
2	The person designated as the recorder.
3	RN - often floor RN
4	no one person is responsible anyone can
5	the recorder
6	Recorder
7	the recorder and the code leader
8	the primary staff RN or any staff RN designated to do the role
9	Recorder (usually another nurse)
10	Code team leader, recorder
11	code recorder
12	RN
13	The code recorder as well as the team leader.
14	usually an rn
15	Whoever picks up the clipboard. Someone usually calls out, "somebody start recording." If it's a long code there may be more than one person recording due to time constraints.
16	the code recorder
17	Whoever is assigned by the code leader, or independently starts documentation on the code clipboard
18	the recorder- usually and ICU RN who is helping
19	the Nurse who is recording the events of the code.
20	the recorder
21	recorder
22	Whoever is scribing
23	one person is assigned recorder
24	RN in care of the pt
25	MD, RN who is recording information
26	RN
27	Whoever identifies themself as the recorder.
28	whoever is designated by the primary care nurse or the charge nurse
29	recorder
30	recorder
31	Code recorder-typically RN
32	RN caring for pt, pt's Primary MD,
33	STAT RN or ICU RN
34	The person who grabs the clipboard
35	Nurse 2 at the scene.
36	Nursing, unspecified.

Who is responsible for summary documentation about the code?

1	Usually the RN caring for the patient
2	It would be beneficial and important for the Code team leader and other key participants to review the process with the recorder.The recorder can then document a summary on the CODE record sheet.
3	Floor RN often institutes, STAT RN reviews and signs off
4	same as above
5	either MD or RN caring for the pt
6	The nurse caring for the patient
7	the recorder
8	primary staff RN taking care of the patient
9	Pt's nurse, and resident or code leader
10	Recorder as agreed and cosigned by participants like leader, anesthesiologist, drug administrator, etc.
11	code leader should provide a summary, patient's nurse usually writes a note about the code
12	RN assigned to patient
13	Who ever is recording the code.
14	ICU rn and stat rn
15	The RN caring for the patient.
16	code recorder
17	I don't really understand the question...after the fact? During the code? Whoever is doing the documentation should complete the paperwork after the fact.
18	MD on the service of the pt who coded and RN documentation in a progresss note
19	the nurse and M.D.
20	the pt's assigned RN?
21	RN
22	Pt's RN
23	primary RN
24	Recording RN as assigned by the charge nurse
25	The Pt's RN and MD
26	RN
27	The patients primary MD and RN.
28	the nurse caring for the patient
29	recorder
30	recorder
31	Primary RN
32	RN recording, RN caring for Pt, Primary team MD, and MD running the code
33	STAT RN
34	A nurse
35	Nurse 2, Stat RN
36	The code team leader (physician) and the ICU RN (often the STAT RN).

How do you use documentation forms during a code?

1	I have only used then during the code as a recorder, but often the MD or leader will ask exact times for drug admin or length of compressions, etc.
2	Designated form filled out by the recorder with the CODE in progress.
3	As intended, but have noticed a tendency not to use the checkboxes
4	
5	You get out the clipboard and record by hand what is going on during the code. For example, pulse, VSS, medications given, shock, pt response
6	
7	I personally write everything and then come back later to clean it up.
8	pen on paper, using the defib monitor by using the history feature
9	Record events including medication administration, defibrillation, vitals, length of code
10	Put data available at the moment every a few min's and read back to reader for remind with some time given for drugs or CPR
11	write down information as it comes (drugs, pulse/no pulse, etc) noting the time
12	Use the current form for vitals, meds given, shock given, labs drawn, procedures done, etc.
13	
14	I have never actually documented on the form during a real code.I have only used them when teaching.
15	Fill out what you can as the code is in progress, then go back to fill in the rest after the code ends.
16	write down the pt's heart rhythm, time meds are pushed, etc on the form as they occur/change.
17	Most often to remember which drugs have been given at what time.
18	pen and paper writing action, pt response, meds, vital and times
19	We have a code sheet form that is used during codes, which is located with the code cart
20	
21	on the clipboard on code-cart used
22	I take a piece of paper and write down everything I notice or know. After all the excitement is over, I review and rewrite on code sheets what is needed.
23	for all information recorded
24	Hand written
25	They are difficult to use, due to the poor quality of the forms and intensity of the situation, but generally we fill in the blanks on the form. We use them in review sessions of the situation.
26	record datat, interventions
27	Fill in the form as specified.
28	as designed. Fill in minute by minute the meds and activity
29	scribe onto the form
30	fill out sheet on code cart
31	as a guide and log to what we have done, what we have not done, the time frames

32	
33	Documentation, Review/Analyze events & actions, Outcomes data
34	Write down the vitals, and acttions
35	yell out drugs as they are given for charting purposes. help fill in form if floor nurse having difficulties.
36	The forms are very cumbersome and not at all well organized for flow documentation. Most of the information must be filled in after the event.

How can the Code Blue documentation forms themselves be improved?

1	Not sure I have used the new one!
2	I personally have not been involved in the documentation piece of a CODE at this facility. It is probably a good idea to have a form available for review during "downtime" or at a staff ed meeting.
3	simplify into three columns: time, med/event, current rhythm/problem being treated
4	
5	More room to write, the areas for documentation are small. Also, what happens to documentation after code is slightly confusing. More clarification on this would be helpful.
6	
7	I have never liked the code forms, but the new ones are worse. They should "flow" better. Of course I like the grid system of vital recording and code therapies. I think the narrative should be after that (ie; time of arrest, when intubated, who was present, etc.)--a summary of sorts.
8	integrate it into ORCA
9	More room in "boxes" to chart items.
10	Review by quality improvement team and charge and feedback to recorder
11	not sure
12	The form does not allow enough space to write, nor is it user friendly.
13	
14	I have not used enough to offer suggestions
15	Not sure, but they do need improvement.
16	more time columns to record
17	They should be simplified...often we don't have time to fill out the info at the beginning until afterward b/c things are well underway when the documentation starts.
18	I don't know I've only ever used one since starting here in Sep 08
19	Have separate directions as to what paper work goes where and who needs to sign the sheets. Sometimes it can get confusing as to what goes down with code cart and what is included in the patients chart
20	
21	N/A
22	Boxes for yes/no or quick questions for example; Intubated? CPR preformed? Did pt have a heart beat? Etc.. The area for writing meds should be left open. It's not easier to document drugs on lines when you don't remember or aren't familiar with the sheet. It's easier in my opinion to scribe per sequence of events as they happened.
23	I dont Know
24	
25	Be on the computer and be able to click them in.
26	
27	No suggestions.
28	revamping the form to make it more user friendly. An example would be to have check boxes where you can add a line for stopping CPR to check for pulse
29	
30	see pretty decent as-is
31	less writing more check boxes for what has been attempted and times
32	Integrated into ORCA to correlate events with vitals, meds, and treatments. It would give a clearer

	picture when referencing back
33	Don't know
34	put them online
35	I think just getting the nurses familiar with the sheets rather than changing them.
36	Vastly. First, the checkmarked sections need to be placed at the end. I realize data collection is important for review, but not helpful during an event. The paperwork needs to be much simpler with columns for: HR, rhythm, BP, RR, SpO2, Interventions. The is simply a minute by minute account of the vitals and interventions taking place. The rest can be filled in after the event.

How can the overall Code Blue documentation process be improved?

1	Make it very easy for the RN to determine what to do with the paperwork after the dode is over
2	Review the process in a staff ed meeting.
3	think paper is still the best option, given the environment, I suppose you could add a vocal recording of the event
4	
5	see previous
6	
7	Better code sheets.
8	
9	
10	
11	
12	Re-do the code form
13	
14	assigned code recorders who will become experts at code documentation
15	Not sure.
16	people be sure to shout out when heart rhythms, procedures, etc are occuring ("ok, I have a central line in the groin!")
17	I would have to look at the documentation sheets and think about it. But I know that it always feels like it takes a lot of time to fill out.
18	Get those hand held PDAs the VA has that syncs with the vial sign machine and props the staff and keeps track of meds given and time.
19	Nothing at this time
20	
21	have people clearly call out meds. they are giving and what they are doing at intervals.
22	It's a crisis situation and varies from good to bad, and there's no way to predict which you will experience. It all depends on the players.
23	Information from code cart slaved into ORCA. Orca records information from defib
24	n/a
25	Be on the computer and it can automatically be updated for codes that happen in room.
26	
27	It would be nice to have feedback on the process and recording in general.
28	improve ORCA so there is a code page that can be brought up and have on line documentation. This way all of the medications could be in e-mar as well
29	rn and recorder assigned prior to shift roles should not be be duplicated
30	not sure
31	official time piece on crash cart designated- simpler forms less writing-its hard to look back trough sloppy handwriting to see when the last time a med was given or what was given last
32	Integrate into ORCA, calling out Meds and Treatments to make sure they get recorded
33	
34	Make it easier online. Someone is usually charting the same info online anyways
35	Get people familiar with the sheets.
36	A standardized group of people to document, to be experts who are familiar with documentation.

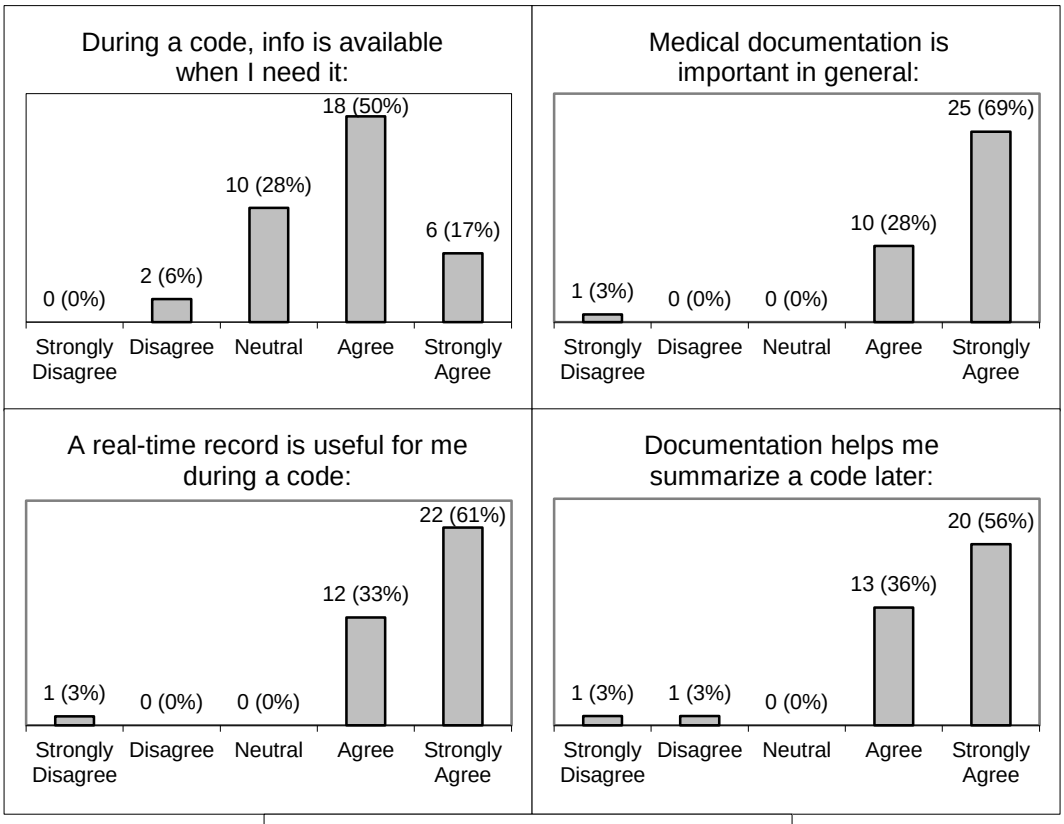
If we could add technology to assist with collecting information during a code, what would you like it to do?

