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Best Practice Recommendations for Patient Care Rounds in the Intensive Care Unit: A Review of Current Practices, Facilitators and Barriers

by

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Abstract

Introduction: Effective communication between HCPs is an essential component of providing high quality care to patients. In the ICU, patient care rounds are important communication events which contribute to the treatment that is provided to critically ill patients. Improving this process may have a profound impact on the quality of care and outcomes for these patients, however, an understanding of the factors that contribute to best practices during patient rounds needs to be developed.

Objectives: To develop an understanding of best practices during patient rounds in the ICU.

Methods: A systematic review was conducted to identify current practices, facilitators, and barriers to best practices during rounds in the ICU. A novel statistical methodology was applied to demonstrate a representative sample of studies was retrieved. Grading of the recommendations that were informed from this review occurred using a validated framework.

Results: Horizon estimate calculations suggest an 80% retrieval of articles for this review. 39 studies identifying 13 facilitators and 9 barriers are described. From these, 13 recommendations for rounding best practices are presented within an illustrative framework that may be applied by clinicians and administrators.

Conclusions: Several low risk, best practice recommendations can be implemented to improve patient rounds in the ICU.

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List of Symbols, Abbreviations and Nomenclature

Abbreviation	Definition
CMR	Capture-Mark Recapture
EHR	Electronic Health Record
HCP	Healthcare Provider
ICU	Intensive Care Unit
JCAHO	Joint Commission for Accreditation of Healthcare Organizations
MD	Medical Doctor
PRISMA	Preferred Reporting Items for Systematic reviews and Meta Analysis
RN	Registered Nurse

Chapter One: Introduction

Communication between healthcare providers (HCP) is a major contributor to patient safety and outcomes in hospitals[1]. The Joint Commission for Accreditation of Healthcare Organizations (JCAHO) has reported that communication failures are an important source of medical error and contribute up to 85% of sentinel events in hospitals[2]. Although widely recognized, communication failures are still considered to be the most common contributor to medical errors in hospitals[3], resulting in a decline in patient safety and positive outcomes. The challenge of provider communication is especially important in complex healthcare settings such as the intensive care unit (ICU), where critically ill patients receive multiple tests and treatments daily, and have a limited physiological reserve to tolerate error[4,5]. Communication between HCPs is a complex activity, but effective communication has been shown to decrease medical errors and improve short-term patient outcomes in the ICU[6-8].

Patient care rounds are a key mechanism in which HCP communicate and make patient care decisions in the ICU. This process involves the scheduled discussion of patients to review clinical information and develop individualized goals and care plans. Since rounds are the key setting for communication between providers, failures during this process may have a profound impact on the quality and safety of patient care. Identifying what factors contribute to effective patient care rounds is therefore essential.

There exists a broad body of literature examining how rounds are conducted in different units, and mechanisms that have been suggested to improve this process. Systematic reviews on the value of intensive care physician led rounds[9], family presence during rounds[10], and information technology to support rounds have been conducted[11], however, no review has attempted to synthesize this large body of literature; to examine what is currently being done, or new mechanisms to improve rounds in the ICU.

This thesis begins by highlighting importance of effective communication throughout the recent literature. A description of current ICU rounding practices and related research to identify the benchmark for improvement to occur is then presented. A systematic review of the literature, followed by an in depth analysis of what is currently known is presented. A new methodology to demonstrate the completeness of systematic review was also tested here. Once the context of our current understanding is developed, facilitators and barriers to this process are identified. Finally, these findings are used to develop recommendations for best practices during ICU rounds, which may be applied by clinicians and hospital administrators. Limitations of the current study, considerations for replication, and potential for future research in this area are also described.

Chapter Two: Background

2.1 The Problems

2.1.1 Quality of Care in Healthcare

Medical errors causing harm are a recognized problem in healthcare[12], yet they continue to be a major contributor to extended patient hospitalizations. In 2004, the Harvard Medical Practice Study found that 30% of all hospitalizations for adverse events were due to medical errors[13]. Although widely identified as causal in the literature, medical errors still occur frequently in clinical practice, increasing morbidity and mortality in all patient populations[14]. Ineffective communication between providers has been identified as a significant factor contributing to medical errors[15].