1	Create a situation where someone doesn't have to be recording at the computer during the emergency
2	I feel that the paper document on a clip board is probably the easiest way to document for a CODE situation. The recorder is more mobile and able to observe and record vs at a computer screen where the recorder often times has their back to the CODE.Even with a computer on wheels,you would have one more piece of eqiptment in the midst of a crowded and very active environment. No risk of computer delays with a slow system.
3	voice recording (maybe), perhaps a wireless menu with drop down menus - would have to be able to see the full line all at once - orient horizontally with the three columns I spoke of, perhaps for the intervention column have two menus - one for meds, one for non-meds. As long as we are getting into technology - how about color coding the meds? So every time you have given epi, it is red font and easy to identify? amio would be green, lido pink, atropine purple (match the box color to the color of the font, even) but colors will need to be dark so they stand out and are easily seen
4	
5	
6	
7	Voice activated would be cool but realistically, the technology should not be too complicated to make the documentation process more complicated.
8	
9	As of now, all code documentation is and remains paper-based. If there was a way, it would be great to somehow integrate it in pts' electronic chart eliminating the need to hunt the paper copy.
10	
11	It might be useful to have a way of keeping track of time other than having to look up at the clock for dosing epinephrine and other drugs so the code leader will know how long it has been since the last dose
12	Computer documentation for code
13	
14	video and/ or audio recording
15	Record verbal communication. . . i.e., "one amp of Epi is in." Record the whole event somehow. Rather than write it all down you could verbally say what is happening and have it record things in the proper place. Just dreaming!
16	assuming the pt is attached to the code card, plug a recording device into the code cart which could automatically record why time rhythm was changing and where you could click "central line inserted at this time"
17	
18	YES! It's very difficult to write everything down in a code. If you could press code on a machine that logged the VS, meds and lab values in cronological order it would be wonderful. In an easy to read layout
19	Nothing at this time
20	
21	computerized
22	The person scribing should ONLY be doing scribing and be near the head of the bed, close to the action and hearing distance of things going on and being done to the pt.
23	see above
24	n/a

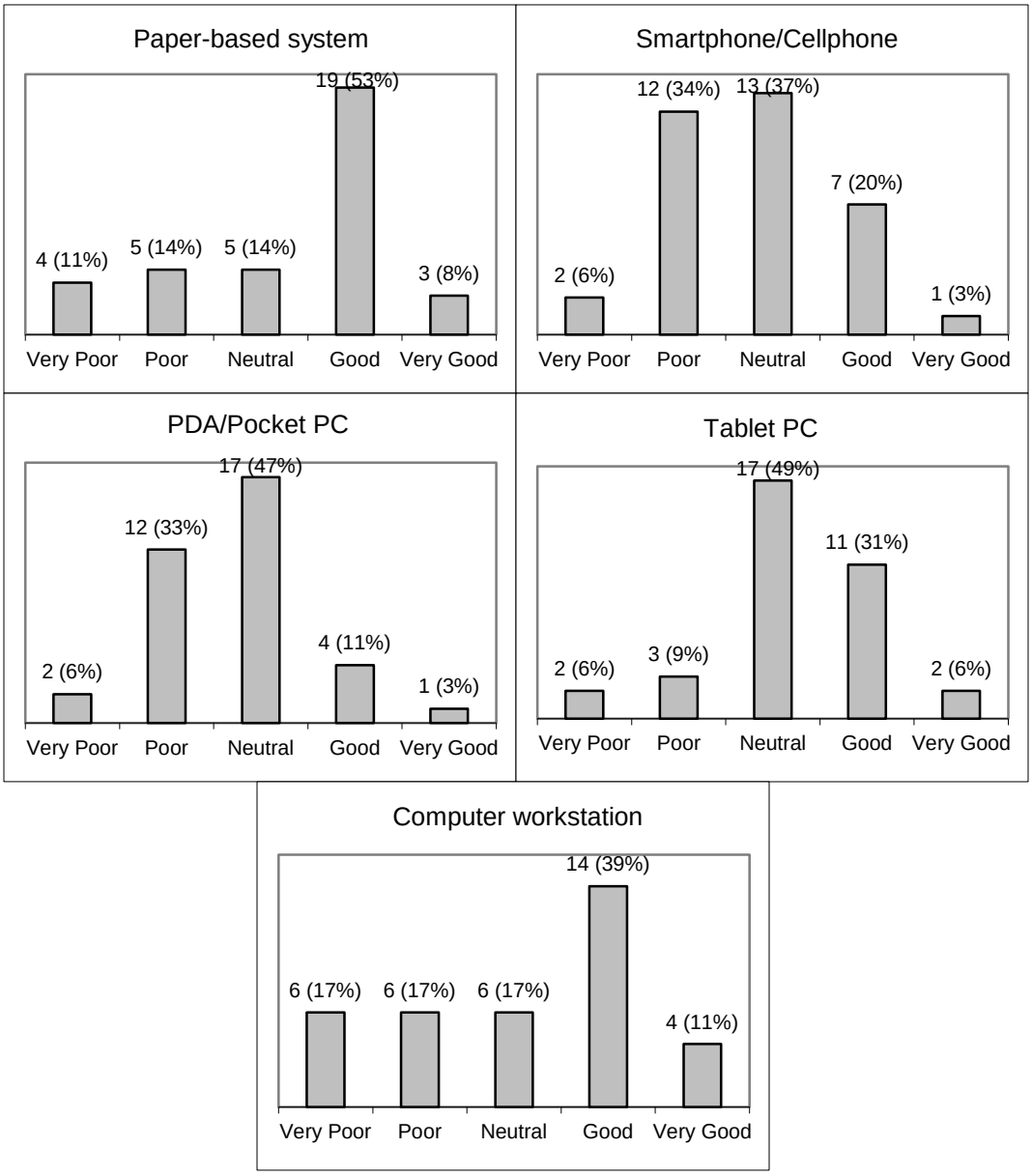
25	Everything that the forms have on it and more.
26	
27	Technology would complicate recording during a code 199.
28	yes I would add a voice feature so the recorder could state the time and the activity
29	something like what the airlift people chart on would help
30	i don't think i'd feel like dealing with technology during a code
31	a palm pilot with a program that can be reaily available to document and use as time piece and as technology keep track of last med given and length of CPR
32	Integrete into ORCA
33	'Tablet' laptop with touch screen technology to select meds, IV infusions, etc and ability to free text. Auto delivery of info to review committee, Able to print record
34	
35	I think technology is over rated people that use the forms just need to be familiar with them so they better utilize them.
36	It would document all the vitals and interventions taking place, real time.

Needs assessment Likert question results

	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
During a code, info is available when I need it:	0	0	2	10	18	6
Medical documentation is important in general:	0	1	0	0	10	25
A real-time record is useful for me during a code:	1	1	0	0	12	22
Documentation helps me summarize a code later:	1	1	1	0	13	20
Emergency documentation is easy to use:	0	3	10	11	9	3



	Very Poor	Poor	Neutral	Good	Very Good
Paper-based system	4	5	5	19	3
Smartphone/Cell phone	2	12	13	7	1
PDA/Pocket PC	2	12	17	4	1
Tablet PC	2	3	17	11	2
Computer workstation	6	6	6	14	4



Is there another option you'd like to see instead?

1	
2	I personally am not familiar with smart phone documentation. Any kind of technology tool not regularly used by personel would require additional training for speed and accuracy of recording.
3	I really haven't had the chance to experience using a tablet PC. Computer workstations that are mobile (COWs) would be useful, but take up room. The current workstations in the rooms are at the end of the bed in a horrible location and require the users back be to the action. I have never used a smartphone or cell phone, but presume they have the same problem as the PDA - too small a screen to work with, that is why I think a tablet PC might work very well with a good combo of pre-designed form and ability for OCR/write in data.
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	automated systems that do not require user input
15	I don't know enough about the above mentioned technology. We use paper currently and sometimes it works well, other times it does not work well. The computers would be more helpful if they were faster. Our current computer system would NOT work well because it is extremely slow.
16	something that records verbal communication would be awesome and the fastest way because then you could keep your eyes on the monitor and patient at all times instead of looking down to write.
17	
18	
19	None
20	
21	
22	Not really.
23	
24	
25	(I dont know what at tablet PC is...)
26	
27	
28	I would agree to the computer if the system were faster and more user friendly than the current system
29	
30	
31	something that you have to wait to log into would not work but something that with a click you have the computerized document would be great.

32	There are already computers that can be used in each pt's room. Code charting needs to be integrated into ORCA
33	
34	
35	No
36	

Needs assessment focus group feedback

STAT nurse focus group

Swedish and VM have a dedicated recorder on their code teams. How they schedule them? I don't know. There is more training for those specific individuals. Would it be possible to change the UWMC model, at least for the ICUs? Maybe give that task to the charge nurses?

The nurses are not as familiar with the "new" form; it would be nice to look at it when there's not a code. The form doesn't seem to be user-friendly, and some would prefer larger blocks of space to write free text.

Maybe change the sections for airways, meds, etc.? Nurses want more space to write, and right now a lot of that stuff gets filled in post-code.

Sometimes there's a lack of forms or places to write. In one case, the nurse had to write on a paper towel and transfer the information over later. In another case, there was a second code right after the first, and it went for over an hour.

Nursing practice council feedback

How about trying to color code it? How do we prompt people to write down the important information?

It's hard to find stuff on the form.

There are a lot of nurses who haven't seen the form.

On the floor, nurses don't always know what to write down.

Sometimes there are 2 codes at the same time. Also, the code isn't the only thing that nurses are doing.

Maybe assign the charge nurses (with backups) as the current documenters? This could be accompanied by additional training.

We could try audio/video recording, like they do in the NICU, but who would review the recordings?

Risk management feedback

There are 2 options here. There will be some overlap, but of course diff people have diff priorities. One option is to go over some records that risk management (RM) has now. The other option is we can both tell you anecdotally what the issues are.

Generally, at least at UWMC (and probably HMC) if a case rises to risk management, whether it goes to lawsuit or not, the cases tend to be kind of a mixed bag. Usually it's how they got to the code rather than the code itself, so often the case is about what happened that led to the code.

As for the code, there are 2 ways it can be an issue: 1. it doesn't go well, and we can't sort out what happened because the documentation isn't there. We have a list of UID numbers (i.e. patient ID) that we can use to go back and look at the code sheets, and see what was the issue.

We had a couple of claims that involved the code sheet too. The code documentation isn't always the main issue, but the cases did rise to RM level. There's always some issue around documentation. The issues around code doc from a RM perspective are: no clear chronology (no times), can't make a consistent timeline, when did the pt. arrest, who arrived when, what drugs when, doses, by whom.

Code sheets show up as RRT in ORCA. Not apparent who was in charge, who was present. Effect of med/procedure is often missing.

Those issues come up in varying degrees. Then that information will be inconsistent with another report. Time is especially an issue. If there's a lawsuit of claim, you can try to explain to lay juries, but they think that you have no idea what you're doing if they have different times all over them. And then as Pat mentioned, not knowing who is there, illegibility of signatures, etc.

The bigger problem is not being able to capture who was there and played some role, but they can't remember exactly what happened. The downside is they can't reconstruct what they did, and if there's a gap, it tends to get filled with a negative inference, and it doesn't look like we know what we were doing.

Accurate and consistent times for critical element, like what arrested first. Was the patient apnea first, or arrest first? Medications are a biggie, and how many intubation attempts, by whom? Was there bagging between intubation attempts? Similarly with IV access, what route were the drugs given by?

We're working on consistent placement of team members, with the Team STEPPS, etc. Back in the old days, we did the positional model (trauma stat mode, out of Philadelphia). Code leader and scribe didn't participate.

The smaller the target groups, the better. Can't have the team leader do it, but they are joined at the hip.

The most important thing is consistent timing intervals. The actual time is not important, as long as t+6 is the same, etc. Intervals is a big one. The next thing is completeness of information, especially around meds.

With the complete form, the problems inherent are that you still don't have the response to what happened. Also, I can't read it--legibility. Details are important, and finding out who was there.

For pt. response, going towards team STEPPS, and during debrief, they can go back and complete it. Pt. responses are things like vitals, sats, etc.

The less the team has to do, the better. Is it cost effective to build in technologies like video? Probably audio would be best.

Be careful that it isn't too routine, and no pick-lists please. Maybe a summary during debrief.

Ways to give a yea or nay before document goes final?

RM is more episodic and damage control; did we meet the standard of care. QI is about improvement.

Appendix 2 – Redesign

The original code blue documentation form, prototype documentation forms, and final code blue documentation form for the redesign section (chapter 3) are contained here.

American Heart Association template form

Facility Name / Logo	Patient Label

Date_____ Time Event Recognized _____ Location_____ Witnessed: ☐ Yes ☐ No
Age _____Weight_____ Height _____ Hospital-wide resuscitation response activated? ☐ Yes ☐ No
Illness Category: ☐ Medical Cardiac ☐ Medical Noncardiac ☐ Newborn ☐ Obstetric
☐ Surgical Cardiac ☐ Surgical Noncardiac ☐ Trauma ☐ Other _____
Condition when need for chest compression/defibrillation was identified? ☐ Pulseless ☐ Pulse (poor perfusion)
Did the patient with a pulse requiring compressions become pulseless? ☐ Yes ☐ No
Was patient conscious at onset? ☐ Yes ☐ No Monitoring at onset: ☐ ECG ☐ Pulse Oximeter ☐ Apnea

Airway/ Ventilation
Breathing at Onset: ☐ Spontaneous ☐ Apneic ☐ Agonal ☐ Assisted
Time of First Assisted Ventilation: _____
Ventilation: ☐ Bag-Valve-Mask ☐ Endotracheal Tube
☐ Tracheostomy ☐ Other:_____
Intubation: Time:_____ Size :_____
By Whom: _____
Confirmation ☐ Auscultation ☐ Exhaled CO_2 ☐ Other

First Rhythm Requiring Compressions: _____
First Documented PULSELESS Rhythm: _____
Compressions: ☐ None ☐ Manual ☐ Device:_____
Time chest compressions started: _____
Impedance Threshold Device used? ☐ Yes ☐ No
AED applied: ☐ Yes ☐ No ➔ Time applied:_____
Defibrillator type(s): _____
Pacemaker On: ☐ Yes ☐ No

Bolus ~ Dose / Route — Infusions ~ Dose / ml per hour

Time	Breathing: Spontaneous	Breathing: Assisted (✓)	Pulse: Spontaneous	Pulse: Compression (✓)	BP	Rhythm	AED	Manual (✓)	Joules	Amiodarone Dose / IV or IO	Atropine Dose / IV or IO	Epinephrine Dose / IV or IO	Lidocaine Dose / IV or IO	Vasopressin Dose / IV or IO		Dopamine	Dobutamine	Epinephrine	Norepinephrine	Comments: i.e.: Peripheral/Central Line Placement, IO, Chest tube, Vital Signs, Response to Interventions

Time Resuscitation Event Ended: _____ Status: ☐Alive ☐ Dead
Reason Resuscitation Ended: ☐ Return of Circulation (ROC) >20 min ☐ Efforts Terminated (No Sustained ROC)
☐ Medical Futility ☐ Advance Directives ☐ Restrictions by Family

Recorder Signature _____ID#_____ Provider Printed Name _____ID#_____
ICU/Team Nurse Signature _____ID#_____ Provider Signature _____

Page ____of _____ Original:_____ Yellow:_____ Provided by American Heart Association's NRCPR

Old UWMC code blue form (evaluation study "Form A")

CPR CODE BLUE

Date: _____ Time Event Recognized: _____ By whom_____Unit/Area: _____

Was hospital-wide resuscitation response activated?	YES ☐	NO ☐
Pediatric Code?	YES ☐	NO ☐
Was this a **witnessed** arrest?	YES ☐	NO ☐
Was the patient **conscious at onset**?	YES ☐	NO ☐
Was the patient **pulseless at onset**?	YES ☐	NO ☐
Did the patient with a pulse **become pulseless**?	YES ☐	NO ☐
Was the patient intubated prior to code?	YES ☐	NO ☐
What monitors were in place prior to code called in? ECG☐	Pulse Oximeter ☐	BP ☐

Airway/Ventilation	**Circulation**
Breathing at code onset: Spontaneous ☐ Apnea ☐ Agonal ☐ Assisted ☐	Rhythm at code onset: VF/VT ☐ PEA ☐ Asystole ☐ Bradycardia ☐
Types of Ventilation: Mouth/Mouth ☐ Mouth/Mask ☐ BVM ☐ ETT ☐ ETT Tracheotomy ☐ Other:_____	Time chest compressions started: Patient Defibrillated? Yes ☐ No ☐ Time of first shock:
Time of First Assisted Ventilation:	AED applied? Yes ☐ No ☐
ETT Intubation: Time: By Whom:	AED shock? Advised ☐ Delivered 1st Shock ☐
Secondary Confirmation: Auscultation ☐ Endtidal CO_2 ☐	Pacemaker on? Yes ☐ No ☐

Time	Resp Rate (Spontaneous = S, Assisted = A)	Pulse (Spontaneous = S, Compression = C)	BP	Rhythm	**Defib/Cardiov** Joules	MEDS	**INFUSIONS**	Labs (e.g. Na^+, K^+)	**Comments** (i.e): Peripheral/Central Line Placement, Chest Tube, Response to Interventions

PT.NO

NAME

DOB

UW Medicine
Harborview Medical Center – UW Medical Center
University of Washington Physicians
Seattle, Washington

CPR CODE BLUE PAGE 1 OF 2

U0665

UH0665 REV DEC 09

PROGRESS – BLUE

Time	Resp Rate Spontaneous = S Assisted = A	Pulse Spontaneous = S Compression = C	BP	Rhythm	**Defib/Cardiov** Joules	MEDS	**INFUSIONS**	Labs (e.g. Na^+, K^+)	**Comments** (i.e): Peripheral/Central Line Placement, Chest Tube, Response to Interventions

Time resuscitation ended: _____ Patient status: Alive ☐ Deceased ☐

Reason resuscitation ended:
Return of Pulse (>20 min.) ☐ Advance Directive ☐ Restriction by family ☐ Efforts terminated due to no sustained return of circulation ☐ Efforts terminated due to medical futility ☐

Patient Disposition:
Remained on unit ☐ Transferred to ICU ☐ Transferred to ED ☐

Recorder's Signature:_____ Team Leader signature:_____

ICU/Code Team Nurse's signature:_____

Physician printed name and signature:_____

PT.NO

NAME

DOB

UW Medicine
Harborview Medical Center – UW Medical Center
University of Washington Physicians
Seattle, Washington

CPR CODE BLUE PAGE 2 OF 2

U0665

UH0665 REV DEC 09

PROGRESS – BLUE

Redesigned code blue form (evaluation study "Form B")

UW MEDICINE: CODE BLUE RECORD

PAGE ____ OF ____

TIME OF CODE START _____
DATE _____
UNIT / AREA _____

☐ Cardiac Arrest ☐ Resp Arrest ☐ Peds Arrest ☐ Not An Arrest

INTUBATED PRIOR TO CODE ☐ Yes (Leave below blank)
TIME OF CODE INTUBATION _____
INTUBATION BY _____

Type of Code Intubation: ☐ ETT ☐ Trach
ETT Confirmation: ☐ $EtCO_2$ ☐ Auscultation

START HERE **TIME**								
Pulse (Y/N)								
Rhythm, Rate								
Compressions (Y/N)								
$EtCO_2$								
Shock (Joules)								
RR (S=Spont, A=Assisted)								
O_2–SAT								
Blood Pressure								
MEDS (Rec. Adult Dose)			PLEASE NOTE IF MEDICATION GIVEN VIA **IV** –OR– **IO**					
EPInephrine (1mg)								
VASOpressin (40 units)								
AMIOdarone(300, 150mg)								
LIDOcaine (1-1.5 mg/kg)								
ATROpine (0.5–1mg)								
Other								
IV Fluid (NS or LR) ↑								
DOPamine (gtt)								
EPInephrine (gtt)								
NOREPInephrine (gtt)								
Blood Products or Other								
Blood Products or Other								

LAB TIME: _____ pH_____ CO_2_____ PaO_2_____ HCO_3_____ K+_____ Glucose_____ HCT_____ Lactate_____

LAB TIME: _____ pH_____ CO_2_____ PaO_2_____ HCO_3_____ K+_____ Glucose_____ HCT_____ Lactate_____

CONTINUE TO NEXT PAGE

PT.NO

NAME

DOB

UW MEDICINE
Harborview Medical Center — UW Medical Center
University of Washington Physicians
Seattle, Washington

CARDIOPULMONARY RESUSCITATION RECORD

U0665

HMC0269 REV MAR 11 • WHITE COPY TO PATIENT CHART • YELLOW TO NURSE MGR

UW MEDICINE: CODE BLUE RECORD — SIGNATURE PAGE PAGE ____ OF ____

TIMEKEEPING SOURCE
(i.e. watch, cell phone, etc.)