2.1.2 Effective Communication is Necessary to Improve Quality

Concurrent with recommendations from the Institute of Medicine in "To err is human"[14] and "Crossing the quality chasm,"[16] effective communication is necessary to improve overall quality of care for patients. High quality patient-provider communication increase patient satisfaction[17] and has a positive effect on patient compliance and outcomes[18]. Interventions targeting failures in communication will contribute to improvements in the quality of healthcare being delivered today.

2.1.3 ICU Patients are a Vulnerable Population

A hospitalized patients' weakened health state makes them more vulnerable to adverse events arising from communication breakdowns. Intensive care patients are particularly vulnerable because of their high dependency on providers, and already poor health. By the nature of these patients' conditions, decisions regarding their treatment must be made in consultation with multiple providers, creating additional opportunities for communication breakdown. Communication failures are detrimental to a patient's health, but as expected, interdisciplinary collaboration and good communication is positively correlated with improved outcomes for patients[6].

In addition to increased patient morbidity or mortality due to communication failures, the nature of the ICU environment and the care provided is such that HCPs are more likely to make errors. Eisendrath[19] compared MD experiences in ICU and non-ICU wards, finding that all subjects working in the ICU reported a higher stress level. When applied to healthcare, research from other high stress settings such as air traffic control towers indicates that an increased load on ICU providers leads to a decline in their ability to perform tasks, and decreases the quality of care provided to patients[20]. In addition, interruptions are frequent during rounds[21] and have been shown to negatively impact the quality of patient care, likely by limiting the working memory of practitioners[22]. This mechanism must be considered when studying rounds; a substantial amount of information is exchanged during this process within the high stress ICU environment. Each practitioner in the ICU is faced with the challenges of providing quality care in a high stress, busy, and distracting environment.

2.1.4 Good Communication is a Challenge in the ICU

A correlation between the severity of a patient's illness and the volume of information associated with their treatment is well understood[23]. From these findings it is known that

ICUs, which treat the most critically ill patients, also have the largest volume of information associated with each patient's care. This vast quantity of information must be shared amongst the allied healthcare team to develop treatment goals and provide appropriate care for patients. Open communication is necessary for providers to understand patient care goals, however the complex nature of the ICU setting makes this a challenging task.

Many strategies have been developed to help staff overcome the challenges of communication within the ICU. The majority of information in ICU is exchanged in a process called rounds, now common practice in many hospital wards. The rounding process often involves various disciplines of healthcare workers: MDs, critical care RNs, respiratory therapists, physiotherapists, pharmacists, dietitians, and social workers, as well as students. This interdisciplinary team collaborates with the patients and their families to develop goals for patient care. During the rounding process, all of this information must be conveyed in a short time to the numerous care providers responsible for each individual patient. The ICU environment, with frequent distractions and interruptions during the rounding process adds to the already difficult task of developing and communicating patient care goals[21,22]. Despite these challenges, rounding is known to be an effective way to develop patient care plans in the ICU[24].

2.1.5 Rounds are a Key Opportunity for Communication to Occur

During the rounding process, HCPs, especially MDs directly involved with treatment decisions, discuss the condition and treatment of multiple patients in a short time. During this time, they must be given current treatment information as well as relevant changes since their previous consultation. This information is used to develop an effective treatment plan. While most of the information is documented, practitioners often rely on verbal reports given by other providers because of the number of patients requiring assessment during each rounding period[25]. Studies have shown that practitioners have different perceptions about the effectiveness of this communication event[26]. Although the process is challenging, effective collaboration is imperative in improving patient outcomes[6] and provider satisfaction[22].

2.2 The Challenge: Developing Strategies for Improvement

Patients admitted to the ICU require intensive, high quality care because of their critical conditions. This demands adequate strategies be developed to assist healthcare workers in providing the highest quality care. Communication is a necessary component of high quality care[14,16] and therefore more effective communication strategies need to be investigated. Although ICU patients are especially vulnerable to communication failures, they stand to benefit most significantly by improvements in these practices as their outcomes are highly correlated with the HCPs' understanding of care[27]. This dichotomy makes it essential for the information exchange process in the ICU to be understood so areas for improvement may be identified.

2.3 A Gap in the Knowledge: Understanding Current Rounding Practices

Before strategies are developed to improve communication, an understanding of rounding practices in the ICU must be obtained[28]. Case reports regarding failures of communication or medical errors in the ICU are prevalent in the literature[29]. Similarly, research in the ICU concerned with interdisciplinary communication is being conducted[26,30]. Some observational studies have been completed which evaluate ICU practices, including rounding[21,26,31]. These studies, however, are limited by their specificity to the units in which they were conducted and cannot be easily generalized to other units. A complete assessment of the experiences of ICU staff with respect to rounding and communication will promote a greater understanding of what improvements in practice may be important.

It is evident that there are many different methods by which rounds are carried out in different ICUs. Some units conduct rounds outside of the patient care area, with HCPs meeting in a single location to discuss each of their patients[31]. More commonly, rounds are conducted with a large group at the patient's bedside. Each of these rounding events are led by a single person, often a senior MD or fellow, though the composition of the rounding team varies notably between units. The discrepancies in rounding practices suggest that an understanding of what the best practices during rounds look like needs to be developed.

Although each study conducted highlights different facilitators and barriers for rounding, clear communication between practitioners is a common theme. Some studies emphasize the necessity of improving RN and MD collaboration[31,32], while others suggest that improved access to information for the rounding team is an important contributor to positive patient outcomes[33,34]. Many strategies to overcome these barriers have been suggested, however no systematic review has been performed to synthesize this body of literature and guide improvements in ICUs. Through this project, we identified what current rounding practices exist, and facilitators and barriers to best practices during the rounding process.

Chapter Three: Methods

3.1 Introduction

To develop an understanding of what is currently known, a review of the relevant literature was required. Although we sought to develop a broad understanding of what current practices exist, a focussed look at strategies and interventions that have been implemented was also important. To satisfy these objectives, a focussed review methodology and analysis process was required and therefore, we conducted a systematic review of the literature.

3.2 Systematic Review: Methods

We searched for studies that investigated current practices, facilitators, or barriers to HCPs rounding in the ICU following the PRISMA (Preferred Reporting Items for Systematic reviews and Meta Analysis) statement for performance and reporting of systematic reviews[35].

3.2.1 Search Strategy and Data Sources

We conducted a systematic search of studies in Medline (1950 forward), Embase (1980 forward), CINAHL (1982 forward), and the Cochrane Library on October 6, 2011. The PubMed database was searched from July 2011 forward to capture studies not yet indexed by Medline. Searches were performed without year or language restrictions and using combinations of the following terms: critical care, intensive care, round, multidisciplinary round, medical round, patient round, healthcare personnel, and medical staff. Search terms were intentionally broad and general to account for poor definitions of these terms in the literature. A detailed search strategy is presented in Appendix A. Reference list searches of the bibliographies from retrieved studies were completed in addition to hand searching of five key journals in critical care for the past five years (American Journal of Respiratory and Critical Care Medicine, Critical Care Medicine, Critical Care Forum, Intensive Care Medicine, and the Journal of Critical Care). Experts in the field and authors of included studies were contacted to determine if they were aware of any additional studies.

3.2.2 Eligibility Criteria

We included all original, peer-reviewed studies which described current practices, facilitators or barriers to HCPs rounding in the ICU. No standard definition for rounds was identified, so for the purposes of this review we defined rounds as regularly scheduled meetings of HCPs, led by a MD but possibly including providers from multiple disciplines, who discuss and prepare a plan of care for patients in the ICU. Studies identifying the value of intensive care specialists leading rounds, or the impact of family members presence on the rounding process were excluded as these questions have been investigated in previous reviews[9,10]. Studies evaluating only the teaching aspect of rounds, or rounding events that did not include a discussion of patient daily care plans (ex. shift handover) were excluded from this review. We did not exclude any studies based on research design or quality assessment.

Two investigators (DL and MF) independently reviewed titles and abstracts for all identified studies from the search, followed by full text review of studies identified by either reviewer as meeting inclusion criteria. Data extraction occurred in duplicate and results were tabulated based on consensus between reviewers. A sample data abstraction form is available in Appendix B.

3.2.3 Data Extraction and Quality Assessment

We extracted data that described the study, measures, and key outcomes. Study characteristics included study design, hospital and ICU setting, round team composition, and sample size. To characterize studies, we separated them into quantitative or qualitative designs and recorded the measures and key findings for quantitative studies, and key findings as described by the authors for qualitative studies.