_____

HOSPITAL–WIDE RESPONSE ACTIVATED
☐ Yes ☐ No

WITNESSED ARREST
☐ Yes ☐ No

CONSCIOUS AT ONSET
☐ Yes ☐ No

BREATHING AT ONSET
☐ Spontaneous
☐ Assisted
☐ Agonal
☐ Apnea
☐ Intubated/ETT

RHYTHM AT ONSET
☐ VF/VT
☐ PEA
☐ Asystole
☐ Bradycardia
☐ Normal Sinus Rhythm
☐ Other

_____

PRE–CODE VASCULAR ACCESS
☐ Central
☐ Peripheral
☐ Other _____
☐ None

VASCULAR ACCESS INSERTED DURING CODE
☐ Central
☐ Peripheral
☐ Intraosseous: Please Circle
LEFT IO –or– RIGHT IO

CODE END TIME

_____

REASON ENDED
☐ Return of Circulation
☐ No Return of Circulation
☐ Advance Directive
☐ Family Request

PATIENT OUTCOME
☐ Deceased
☐ Remained on Unit
☐ Transferred To:

_____

PLEASE CHECK ALL TEAM MEMBERS PRESENT DURING CODE

Anesthesiologist ☐ ☐ Respiratory Therapist
Med Admin RN ☐ ☐ Compression Providers
RN #2 ☐
PATIENT
☐ Bedside RN
Pharmacist ☐ ☐ Recorder
☐ MD Leader

Comments: _____

SIGN _____ MD LEADER SIGNATURE | _____ PRINT NAME | _____ DATE/TIME

SIGN _____ MEDICATION ADMINISTRATION RN SIGNATURE | _____ PRINT NAME | _____ DATE/TIME

SIGN _____ RECORDER SIGNATURE | _____ PRINT NAME/TITLE | _____ DATE/TIME

PT.NO

NAME

DOB

UW MEDICINE
Harborview Medical Center — UW Medical Center
University of Washington Physicians
Seattle, Washington

CARDIOPULMONARY RESUSCITATION RECORD

U0665

HMC0269 REV MAR 11•WHITE COPY TO PATIENT CHART• YELLOW TO NURSE MGR

Prototype 1

UW Medicine – Code Blue Event Record

Page 1/2

Code Start Time: _____ Time of First CPR/Compressions: _____ Time of First Shock: _____

Time	Vitals (BP, HR, O_2)	Rhythm / AED / Shock (joules)	Medications / Dose (ATRopine AMIOdarone, EPInephrine, LIDOcaine, VASOpressin, MAGnesium, $NaHCO_3$, CaCl, Other?)	CPR (start/stop) / Airway (BVM, ETT)	Patient Response / Labs / Comments

CONTINUE ON PAGE 2

Patient Information (place sticker here)
Patient Number: _____
Patient Name: _____

UW Medicine
Harborview Medical Center – UW Medical Center
University of Washington Physicians
Seattle, Washington

CPR CODE BLUE

UH0665 REV JUL 10

UW Medicine – Code Blue Event Record

Time	Vitals (BP, HR, O_2)	Rhythm / AED / Shock (joules)	Medications / Dose (ATRopine AMIOdarone, EPInephrine, LIDOcaine, VASOpressin, MAGnesium, $NaHCO_3$, CaCl, Other?)	CPR (start/stop) / Airway (BVM, ETT)	Patient Response / Labs / Comments

Code End Time: _____

Patient Outcome: Deceased __ Remained on Unit __ Transferred to: _____

Recorder Name/Signature: _____ ICU/Code Team nurse _____

Physician Name/Signature: _____ Team leader _____

Airway
Breathing at onset?
Spontaneous __ Apnea __ Agonal __ Assisted __

Ventilation type?
Mouth/mouth __ Mask __ Bag/mask __ ETT __ Trach. __

ETT Confirmation: Auscultation __ Endtidal CO2 __

Circulation
Rhythm at code onset?
VF/VT __ PEA __ Asystole __ Bradycardia __

AED applied? Yes __ No __

Pacemaker on? Yes __ No __

Patient Information (place sticker here)
Patient Number: _____

Patient Name: _____

UW Medicine
Harborview Medical Center – UW Medical Center
University of Washington Physicians
Seattle, Washington

CPR CODE BLUE

UH0665 REV JUL 10

Prototype 2

UW Medicine – Code Blue Event Record

False Arrest? ☐ Page # 1/2

Time of Code Start: _____ Time of first chest compressions: _____ Time of first shock: _____ Time of first assisted ventilation: _____

Time	**Vitals** (HR, BP, O_2 sat.)	**Rhythm** / **AED** / **Shock** (joules)	**Medications** (dose) / **IV** (rate) **ATR**opine, **AMI**Odarone, **Na**HCO_3, **EP**Inephrine, **LID**Ocaine, **CaCl**, VA **S**Opressin, **MAG**nesium, Other?	**CPR** (compressions) / **Airway** (BVM, ETT)	**Patient Response** / **Comments** / **Labs**

CONTINUE ON PAGE 2

Patient Information (place sticker here)

Patient Number: _____

Patient Name: _____

UW Medicine
Harborview Medical Center – UW Medical Center
University of Washington Physicians
Seattle, Washington

U0665

Code Blue Page 1 of 2 UH0665 REV AUG 10

WHITE – Medical Record / CANARY – Center for Clinical Excellence

UW Medicine – Code Blue Event Record

CONTINUED FROM PAGE 1

Time	Vitals (HR, BP, O_2 sat.)	Rhythm / AED / Shock (joules)	Medications (dose) / IV (rate) ATRopine, AMIOdarone, $NaHCO_3$, EPInephrine, LIDOcaine, CaCl, VA $Opressin, MAGnesium, Other?	CPR (compressions) / Airway (BVM, ETT)	Patient Response / Comments / Labs

Code End Time: _____ **Patient Outcome:** Deceased ☐ Remained on unit ☐ Transferred to _____

Reason ended: Return of Circ. (20 min.+) ☐ No return of circ. ☐ Advance directive ☐ Medical futility ☐ Family request ☐

Recorder Name/Signature: _____ **ICU/Code Team nurse:** _____

Physician Name/Signature: _____ **Team leader (if different):** _____

Date: _____ **Unit/Area:** _____

Witnessed arrest: Yes ☐ No ☐

Breathing at onset:
Spontaneous ☐ Apnea ☐ Agonal ☐ Assisted ☐ Intubated ☐

Rhythm at onset:
VF/VT ☐ PEA ☐ Asystole ☐ Bradycardia ☐ Other _____

Patient Information (place sticker here)

Patient Number: _____

Patient Name: _____

UW Medicine
Harborview Medical Center – UW Medical Center
University of Washington Physicians
Seattle, Washington

U0665

Code Blue Page 2 of 2 UH0665 REV AUG 10

WHITE – Medical Record / CANARY – Center for Clinical Excellence

UW Medicine – Code Blue Event Record

False Arrest? ☐ Page # 1/2

Time of Code Start:_____ Time of first CPR: _____ Time of first shock: _____ Time of first airway: _____

Time	Vitals (BP, HR, O_2)	Rhythm / AED / Shock (joules)	Medications (dose) / IV (rate) ATRopine, AMIOdarone, $NaHCO_3$, EPInephrine, LIDOcaine, CaCl, VA SOpressin, MAGnesium, Other?	CPR (start/stop) / Airway (BVM, ETT)	Patient Response / Comments / Labs

CONTINUE ON PAGE 2

Patient Information (place sticker here)

Patient Number: _____

Patient Name: _____

UW Medicine
Harborview Medical Center – UW Medical Center
University of Washington Physicians
Seattle, Washington

U0665

UH0665 REV AUG 10

UW Medicine – Code Blue Event Record

CONTINUED FROM PAGE 1

Time	Vitals (BP, HR, O_2)	Rhythm / AED / Shock (joules)	Medications (dose) / IV (rate) ATRopine, AMIOdarone, $NaHCO_3$, EPInephrine, LIDOcaine, CaCl, VASOpressin, MAGnesium, Other?	CPR (start/stop) / Airway (BVM, ETT)	Patient Response / Comments / Labs

Code End Time: _____ **Patient Outcome:** Deceased ☐ Remained on unit ☐ Transferred to _____

Reason ended: Return of Circulation (20 min.+) ☐ No return of circulation ☐ Advance directive ☐ Medical futility ☐ Family request ☐

Recorder Name/ Signature: _____ **ICU/Code Team nurse:** _____

Physician Name/Signature: _____ **Team leader (if different):** _____

Date: _____ **Unit/Area:** _____

Witnessed arrest: Yes ☐ No ☐

Breathing at onset: Spontaneous ☐ Apnea ☐ Agonal ☐ Assisted ☐

Rhythm at onset VF/VT ☐ PEA ☐ Asystole ☐ Bradycardia ☐ Other _____

Patient Information (place sticker here)

Patient Number: _____

Patient Name: _____

UW Medicine
Harborview Medical Center – UW Medical Center
University of Washington Physicians
Seattle, Washington

U0665

UH0665 REV AUG 10

UW Medicine – Code Blue Event Record

Page # 1/2

Time of Code Start: _____ Cardiac Arrest ☐ Respiratory Arrest ☐ False Arrest ☐

Time	Vitals			Cardiac	Medications (dose) / IV (rate)	Respiratory	Comments
	HR	BP	O_2 sat.	Rhythm / AED / Shock (joules)	Atropine, Amiodarone, $NaHCO_3$, CaCl, Epinephrine, Lidocaine, Vasopressin, Magnesium, Other?	Compressions / BVM / Intubation	Patient Response / Labs / Other Notes

CONTINUE ON PAGE 2

Patient Information (place sticker here)

Patient Number: _____

Patient Name: _____

UW Medicine
Harborview Medical Center – UW Medical Center
University of Washington Physicians
Seattle, Washington

U0665
UH0665 REV SEP 10

UW Medicine – Code Blue Event Record

CONTINUED FROM PAGE 1

Time	Vitals			Cardiac	Medications (dose) / IV (rate)	Respiratory	Comments
	HR	BP	O_2 sat.	Rhythm / AED / Shock (joules)	Atropine, Amiodarone, $NaHCO_3$, $CaCl$, Epinephrine, Lidocaine, Vasopressin, Magnesium, Other?	Compressions / BVM / Intubation	Patient Response / Labs / Other Notes

Code End Time: _____ **Patient Outcome:** Deceased ☐ Remained on unit ☐ Transferred to _____

Reason ended: Return of circulation (20 min.+) ☐ No return of circulation ☐ Advance directive ☐ Medical futility ☐ Family request ☐