Study quality was assessed using the framework of Caldwell et al.[36] for evaluating both quantitative and qualitative study designs. Both reviewers performed quality assessment independently and results were included based on consensus between reviewers. Results for this assessment did not inform inclusion or exclusion, but helped to infer the strength of the recommendations from each study. Recommendations were graded using the Users' Guide to the Medical Literature[37], and Users' Guide for Quality Improvement Articles[38]. Authors independently assessed the study that was most relevant, and had the best quality of evidence contributing to each recommendation, and consensus was reached through discussion.

3.2.4 Analysis

We analyzed the literature described in this review through validated guidelines set for a narrative synthesis of quantitative studies[39-41], and a semi-quantitative meta-synthesis[42] of qualitative studies. Pooling of quantitative data was not possible due to the heterogeneity of studies identified in this review. Results of these syntheses were separated into current rounding practices, and facilitators or barriers to rounding. Current practices were summarized narratively, while facilitators and barriers were grouped by theme as informed by our analysis. Capture-mark-recapture analysis was applied to studies in final level of inclusion to assess search completeness and the risk for publication bias[43,44].

Narrative synthesis involves the tabulation and grouping of studies according to characteristics that may inform subsequent analysis. Findings from the studies are described and tabulated so that relationships between studies may be identified. Study characteristics are examined to identify any factors that may explain differences in findings. The influence of heterogeneity is investigated by considering methodological and baseline population differences to explain variability in outcomes. Variability in study designs and context of the studies was also examined.

When exploring current practice, we hoped to define what constitutes best practices in the rounding process. An integral component of this was effective information exchange as highlighted by qualitative studies. Qualitative studies are often hypothesis generating, and in the case of this review may also help to explain some of the findings of quantitative studies discussed. Meta-synthesis of qualitative studies involves the comparison of key outcomes and themes identified by the authors of each study. Key ideas and concepts were identified from the studies, preserving the meaning from their original source, and tabulated within the review. Translations of the key concepts from all studies were completed in order to identify novel concepts not explored by individual studies. A semi-quantitative analysis was completed at this point to identify the overlap of key concepts within these studies. Finally, the translated concepts were synthesized and refined to identify core themes.

3.3 Capture-mark Recapture Analysis to Ensure Search Completeness

3.3.1 Introduction

Systematic reviews are an important tool for synthesizing evidence to inform clinical practice and policy in critical care medicine[45-47]. However, with the increasing number of published research studies, the process of completing a systematic review has become more labor intensive and inefficient as the majority of articles identified from multiple databases searches are discarded[48]. A methodology for determining when a sufficient number of articles have been selected would reduce workload, improve efficiency and facilitate timely publication of systematic reviews.

Capture-mark recapture (CMR) is an ecological technique designed to estimate population size (also called horizon estimation) that may allow reviewers to evaluate the completeness of their literature search. The technique involves sampling items from a population (e.g. catching fish in a lake), tagging the items (e.g. applying a dorsal fin tag), releasing the items (e.g. releasing tagged fish back into the lake) and then resampling the items (e.g. catching more fish from the same lake) at a later time. The number of items with tags captured during resamplings (e.g. tagged fish) can then be used to estimate the population (e.g. total number of fish in a lake)[49,50].

Capture-mark recapture has been applied to estimate population sizes in healthcare. For example, in epidemiology it has been used to estimate the number of patients with chronic medical conditions[51-53]. In health services research it has received limited evaluation as a tool for guiding systematic searches of the literature[43,54,55]. These evaluations have concluded that CMR may be an effective tool for estimating the population of articles available and guiding the development of efficient search strategies. However, current evaluations have been limited to systematic reviews of randomized controlled trials in rheumatology, gastroenterology, surgery and hematology[43,54,55]. We therefore tested the effectiveness of CMR to provide horizon estimation for a systematic review of rounding practices in critical care medicine that included a heterogeneous mixture of research methodologies (no methodology restrictions, i.e. including qualitative and quantitative).