Recorder Name/Signature: _____ **ICU/Code Team nurse:** _____

Physician Name/Signature: _____ **Team leader (if different):** _____

Date: _____ **Unit/Area:** _____
Hospital-wide response activated: Yes ☐ No ☐
Witnessed arrest: Yes ☐ No ☐

Breathing at onset: Spontaneous ☐ Apnea ☐ Agonal ☐ Assisted ☐ Intubated/ETT ☐
Rhythm at onset: VF/VT ☐ PEA ☐ Asystole ☐ Bradycardia ☐ Other _____
Conscious at onset: Yes ☐ No ☐

Patient Information (place sticker here)

Patient Number: _____

Patient Name: _____

UW Medicine
Harborview Medical Center – UW Medical Center
University of Washington Physicians
Seattle, Washington

UW Medicine – Code Blue Event Record

False Arrest? ☐ Page # 1/2

Time of Code Start: _____

Time	Vitals			Cardiac	Medications (dose) / IV (rate)	Respiratory	Comments
	HR	BP	O_2 sat.	Rhythm / AED / Shock (joules)	Atropine, Amiodarone, $NaHCO_3$, $CaCl$, Epinephrine, Lidocaine, Vasopressin, Magnesium, Other?	Compressions / BVM / Intubation	Patient Response / Labs / Other Notes

CONTINUE ON PAGE 2

Patient Information (place sticker here)

Patient Number: _____

Patient Name: _____

UW Medicine
Harborview Medical Center – UW Medical Center
University of Washington Physicians
Seattle, Washington

U0665
UH0665 REV SEP 10

UW Medicine – Code Blue Event Record

CONTINUED FROM PAGE 1

Time	Vitals			Cardiac	Medications (dose) / IV (rate)	Respiratory	Comments
	HR	BP	O_2 sat.	Rhythm / AED / Shock (joules)	Atropine, Amiodarone, $NaHCO_3$, $CaCl$, b/Epinephrine, Lidocaine, Vasopressin, MAGnesium, Other?	Compressions / BVM / Intubation	Patient Response / Labs / Other Notes

Code End Time: _____ **Patient Outcome:** Deceased ☐ Remained on unit ☐ Transferred to _____

Reason ended: Return of circulation (20 min.+) ☐ No return of circulation ☐ Advance directive ☐ Medical futility ☐ Family request ☐

Recorder Name/Signature: _____ **ICU/Code Team nurse:** _____

Physician Name/Signature: _____ **Team leader (if different):** _____

Date: _____ **Unit/Area:** _____
Hospital-wide response activated: Yes ☐ No ☐
Witnessed arrest: Yes ☐ No ☐

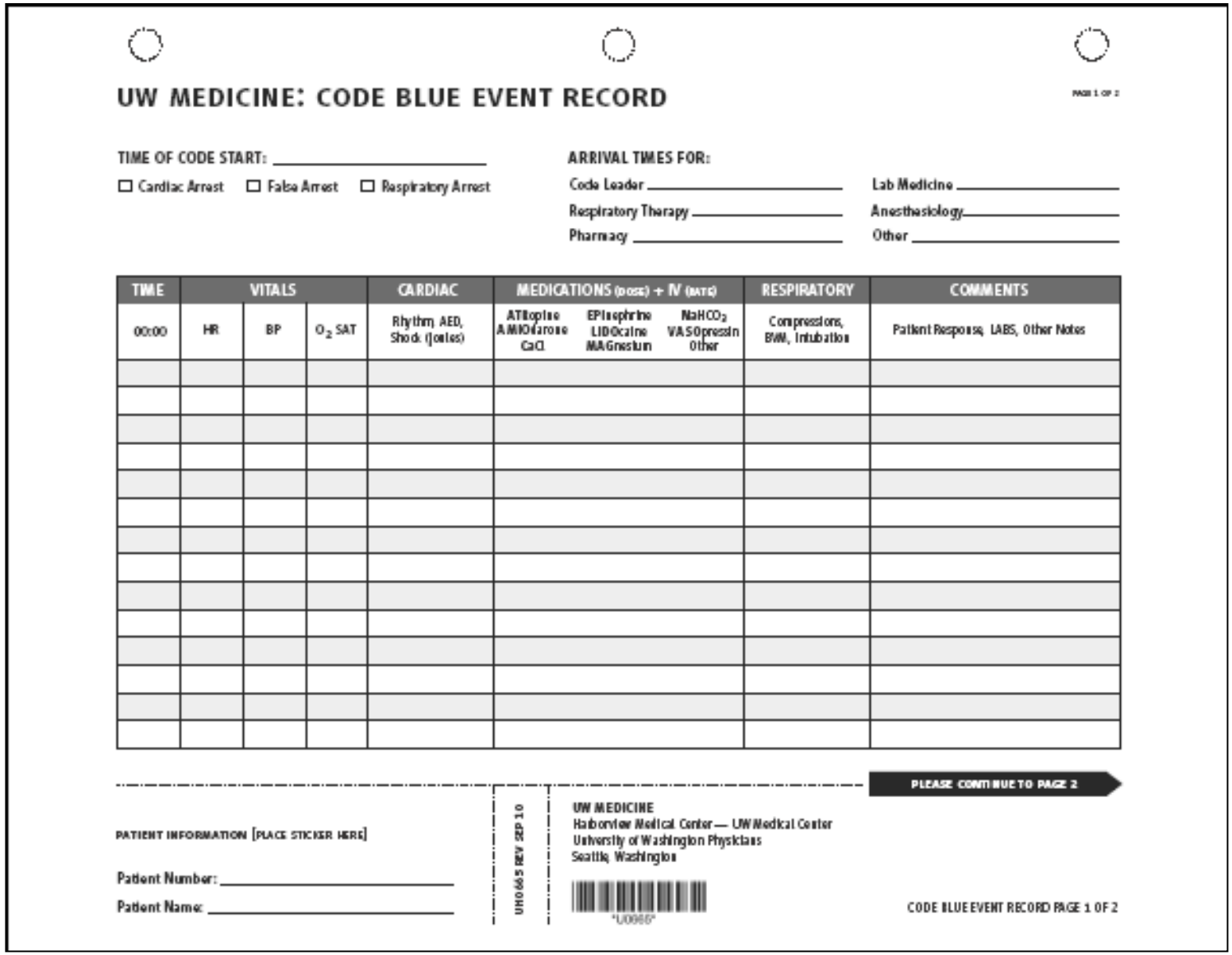
Breathing at onset: Spontaneous ☐ Apnea ☐ Agonal ☐ Assisted ☐ Intubated/ETT ☐
Rhythm at onset: VF/VT ☐ PEA ☐ Asystole ☐ Bradycardia ☐ Other _____
Conscious at onset: Yes ☐ No ☐

Patient Information (place sticker here)

Patient Number: _____

Patient Name: _____

UW Medicine
Harborview Medical Center – UW Medical Center
University of Washington Physicians
Seattle, Washington



UW MEDICINE: CODE BLUE EVENT RECORD

PAGE 1 OF 2

TIME OF CODE START: _____

☐ Cardiac Arrest ☐ False Arrest ☐ Respiratory Arrest

ARRIVAL TIMES FOR:

Code Leader _____ Lab Medicine _____

Respiratory Therapy _____ Anesthesiology _____

Pharmacy _____ Other _____

TIME	VITALS			CARDIAC	MEDICATIONS (poss) + IV (mtrs)	RESPIRATORY	COMMENTS
00:00	HR	BP	O_2 SAT	Rhythm, AED, Shock (Joules)	ATRopine EPInephrine $NaHCO_3$ AMIOdarone LIDOcaine VASOpressin CaCl MAGnesium Other	Compressions, BVM, Intubation	Patient Response, LABS, Other Notes

PLEASE CONTINUE TO PAGE 2

PATIENT INFORMATION [PLACE STICKER HERE]

Patient Number: _____

Patient Name: _____

UH0665 REV SEP 10

UW MEDICINE
Harborview Medical Center — UW Medical Center
University of Washington Physicians
Seattle, Washington

U0665

CODE BLUE EVENT RECORD PAGE 1 OF 2

UW MEDICINE: CODE BLUE EVENT RECORD — PAGE 2 OF 2

CONTINUED FROM PAGE 1

TIME	VITALS			CARDIAC	MEDICATIONS (dose) + IV (rate)			RESPIRATORY	COMMENTS
00:00	HR	BP	O_2 SAT	Rhythm, AED, Shock (Joules)	ATropine AMIOdarone CaCl	EPInephrine LIDOcaine MAGnesium	$NaHCO_3$ VASOpressin Other	Compressions, BVM, Intubation	Patient Response, LABS, Other Notes

DATE: _____

UNIT/AREA: _____

SIGN _____
Physician Name + Signature

SIGN _____
Recorder Name + Signature

SIGN _____
ICU Code Team Nurse Name + Signature

SIGN _____
Team Leader Name + Signature (If different)

HOSPITAL-WIDE RESPONSE ACTIVATED
☐ Yes ☐ No

WITNESSED ARREST
☐ Yes ☐ No

CONSCIOUS AT ONSET
☐ Yes ☐ No

BREATHING AT ONSET
☐ Spontaneous
☐ Apnea
☐ Agonal
☐ Assisted
☐ Intubated/ETT

RHYTHYM AT ONSET
☐ VF/VT
☐ PEA
☐ Asystole
☐ Bradycardia
☐ Other _____

CODE END TIME: _____

REASON ENDED
☐ Return of Circulation (20 mins+)
☐ No Return of Circulation
☐ Advance Directive
☐ Medical Futility
☐ Family Request

PATIENT OUTCOME
☐ Deceased
☐ Remained on Unit
☐ Transferred to _____

PATIENT INFORMATION [PLACE STICKER HERE]

Patient Number: _____

Patient Name: _____

UH0665 REV SEP 10

UW MEDICINE
Harborview Medical Center — UW Medical Center
University of Washington Physicians
Seattle, Washington

U0665

CODE BLUE EVENT RECORD PAGE 2 OF 2

Prototype 7

UW MEDICINE: CODE BLUE EVENT RECORD

TIME OF CODE START: _____ DATE _____

☐ Cardiac Arrest ☐ False Arrest ☐ Respiratory Arrest UNIT/AREA _____

TIME	VITALS			RESPIRATORY	CARDIAC	MEDICATIONS			COMMENTS
	HR	BP	O_2 SAT	Compressions, BVM, Intub, Intubation Confirmation	Rhythm, AED Shock (Joules)	ATROpine AMIOdarone CaCl	EPInephrine LIDOcaine MAGnesium	$NaHCO_3$ VASOpressin Other	Patient Response, LABS, Other
00:00									

CONTINUE TO PAGE 2

PT. NO

NAME

DOB

UW Medicine Health System
Harborview Medical Center – UW Medical Center
Northwest Hospital & Medical Center – University of Washington Physicians
Seattle, Washington