3.3.2 Methods of Horizon Estimate

Horizon estimates (for the population of articles) were calculated following the initial literature search, full text review and final inclusion. Following the search of each database, articles were marked as being retrieved from that search (e.g. Medline was first database searched) and compared to articles retrieved through subsequent searches (e.g. Embase was the second database searched). Models were built to include each of the databases, and combinations of databases that the individual articles may have been found in (e.g. articles could have been found in each of the 4 databases, a combination of less than 4 of the databases, or only one database). Sorting articles by their tags then created counts of the number of articles fitting within each of the unique models (Appendix C).

To estimate the total horizon of articles, fitted estimates of the cell counts were calculated using Poisson regression[43] in Stata 11.2[56]. Ideal model selection was performed using comparisons of deviance, selecting the model with the smallest estimate for deviance and still included interaction terms to account for dependence between databases. Poisson regression allowed for the estimation of missing data when the model was fit to the known values and therefore provided an estimate for the total number of missing articles. The percentage of captured articles was calculated as each database was added to the model[57]. An outline of how to conduct CMR analysis is presented in Table 1.

Horizon estimates were also used to determine the optimal order for database searching. Searching was considered comprehensive enough when a predefined threshold of retrieval (80% of total article population defined *a priori*) was obtained or the 95% confidence intervals from the estimates overlapped with the number of retrieved articles. Capture-mark recapture was also applied to determine the ideal order of searching by comparing the number of articles retrieved from each database at each stage of the systematic review.

Chapter Four: Results

4.1 Capture-mark Recapture Results

CMR results are based on search conducted in April 2011. This search was later updated. Horizon Estimates were based on the articles identified in all 4 databases from the initial search (n=4,462), articles selected for full text review (n=133) and articles selected for inclusion in the systematic review, prior to the update (n=38)(Figure 1). Results are summarized in Table 2.

At the initial search level (i.e 4,462 articles identified from search engines), the Horizon estimate (i.e. total population of articles) was estimated to be 4,482 articles (95% confidence interval [CI] 4,479-4,485) when Medline (M) followed by Embase (E) were searched, and 68,687 (95% CI 60,292-78,342) when Medline, Embase, then CINAHL were searched. After searching all four databases, the Horizon estimate was 28,839 (95% CI 13,393-70,990). These data imply that an estimated 24,377 articles were missing from the initial search and that 15.5% (4,462/24,377) of known articles were captured from the four large databases (Figure 2).

After screening the titles and abstracts of articles to select those for full text review, the Horizon estimate was 107 articles (95% CI 105-108) when Medline then Embase were searched, and 170 (95% CI 153-203) when Medline, Embase, and then CINAHL were searched. The search of all four databases yielded a Horizon estimate of 169 articles (95% CI 152-202). These data imply that an estimated 36 articles were missing during full text review and that 79% (133/169) of known articles were captured from the four large databases (Figure 3).

At the final inclusion level, the Horizon estimate was 33 articles when considering the Medline and Embase databases, which was equivalent to the number of articles retrieved from these databases (i.e. 100% capture). When considering Medline, Embase and then CINAHL, the Horizon estimate was 48 (95% CI 39-131) and was unchanged by adding Cochrane to the other databases. This final estimate represents a difference of 10 articles from the number of estimated articles within the population and the actual number of articles captured through the four databases searched. Therefore, our horizon estimate suggests that 79% (38/48) of the total population of relevant articles were included in the systematic review (Figure 4). The proportion of articles captured in the systematic review did not reach our predefined threshold for search completeness (prespecified at 80% of horizon estimation). Therefore a search of PubMed was performed (because PubMed indexes a subset of articles included in Medline, but does so earlier) which revealed six additional articles that had not yet been indexed in Medline, two that were encompassed by the initial search timeline, bringing the total number of articles to 40 or a retrieval of 83% of the estimated total population of relevant articles.

An assessment of the optimal search order of the databases indicated that the most efficient search order for our systematic review would have been Embase, CINAHL then Medline; and would exclude the Cochrane all together. Our actual search order was Medline, Embase, CINAHL, then Cochrane (Table 3).

4.2 Systematic Review Results and Identified Themes

Systematic review results were updated from initial search (April 2011) on October 6, 2011.

The literature search identified 6934 potentially relevant articles in five databases; from these, we selected 39 articles written in three languages (36 English, 2 German, 1 Spanish) for final inclusion in the study (Figure 5). We did not identify any additional articles that satisfied our inclusion criteria by reviewing reference lists of the included studies, hand-searching journals or contacting authors. Articles were excluded for several reasons, including lack of full text availability in conference abstracts, or no discussion of ICU rounds structure or processes. Analysis of excluded conference abstracts revealed no additional themes relevant to this review (Appendix D). Agreement between reviewers was good for full text review (Kappa=0.86), and very good for final inclusion (Kappa=1.0).

Characteristics of the included studies are summarized in Table 4 while results and key outcomes are summarized in Tables 5 and 6. Thirty-two studies reported quantitative outcomes[21,27,32,33,58-85] and seven reported qualitative outcomes[31,34,86-90]. Study sample size ranged from 18 to 107,324 patients, and 3 to 87 healthcare providers. Most studies were conducted in academic adult medical ICUs in the United States. The included studies consisted of 1 cross-over randomized design, 1 time series, 3 cohort, 1 controlled before-after, 12 uncontrolled before-after, 4 case-series, 2 cross sectional surveys, 13 ethnographic/observational with interviews or chart reviews, and 2 qualitative using interviews (Table 4).

The quantitative studies reported six key themes: current rounding practices, health record use and documentation, communication strategies, tool use, goals and planning, and team composition. Three key themes were described by the qualitative studies; effective information exchange, collaborative decision-making and patient management, and power relationships. Key outcomes and results are categorized by theme and presented in Table 5 and Table 6. Facilitators and barriers identified by each study are presented in Table 7.

4.2.1 Described Practices

Thirty-eight of the studies described rounding practices in the study unit; five of which described but did not evaluate facilitators or barriers. Most studies described patient care rounds as being performed daily (49%), with a multidisciplinary team (90%), at the patients' bedside (54%) (Table 4). Considerable variation in the structure and process of rounds was described[83], with a duration between 5 and 15 minutes per patient reported, and total rounding time lasting 131 minutes on average[33,82]. Rounds discussions consist of reviewing a patient's medical history, course in the ICU, and acute clinical status; and making a care plan[33]. One study described an average of 14 participants contributing to discussion during rounds, totalling an average salary cost of $140.87 per patient, per day (dollars in 2009)[82]. Interruptions were reported to account for up to 42% of communication time in bedside rounds[21]. Described rounding practices are summarized in Table 8.

4.2.2 Current Rounding Practices

Five studies examined facilitators and barriers to current rounding practices; results are shown in Tables 9 and 10, respectively. Studies were grouped into this theme if they identified facilitators or barriers but lacked specific strategies or tools that could be used to improve communication during rounds. One study reported empowering RNs with an open discussion environment at the bedside increased RN participation on rounds in a neonatal ICU[75]. Three studies evaluated the timeliness and satisfaction of HCP completing rounds at patients' bedsides, or in a location away from the bedside (ex. conference room). Two studies reported increased family and HCP satisfaction at the bedside[64,75]. One study reported better communication (greater clinical content completeness score) away from the bedside[85]. Bedside rounds were identified by three studies to increase rounding time[64,75,85]. A Lean quality improvement initiative was applied to improve the efficiency of rounds. From this initiative, the authors gave 4 recommendations to improve rounding efficiency (eg. limit teaching to one point per patient)[84]. Their recommendations helped to reduce rounding time and increase HCP satisfaction in one pediatric ICU[74]. Distractions and interruptions increased rounding time, and decreased the quality of communication[21,85]. Facilitators identified from these studies included *open, collaborative discussion environments*; and *reducing nonessential activities to improve efficiency in rounding* (Table 9). Barriers included *increased rounding time*; and *registered nurse (RN) perceptions of not being valued by medical doctors (MD)*(Table 10). The location of rounds (bedside vs. conference room) was identified as both a facilitator and barrier.

4.2.3 Health Record Use and Documentation

Three studies evaluated health record use and documentation of patient information[58,59,81]. Two facilitators, *access to patient data for all HCP* and *documentation of patient care goals* (Table 9), and one barrier, *poor information retrieval and documentation* (Table 10), were identified. Collins et al.[58] evaluated the importance of effective documentation in shaping discussions and improving communication between providers. They found that 75% of goals discussed on rounds were documented in the medical record. Cummings et al.[59] reported that providing pharmacists with a mobile computer improved information retrieval, thereby reducing time required by pharmacists to access EHR, and increasing their availability on rounds.