CPR CODE BLUE PAGE 1 OF 2

U0665

WHITE – MEDICAL RECORD
CANARY– SPECIAL RED ENVELOPE

UH0665 REV SEP 10

UW MEDICINE: CODE BLUE EVENT RECORD — PAGE 2 OF 2

CONTINUED FROM PAGE 1

TIME	VITALS			RESPIRATORY	CARDIAC	MEDICATIONS			COMMENTS
00:00	HR	BP	O_2 SAT	Compressions; BVM, Bath; Intubation Confirmation	Rhythm, AED Shock (Joules)	ATRopine AMIOdarone CaCl	EPInephrine LIDocaine MAGnesium	$NaHCO_3$ VASOpressin Other	Patient Response, LABS, Other

Physician Signature _____ *Print Name* _____

Date/Time _____

Recorder Signature _____ *Print Name* _____

Date/Time _____

ICU/Code Team Nurse Signature _____ *Print Name* _____

Date/Time _____

Team Leader Signature (if different) _____ *Print Name* _____

Date/Time _____

HOSPITAL-WIDE RESPONSE ACTIVATED
☐ Yes ☐ No

WITNESSED ARREST
☐ Yes ☐ No

CONSCIOUS AT ONSET
☐ Yes ☐ No

BREATHING AT ONSET
☐ Spontaneous
☐ Apnea
☐ Agonal
☐ Assisted
☐ Intubated/ETT

RHYTHYM AT ONSET
☐ VF/VT
☐ PEA
☐ Asystole
☐ Bradycardia
☐ Normal NSR
☐ Other _____

CODE END TIME
_____

REASON ENDED
☐ Return of Circulation (20 min+)
☐ No Return of Circulation
☐ Advance Directive
☐ Medical Futility
☐ Family Request

PATIENT OUTCOME
☐ Deceased
☐ Remained on Unit
☐ Transferred to _____

PT. NO

NAME

DOB

UW Medicine Health System
Harborview Medical Center – UW Medical Center
Northwest Hospital & Medical Center – University of Washington Physicians
Seattle, Washington

CPR CODE BLUE PAGE 1 OF 2

U0665

UH0665 REV SEP 10

WHITE – MEDICAL RECORD
CANARY– SPECIAL RED ENVELOPE

UW MEDICINE: CODE BLUE EVENT RECORD

TIME OF CODE START: _____ DATE _____

☐ Cardiac Arrest ☐ False Arrest ☐ Respiratory Arrest UNIT/AREA _____

TIME	VITALS			RESPIRATORY	CARDIAC	MEDICATIONS	COMMENTS
00:00	HR	BP	O_2 SAT	Compressions; BVM, Bats, Intubation Confirmation	Rhythm, AED Shock (Joules)	AMIOdarone EPInephrine ATIlopine Other	Patient Response; LABS, Other

CONTINUE TO PAGE 2

PATIENT INFORMATION [PLACE STICKER HERE]

Patient Number: _____

Patient Name: _____

UH0665 REV SEP 10

UW MEDICINE
Harborview Medical Center — UW Medical Center
University of Washington Physicians
Seattle, Washington

U0665

UW MEDICINE: CODE BLUE EVENT RECORD — PAGE 2 OF 2

CONTINUED FROM PAGE 1

TIME	VITALS			RESPIRATORY	CARDIAC	MEDICATIONS	COMMENTS
00:00	HR	BP	O_2 SAT	Compressions; BVM, Bats, Intubation Confirmation	Rhythm, AED Shock (Joules)	AMIOdarone ATRopine EPInephrine Other	Patient Response, LABS, Other

SIGN _____ _____ _____
Physician Signature *Print Name* *Date/Time*

SIGN _____ _____ _____
Recorder Signature *Print Name* *Date/Time*

SIGN _____ _____ _____
ICU/Code Team Nurse Signature *Print Name* *Date/Time*

SIGN _____ _____ _____
Team Leader Signature if different *Print Name* *Date/Time*

HOSPITAL-WIDE RESPONSE ACTIVATED
☐ Yes ☐ No

WITNESSED ARREST
☐ Yes ☐ No

CONSCIOUS AT ONSET
☐ Yes ☐ No

BREATHING AT ONSET
☐ Spontaneous
☐ Apnea
☐ Agonal
☐ Assisted
☐ Intubated/ETT

RHYTHM AT ONSET
☐ V/F/VT
☐ PEA
☐ Asystole
☐ Bradycardia
☐ Normal Sinus Rhythm
☐ Other _____

CODE END TIME _____

REASON ENDED
☐ Return of Circulation (20 min+)
☐ No Return of Circulation
☐ Advance Directive
☐ Medical Futility
☐ Family Request

PATIENT OUTCOME
☐ Deceased
☐ Remained on Unit
☐ Transferred to _____

PATIENT INFORMATION [PLACE STICKER HERE]

Patient Number: _____

Patient Name: _____

UW0665 REV SEP 10

UW MEDICINE
Harborview Medical Center — UW Medical Center
University of Washington Physicians
Seattle, Washington

UW665

CODE BLUE EVENT RECORD PAGE 2 OF 2

UW MEDICINE: CODE BLUE EVENT RECORD

TIME OF CODE START _____ DATE _____

☐ Cardiac Arrest ☐ Respiratory Arrest ☐ False Arrest UNIT/AREA _____

TIME	CIRCULATION		CARDIAC		RESPIRATION	INTUBATION	VITALS			MEDS (Dose/Route)		COMMENTS
00:00	Compress (Y/N)	et CO_2	Rhythm	Shock (joules)	Spontaneous/ Assisted	ETT Tracheotomy	Heart Rate	Blood Pressure	O_2 SAT	AMIOdarone LIDOcaine EPInephrine VASOpressin Other	Dose/ Route	Intubation Confirmed, Patient Response, LABS, Other

PLEASE CONTINUE TO NEXT PAGE

PATIENT INFORMATION [PLACE STICKER HERE]

Patient Number: _____

Patient Name: _____

UH0665 REV FEB 11

UW MEDICINE
Harborview Medical Center — UW Medical Center
University of Washington Physicians
Seattle, Washington

U0665

UW CODE BLUE EVENT RECORD PAGE_____ OF _____

UW MEDICINE: CODE BLUE EVENT RECORD — SIGNATURE PAGE

SIGN	PHYSICIAN SIGNATURE	PRINT NAME	DATE/TIME
SIGN	RECORDER SIGNATURE	PRINT NAME	DATE/TIME
SIGN	ICU/CODE TEAM NURSE SIGNATURE	PRINT NAME	DATE/TIME
SIGN	TEAM LEADER (IF DIFFERENT) SIGNATURE	PRINT NAME	DATE/TIME

HOSPITAL-WIDE RESPONSE ACTIVATED
☐ Yes ☐ No

WITNESSED ARREST
☐ Yes ☐ No

CONSCIOUS AT ONSET
☐ Yes ☐ No

BREATHING AT ONSET
☐ Spontaneous
☐ Assisted
☐ Agonal
☐ Apnea
☐ Intubated/ETT

RHYTHM AT ONSET
☐ VF/VT
☐ PEA
☐ Asystole
☐ Bradycardia
☐ Normal Sinus Rhythm
☐ Other _____

CODE END TIME_____

REASON ENDED
☐ Return of Circulation
☐ No Return of Circulation
☐ Medical Futility
☐ Advance Directive
☐ Family Request

PATIENT OUTCOME
☐ Deceased
☐ Remained on Unit
☐ Transferred to: _____

PLEASE CHECK ALL TEAM MEMBERS PRESENT AT CODE

Anesthesiologist ☐

ICU/Code Team Nurse ☐
Nurse #2 ☐
Pharmacist ☐

PATIENT

☐ Respiratory Therapist
☐ Compression Provider #1
☐ Compression Provider #2
☐ Bedside Nurse
☐ Recorder

☐ Team Leader

PATIENT INFORMATION [PLACE STICKER HERE]

Patient Number: _____

Patient Name: _____

UH1665 REV FEB 11

UW MEDICINE
Harborview Medical Center — UW Medical Center
University of Washington Physicians
Seattle, Washington

U0665

UW CODE BLUE EVENT RECORD PAGE_____ OF _____

Prototype 10

UW MEDICINE: CODE BLUE RECORD

PAGE _____ OF _____

TIME OF CODE START _____

DATE _____

UNIT / AREA _____

☐ Cardiac Arrest ☐ Respiratory Arrest ☐ Not An Arrest

INTUBATED PRIOR TO CODE ☐ Yes (Leave below blank)

TIME OF CODE INTUBATION _____

INTUBATION BY _____

Type of Code Intubation: ☐ ETT ☐ Trach

ETT Confirmation: ☐ $etCO_2$ ☐ Auscultation

START HERE TIME								
Compressions (Y/N)								
End Tidal CO_2 and RR								
Rhythm								
Shock (Joules)								
Resps (Spont or Assisted)								
Pulse (Yes w/Rate or None)								
Heart Rate								
MEDS (DOSE)	PLEASE NOTE IF MEDICATION GIVEN VIA IV –OR– IO							
AMIOdarone (150–300mg)								
LIDOcaine								
EPInephrine (1mg)								
VASOpressin (40 units)								
ATROpine (0.5–1mg)								
$NaHCO_3$ (amp)								
Other								
INFUSIONS	PLEASE CIRCLE IV FLUID: NS –OR– LR							
DOPamine								
EPInephrine								
NOREPInephrine								
Other								
Other								

LAB TIME: _____ pH_____ CO_2_____ PaO_2_____ HCO_3_____ K+_____ Glucose_____ HCT_____ Lactate _____

LAB TIME: _____ pH_____ CO_2_____ PaO_2_____ HCO_3_____ K+_____ Glucose_____ HCT_____ Lactate _____

CONTINUE TO NEXT PAGE

PT.NO

NAME

DOB

UW MEDICINE
Harborview Medical Center — UW Medical Center
University of Washington Physicians
Seattle, Washington

CARDIOPULMONARY RESUSCITATION RECORD

U0665

HMC0269 REV FEB 11 • WHITE COPY TO PATIENT CHART • YELLOW TO MCICU NURSE MGR

UW MEDICINE: CODE BLUE RECORD — SIGNATURE PAGE

PAGE _____ OF _____

SIGN _____ PHYSICIAN/TEAM LEADER SIGNATURE _____ PRINT NAME _____ DATE/TIME

SIGN _____ RECORDER SIGNATURE _____ PRINT NAME _____ DATE/TIME

SIGN _____ ICU/CODE TEAM NURSE SIGNATURE _____ PRINT NAME _____ DATE/TIME

HOSPITAL–WIDE RESPONSE ACTIVATED
☐ Yes ☐ No

WITNESSED ARREST
☐ Yes ☐ No

CONSCIOUS AT ONSET
☐ Yes ☐ No

BREATHING AT ONSET
☐ Spontaneous
☐ Assisted
☐ Agonal
☐ Apnea
☐ Intubated/ETT

RHYTHM AT ONSET
☐ VF/VT
☐ PEA
☐ Asystole
☐ Bradycardia
☐ Normal Sinus Rhythm
☐ Other

_____

PRE–CODE VASCULAR ACCESS
☐ Central
☐ Peripheral
☐ None

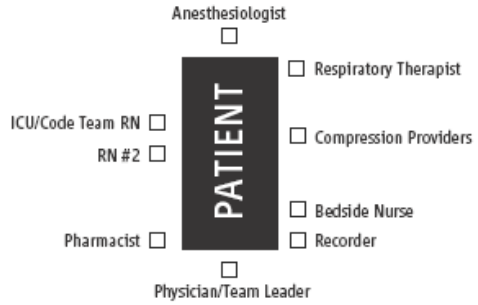
VASCULAR ACCESS INSERTED DURING CODE
☐ Central
☐ Peripheral
☐ Intraosseous: Please Circle
LEFT IO –or– RIGHT IO

CODE END TIME
_____

REASON ENDED
☐ Return of Circulation
☐ No Return of Circulation
☐ Medical Futility
☐ Advance Directive
☐ Family Request

PATIENT OUTCOME
☐ Deceased
☐ Remained on Unit
☐ Transferred To:
_____

PLEASE CHECK ALL TEAM MEMBERS PRESENT AT CODE



Additional Comments:

PT.NO

NAME

DOB

UW MEDICINE
Harborview Medical Center — UW Medical Center
University of Washington Physicians
Seattle, Washington

CARDIOPULMONARY RESUSCITATION RECORD

U0665

HMC0269 REV FEB 11•WHITE COPY TO PATIENT CHART•YELLOW TO MCICU NURSE MGR

Redesign focus group feedback

Group 1 – Nursing practice council

The printed labels and blank spaces for writing are too small on the HMC form, making them difficult to use. Generally, the nurses would like to have larger spaces for writing. They would also like to have a separate comment area for each timeslot.

The checkboxes at the top of the NRCPR (and similar) forms are often skipped, or only given the most cursory of glances at the start of a code. Sometimes they are filled in retrospectively later. One suggestion is to move them to the bottom of the form, next to the signature area.

It's useful to have drug names spelled out on the form. This prevents typographic errors and misspellings that can affect legibility. The Swedish form was cited as a nice way of displaying medications, particularly nice because then the recorder can focus on the dosing information.

Nurses did not like the idea of having to write down 'I' for every listing for an IV med, or writing C or A or S in the vitals column for each entry.

The order of the "vitals" columns can be changed to more closely match the way in which nurses are used to conveying and receiving information. Blood pressure, heart rate, and heart rhythm can be presented in that order on the form.

Landscape format is okay if the clipboard accommodates it.

Time listings are useful either top-to-bottom or left-to-right. Top-to-bottom is nice because it's consistent and unmistakable, since time entries are sometimes left-to-right and sometimes right-to-left on Orca. Left-to-right is acceptable though.

Codes can sometimes run long, and making notes every 1-2 minutes requires several sheets. This is awkward with a set 2-page form. It would be nice to instead include "supplementary" pages, with a spot to write the page number.

Suggested the possibility of having a future practice council meeting in the ISIS conference room, which could include a 15 minute mock code video.

Group 2 – Risk management feedback

From a risk management perspective, the focus is on reconstruction of care. What happened? What's the timeline? Who was there? What medications were given? Who did what, when, and can you reconstruct the events that occurred if you have to revisit the documentation? From a narrow risk management perspective, what is going to be clinically important if you have to reconstruct the event three years later?

When it comes to documentation, the primary focus should be on what makes sense clinically. However, there are some things that always get asked. For example, ventilation/airway issues are often a focal point for disputes, and the legal folks want to know who they need to contact when they go to take depositions. Then they want to know about oxygen levels, compressions, the number of airway attempts, who was administering medications, etc.

The medication-order functionality of the documentation requires a physician signature. Check with forms administrator about other signature requirements, to find out who actually needs to sign. Otherwise, signatures may not be necessary. From a risk management point of view, it's more important to know who was there, and (illegible) signatures don't always provide the information. A print name is much better.

Ideally the print names of all people present would be collected. This might be a responsibility for a designated "traffic cop" role who stands by the door and provides crowd/noise control. That person could also take names as people enter the room. Alternately, this could be a training issue, so that people are accustomed to saying their names and roles when entering the room.

Other care providers (like anesthesia, RT) write their own code notes, but risk management wants a step-by-step chronology on one document. Although some information (e.g. attendee names) could be tracked on the evaluation form, it would be preferable not to rely on internal QI documents or expose those in case of legal action.

When deciding what to document, it depends on what is likely to be clinically relevant to the outcome. The AHA/NRCPR guidelines aren't a risk management concern. However, the "medical futility" option for ending a code should be reexamined. If the AHA has a specific definition, that would be nice to know. Otherwise, the value "medical futility" should be omitted in favor of more clinically specific options, like "family request."

Ultimately, code documentation is sort of the tail wagging the dog. It should be clinically driven. And of course, the other question is whether people will use it, because it doesn't help if the documentation comes back blank.

Issues around videotaping of patient care are being discussed as part of the ongoing OB grant, and it would be instructive to see how they end up handling it. This is less of a concern for research or mock codes, where participants can explicitly opt-in or opt-out. Posting signage during mock codes would solve some of the requirements.

Add space for names to the diagram, change "ICU/Code Team Nurse" to "Med. Administration Nurse", specify that "adequate compressions" were given, move signatures to end, possibly eliminate "medical futility" reason at end.

Group 3 – Patient safety committee feedback

Nurses prefer form where time is across; nurses feel that eye travels across more easily in the horizontal direction. Also, easier to see a vertical column as a "snapshot" of info. Preference may stem from the fact that time is horizontal in other standard ORCA and paramedics charts.

Nurses felt it was impossible to squeeze all info/charting on to one page. Agreed it was fine to have two pages, especially when one page can be defined as a timeline page and the other as a checkbox/signature page to be completed at a later date.

Better to have medications all listed as on Harborview form. Nurses said that they don't want to write each med, that it's easier to check boxes. Also, meds and their doses served as a helpful prompt. Calcium and Magnesium should be deleted. Also, move Atropine and Sodium Bicarb to bottom of the table (in that order). May need to add SUX/ROCKS (rocuronium, succinylcholine) drugs later (but not now). LAB slips are collected/attached as reference. But all Meds have to be transcribed later by nurses so that they appear on a barcoded form.

Add specifications as on Harborview form, but remove units. NS and LR need to be specified (these are types of IV fluid).

Need all 8 categories listed in Harborview form. Space for 2 sets of Labs is desirable but one would be acceptable. Lab results are mostly three digit numbers.

Would be nice to have a comments section somewhere. Harborview prefers a single comments area rather than comments tied to time. Comment area is used for unusual and out of the norm occurrences. Sometimes comments area is used to describe what happened prior to the code. An area for pre-code behavior may be useful on the evaluation sheet.

Intubation can be removed from the page 1 timeline.
Intubation should be on Page 1 because it is time sensitive.
Intubation needs to include TIME, WHO did the intubation, WHAT kind of intubation that it is (ETT/Trach), and the Confirmation Type.
Note that an option for "Already Intubated" appears on page 2

Line Placement info from Harborview should be added on page 2. The length of the line is not needed.

List vitals in order: Compressions (Y/N), EtC02/RR (Respiratory Rate), Rhythm, Shock (joules), Resp (Spont or Assist/BVM), Pulse (Yes/No) and write the number in it, Heart Rate

“Hypothermia” and “Family Notified by Physician” can be eliminated from form.

Very good to have "False Arrest" (reminds people to check this box), but perhaps "Not An Arrest" is more neutral sounding.

Risk Management to decide if the Anesthesiologist, Pharmacist, and/or Respiratory Therapist need to sign. For now, the Physician/Team Leader signature can be combined into one line.

Merge compression providers into one box.

If possible, allow space for additional names of the code team be added.
This could be done as a series of free lines, with the heading: "Names of Code Team Members in Attendance". This is also a Risk Management issue.

Some nurses described discomfort with leaving parts of the form blank (i.e. "I feel that I have to put something in each box."). This may be a training issue
Nurses liked having a strong prompt for "Continue to next page."
Nurses like the zebra striping, felt it increased legibility.
Nurses liked having reversed black headings - they felt this makes heads and subheads more clear.
Nurses do write IV and IO in the Meds boxes even though this is not stated/prompted on the form; nurses often miss filling out this important information.
Nurses liked having the case change in the medications (i.e., "VASOpressin").
Nurses disliked the sideways/ reading orientation change on the existing UWMC form.
Nurses liked the spaciousness and overall feeling of accessibility of the proposed form:
"I could fill this out even though I'm not familiar with it - even though I haven't seen it before."

RESP or RESPS is acceptable for RESPIRATION(S).
AIRWAY okay (perhaps better) to substitute for INTUBATE.
CIRCULATION and CARDIAC interchangeable words.
INFUSIONS cannot be abbreviated.
IV FLUID is not acceptable as a synonym for INFUSIONS, as this refers to the carrier fluid only (no medications).
Medication names cannot be abbreviated due to safety issues.

Group 4 – Forms committee feedback

Option 1
Patient Sticker on the front/short (8.5) side of a letter-sized NCR carbonless form.
The remainder of the information/table can be horizontal.

Pros: Allows for one-sided (standard, inexpensive) printing of the carbonless form. Also, facilitates the routing of a "Canary" (second) copy to Sheryl in a timely fashion.

Cons: Patient Sticker greatly reduces the amount of space that can be used for the main table of information, limiting usability/readability for nurses/users. This format will be difficult to construct in Word.

Option 2
Patient Sticker on the back side of a letter-sized NCR carbonless form.
Front size of the form is completely horizontal.

Pros: Allows for much greater space for a horizontal table of information.
Easier to construct form in Word.

Cons: Will be much more expensive to produce a two-sided NCR carbonless form.
[*Note: Could ask how much more expensive given a specific quantity of forms.*]

Option 3
Patient Sticker on the back side of a regular (not carbonless) form.
Front size of the form can be completely horizontal.

Pros: Allows for much greater space for a horizontal table of information. Easier to construct in Word.

Cons: Difficult to train nurses to immediately xerox the filled-out Cardiac form and send it to Sheryl. This behavior might be encouraged via the evaluation form.

Also note that:
1) The form must be available as a MS Word document.
2) The form must be 8.5x11 in size (to fit document scanners)
3) Screen tints should be kept to 10% or less
4) Reversed out boxes/text should be designed for maximum legibility
5) Having more content-specific areas of input on the paper form can help database personnel process the information into a database at a later date.

Group 5 – Nursing feedback

"Would be nice to capture [more comments]." This is a recurring theme from comments, where users expressed interest in a free-text section. It was hoped that a more carefully chosen set of options would reduce the need for free text and "other" entries, but ultimately not everything can be given a specific place on the forms. Comments are ultimately a necessity because of this. There is some space for other entries, but given the time pressure, people may not automatically think to use those spaces.