4.2.4 Communication Strategies

Four studies suggested strategies to improve communication during rounds, which were defined as structured, standardized approaches to improving information transfer or retention. A standardized rounding process achieved by structured presentation was evaluated by three studies, all of which showed a significant increase in HCP satisfaction[60,91] and quality of discussions[85]. Prompting HCPs to use communication tools reduced ICU and hospital mortality in one study[77]. *Standardized rounding structures and processes*, combined with *prompting*, were identified as facilitators from these studies (Table 9), while a *non-standardized rounding structure* was identified as a barrier (Table 10).

4.2.5 Tool Use

Six studies evaluated using checklist tools to standardize output from rounds discussions (ex. daily patient goals). Pronovost et al.[27] demonstrated that using a daily goals checklist during rounds significantly improved understanding of goals of care among providers. Five subsequent studies demonstrated that using a *checklist tool* during rounds is an important facilitator to improved provider satisfaction[62], overall provider understanding of care[27,67], communication[27,67,69], adherence to best practice guidelines[61] and patient outcomes[67,73] (Table 9).

4.2.6 Goals and Planning

Two studies evaluated patient care planning and goal setting during rounds. Two facilitators were identified from these studies*: discussion of goals* and *measuring the completion of daily patient goals* (Table 9). *Increased rounding time* was identified as a barrier (Table 10). Pronovost et al.[27] reported improved patient outcomes with goal-oriented discussions. Stockwell et al.[72] found that goal completion was positively associated with the physician's management abilities, and negatively associated with length of rounds (total time and time per patient).

4.2.7 Team Composition

Nine studies evaluated the composition of the HCP team that participates on rounds. Multidisciplinary rounds (patient care discussions consisting of MDs and at least one other healthcare professional, such as a RN) improved patient outcomes[63], improved RN satisfaction[70], and shifted discussion to be more goal oriented and include more discussion around patient prognosis[66]. In particular, adding pharmacists to the rounding team reduced adverse drug events by up to 66%[65]. Six studies found significant cost savings[65,68,76] and clinical benefits[65,68,71,78,80] with pharmacist participation. These studies identified two facilitators: *multidisciplinary rounds* and *pharmacist participation* on rounds (Table 9).

4.2.8 Effective Information Exchange

Four studies discussed effective information exchange during rounds. Two studies explored the spatial configuration of participants during rounds and found that a circular arrangement of participants, with clear sightlines and a visual handout of patient information for all HCPs during rounds, improved communication[34,90]. One study considered the nursing perspective of barriers to information exchange[89], and found that the hierarchical structure of HCP relationships restricted information exchange. Two studies evaluated contributors to an effective rounding process[84,85], and identified that standardization of the rounding process and continuous evaluation improved the efficiency of rounds. These studies identified three facilitators: *standardized rounding structure and process, discussion environment that facilitates collaboration*, and *visual representation of patient data for all HCPs* (Table 9). Two barriers were identified: *hierarchical HCP relationships*, and *poor documentation or access to patient information* (Table 10).

4.2.9 Collaborative Decision Making and Patient Management

Three studies evaluated collaborative decision making and patient management[31,87,88]. These studies reported that RNs felt marginalized when they perceived that they were not included and valued by physicians during rounding discussions, and such feelings were associated with perceptions of decreased quality of care by RNs. RN satisfaction and participation in discussions increased when they felt their presence was valued[75,88], and rounds were conducted at the bedside where they were more readily available[31]. A standard script, which RNs could use to present during rounds, further facilitated their participation in discussions[88]. Differences in HCP perceptions of decision-making during rounds were reported as a barrier to collaborative decision-making. For example, Coombs et al.[87] identified that MDs felt that a team-based approach to decision making was being applied in rounds, while RNs felt that decision making rested solely with the MDs. These studies identified three facilitators: *rounds performed at the bedside, open and collaborative discussion environment*, and *standardized rounding structure and process* (Table 9). The two barriers identified were *RNs' perceptions of not being valued by physicians*, and *different perceptions about decision-making* (Table 10).