Wanted to be able to record what else is going on at the same time, ended up writing in unused columns. "If I had an 'other' or something like that…"

For example, where do you write down when labs are ordered (but not when the lab values are back). "This is what time I drew, and this is when they came back."

"There are two different ways my mind works on this." This is in reference to the order of elements on the form, e.g. pulse, rhythm, compressions… "If this matches with [Basic Life Support], maybe everything is aligned."

Pulse first, definitely. Don't always know the rhythm though, unless it's a critical event.

"I was wondering what this was." [pointing at header for IV fluids] "Oh, now I see." [after looking at the form longer.]

Intubation—focus is on the space down below, in the timeline area, and there isn't a "designated" space for it there.

"Family … present? Not present. Someone called?" Would like to have a space to indicate whether family was there or otherwise notified, because it's sometimes asked afterwards, maybe years later when the case is reviewed, and the family complains about non-notification.

"Other: something like [the comments section], maybe give examples [points to old form comments header]." It seems like it would be useful, especially for first-time form users, to give suggestions on how to use extra space on the forms, or what to write in the comments/other areas.

Appendix 3 – Evaluation study

The materials and raw data for the evaluation study (chapter 4) are contained here.

Pre-study questionnaire

Research Overview:

As part of my dissertation research, I'm evaluating the effectiveness, ease of use, and overall presentation of Code Blue documentation forms. I would like to ask you some questions about your background and experience with Code Blue events and documentation. Responses are confidential. You may opt out at any time.

Age:

☐ 18—24 ☐ 25—34 ☐ 35—44 ☐ 45—54 ☐ 55 or over

Clinical training/role:

(e.g. Tech, RN2, RN3, NP, PA, MD, PhD, medical student, nursing student, etc.)

_____

Total years of clinical experience:

☐ Less than 1 ☐ 1—2 ☐3—5 ☐ 6—10 ☐ More than 10

Total number of Code Blue events attended:

☐ None ☐ 1—2 ☐3—5 ☐ 6—10 ☐ More than 10

Number of Code Blue events where you were the recorder:

☐ None ☐ 1—2 ☐3—5 ☐ 6—10 ☐ More than 10

SVT scenario script

0:15	patient conscious/talking
0:20	heart rhythm SVT, heart rate 220, code initiated
0:30	MICU resident arrives
0:50	adenosine 6 mg ordered
1:00	start recording
1:07	adenosine 6 mg given
1:20	adenosine 12 mg ordered
1:30	heart rate “high”
1:35	adenosine 12 mg given
2:00	heart rhythm SVT
2:10	anesthesia arrives
2:15	cardioversion ordered
2:38	propofol ordered
2:45	propofol given
2:50	shock delivered (cardiovert), vfib rhythm, no pulse
3:00	start compressions (pulse w/compressions)
3:23	charge 200j
3:34	shock delivered, vfib rhythm
3:56	lab arrives
4:01	epinephrine 1 mg ordered
4:16	PRBC 2 units ordered
4:31	epinephrine 1 mg given, no pulse
4:43	charge 200j
4:48	shock delivered, no pulse
5:08	backboard ordered
5:22	backboard placed
5:32	vasopressin 40 units ordered
5:44	central line ordered
5:49	vasopressin 40 units given
6:00	ABG drawn
6:06	amiodarone 300 mg ordered
6:23	amiodarone 150 mg given (different dose than ordered)
6:32	no pulse
6:38	charge 200j
6:45	shock 200j, vfib rhythm
6:57	ABG results
7:23	epinephrine ordered (no dose specified) but not given
7:50	shock 200j given, sinus tach rhythm, BP
8:00	code ended, patient transfer to ICU

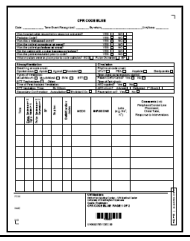
PEA scenario script

0:10	initiated code
0:16	patient conscious
0:24	resident arrived
0:38	respiratory
0:50	code cart arrived
0:58	start recording
1:00	atropine 0.50mg IV ordered
1:13	heart rate “slow” (bradycardia)
1:23	atropine 0.50mg IV given
1:25	atropine 1mg ordered
1:52	ventilating ok
1:59	atropine 1mg given
2:13	heart rate 27, external pacer ordered
2:20	pacer pads placed
2:30	pacer turned on
2:39	pacing at 60, heart rate 24
2:50	pacing at 80
3:04	anesthesia arrives
3:18	fentanyl (given by anesthesia/RT)
3:29	BP 92/61
3:35	pharmacy arrives
3:44	patient unresponsive
3:50	no pulse
3:54	compressions started
4:04	ventilating ok
4:07	epinephrine 1 mg ordered
4:27	backboard ordered
4:34	epinephrine 1 mg given
4:38	ABG ordered
5:00	ABG drawn
5:10	no pulse, intubation started
5:30	tube not placed, no pulse
5:53	tube placed
6:14	epinephrine 1 mg ordered
6:39	epinephrine 1 mg given, atropine 1 mg ordered
6:51	IV line infiltrated, new IV line ordered
7:18	pulse via compressions
7:40	tube placement attempt
7:50	new IV line ready

8:09	no breath sounds
8:20	no pulse
8:29	ABG requested (2nd)
8:36	no pulse, resume compressions
8:52	ABG results (1st)
9:09	vasopressin 40 unit ordered
9:18	vasopressin 40 units given
9:26	ABG drawn (2nd)
9:34	no pulse, code ended

Post-study questionnaire

1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = somewhat agree, 5 = agree, 6 = strongly agree

Post-scenario Questionnaire Please mark the number that best represents your opinion about each of the following.	Form A 	Form B 
I was able to document events I observed accurately.	(disagree) 1 2 3 4 5 6 (agree)	(disagree) 1 2 3 4 5 6 (agree)
I was able to document events I observed completely.	(disagree) 1 2 3 4 5 6 (agree)	(disagree) 1 2 3 4 5 6 (agree)
The directions for using the form were complete and easy to understand.	(disagree) 1 2 3 4 5 6 (agree)	(disagree) 1 2 3 4 5 6 (agree)
I had enough space to write necessary details on the form.	(disagree) 1 2 3 4 5 6 (agree)	(disagree) 1 2 3 4 5 6 (agree)
The order of fields on the form was logical.	(disagree) 1 2 3 4 5 6 (agree)	(disagree) 1 2 3 4 5 6 (agree)
If I used the form again later, I would be familiar with the layout.	(disagree) 1 2 3 4 5 6 (agree)	(disagree) 1 2 3 4 5 6 (agree)
I was able to quickly document events on the form in real-time.	(disagree) 1 2 3 4 5 6 (agree)	(disagree) 1 2 3 4 5 6 (agree)
The form is visually easy to read.	(disagree) 1 2 3 4 5 6 (agree)	(disagree) 1 2 3 4 5 6 (agree)
Overall, this form is useful for documenting Code Blue events.	(disagree) 1 2 3 4 5 6 (agree)	(disagree) 1 2 3 4 5 6 (agree)
Comments (these help me a lot!):		

Qualitative feedback from subjects

1	Thought repeated use of forms would yield better results. I liked the form that wasn't filling in the little boxes, because I just like to record the events as they happen and not have to look for where they go (each box). I wasn't clear if all the drugs should go in chronologic order, or each drug would go in its own line, so that for me was a little confusing. You would have to reorder events based on the time. The amount of writing was less on this form (B) if you could fill in the box, but there was some loss of information. The big advantage on this form (B) was the space to write the labs.
2	Yes/no questions easier to answer, didn't have to write med names out. Did like comments area, to write intubations notes, etc. I felt that form B was much easier to use--it was easy to read and you could easily record numbers in the appropriate fields rather than having to record U numbers and med. names on form A. Also, form B had a lot of Y/N questions which were easy to complete in a quick manner. I definitely liked form B better. Form A was visually jumbled and disorganized to me - especially the top portion with all the checkboxes. I liked how time was on the x-axis on form B rather than on the y-axis on form A.
3	Focused more on checkboxes with A. Thought yes/no was easier to fill out, liked pre-written med doses. Thought checkboxes section of A was too wordy and confusing. I found Form A very complex visually and harder to follow. Form B was very easy to fill in visually and I (hopefully) was more accurate in my time keeping. Form A had too many words in the beginning that could have been filled in after the fact. I like in Form B the diagram of the patient + the staff surrounding the patient. I also liked on form B that the medications were listed and w/ dosages; could also put different dosages for adults vs. peds. I also liked the Y/N responses with basic vitals pulse + if compressions were started, etc. I think there should be an intubation initiated time in the column/rows (hard to remember these after the fact). Overall Form B was far easier!
4	Mental model is important; blank paper would work if the documenter knew which things to record. Space is an issue [on both forms A & B]. Once familiar with the forms, either would be useful. My question is regarding how to document events more linearly in terms of time - or perhaps this is not most critical or pertinent.
5	Having drugs written out maybe not needed. Also, some less/more than listed, e.g. lidocaine not used much. Fluids was nice, but sometimes different drips are hung. Would be easier if used a couple of times. Space for labs was nice. Horizontal timeline a little unusual. Could use more columns on Form B.
6	Form B is better than form A. It would be nice to have everything on one page. Too much to hand-write on form A.
7	I didn't like either form. I'm a time person - I stick to the 2-minute cycle.
8	During a real code situation, Form B is much easier to read, follow + use. However it would benefit from an events/comment section to document details not included. Form A requires too much hand-written information, i.e. drugs + less order or visual ques.
9	I like form B better; it's less cluttered. The more things are pre-printed, the better. Prefer the layout of Form B, easier to read - wished the comments section was also on the 1st page though, had to flip back & forth. Also, do like the vertical layout of form A to track the times. Lab draw is helpful on form B, but I didn't have time to write (all) the values down.
10	[no comments]

11	Liked B better, just a checklist, didn't have to write as much. Form B is so much easier to follow along with; didn't have to jump all over.
12	Have a "start time" spot and pre-marked time intervals. It seemed that I was being observed more intently while filling out Form B, thus I felt like it was the one being tested, thus I may have concentrated more while using this form (Form B).
13	Would be nice to have a stopwatch on the clipboard. Neither of the forms really had enough space to document everything. Form B was less cluttered & easier to fill out.
14	1st form (A) overwhelming at top, but having it on 1st page reminds one to note time / description of event; having it on 2nd page makes you forget. 1st form (A) has comment section -> helpful. 1st form (A) has more slots for time of events; I ran out of room on 2nd form (B).
15	Form B easier to timestamp events & meds but when needing to describe event became more difficult given lack of space for i.e. (needle decompression). Form B easier to record lab also.
16	I found form A to be chronologically easier to follow. Liked that form B had drugs name & dose already. 2 page form B harder to fill out first time.
17	Form B much easier to use, felt more organized.
18	I do wish I had an empty spot for comments (on B). Too much stuff for me to look at (on A).
19	Need room for random items - who enters room, CPR on/off, etc. On form A area for labs/ABG small.
20	Labs are wasted time on these sheets.