4.2.10 Power Relationships

Four studies considered the unequal distribution of the power relationship between HCP[86-89]. This unequal distribution was recognized by both MDs and RNs, and contributed to conflict around decision making[87]. Flattening the decision making hierarchy was proposed to improve the constructive decision making relationship and increase communication between providers[86-89]. These studies identified *greater HCP autonomy* as a facilitator (Table 9).

4.3 Study Quality and Robustness

Methodological quality of the studies was objectively assessed[36] and reported (Table 12). We did not exclude any studies based on the quality assessment, but greater than 85% of the included studies satisfied at least two thirds of the quality criteria outlined in the framework. Agreement between reviewers for Grading of recommendations was very good (Kappa = 0.85) (Table 13).

Discussion

4.4 Capture-mark Recapture

To our knowledge, this study provides the first Horizon estimation for a systematic review in critical care medicine and one that includes studies of heterogeneous methodology. Our results suggest that we identified the majority of relevant studies (83%) in our systematic review of ICU rounding practices. Estimates for the initial search appear to be less precise than for full text review or final inclusion. The optimal database search order was also established and could have been improved based on our findings. The results suggest that CMR can be an effective tool for estimating the population of articles available and guiding the development of efficient literature search strategies.

The application of CMR in this review differed from applications in other studies. Dickersin et al.[92] first applied this technique to determine the sensitivity of Medline in identifying randomised clinical trials conducted in ophthalmology. They compared an electronic Medline search to a recently published systematic review (gold standard) and found that the electronic searching identified 87% of articles for any journal indexed by Medline. The sensitivity of Medline in identifying articles was evaluated against hand searching journals by Spoor et al. in 1996[44] using CMR. They similarly showed that hand searching identified additional articles from those retrieved from searching Medline. Their results highlighted that an important body of literature was not being captured from the electronic database search alone. The application of CMR to systematic reviews of clinical trials was initially performed as a method to assess publication bias[93,94]. Bennett et al.[93] compared the use of CMR for a review of Progressive Resistance Training, to more conventional methods, such as Trim and Fill or funnel plots, and demonstrated that it can also be applied to successfully assess publication bias. A second review estimating the duration of protection for Hepatitis B vaccines demonstrated that CMR could be used to estimate the risk of publication bias due to missing articles[94]. Kastner et al.[43] performed a CMR for a systematic review of randomized controlled trials evaluating clinical decision support tools for osteoporosis disease management. Based on their evaluation they proposed that CMR could be applied prospectively and that search stopping rules could be developed to reduce the number of citations needed to be screened for systematic reviews. Most recently, Rucker et al.[55] evaluated a statistical boosting technique as an amendment to the CMR procedure used by Kastner et al. to help manage the challenges of statistical model selection when using CMR.

Our study adds to the literature by evaluating the application of CMR to a systematic review in critical care that was not restricted to clinical trials, but included a heterogeneous mix of study methodologies including both qualitative and quantitative studies. The key lessons from our study are the following.

One, CMR works for systematic reviews in critical care medicine. Horizon estimation was successfully performed for our systematic review and provided a mechanism for evaluating the completeness of our literature search. The technique (Table 1) involves sampling items from a population (e.g. articles identified from searching Medline), tagging the items (e.g. recording the articles identified) and then resampling the population (e.g. searching a second database such as Embase). The number of items with tags captured during the samplings (e.g. common articles identified from both databases) can then be used to estimate the population (e.g. horizon of relevant articles for the review).

Two, CMR can be applied to reviews that include studies with heterogeneous methodologies. Previous published applications of CMR have been restricted to systematic reviews of clinical trials. However, systematic reviews are increasingly used to synthesize data from studies employing a wide range of methodologies other than clinical trials[9,95,96]. Given the larger number of citations that are often identified for screening with these reviews, our results are particularly important because they suggest that CMR can be a technique for establishing search-stopping rules for these challenging reviews. However, our results suggest that including heterogeneous methodologies in a systematic review likely results in larger horizon estimates. This may be partially explained by dependency between literature databases in medicine (i.e. the population of journals indexed in each database is different, therefore impacting the probability that a given study can be "captured" in multiple databases). Therefore, the prespecified threshold for retrieval in reviews of heterogeneous methodologies may need to be adjusted to account for the reduced sensitivity of searches.

Three, the stage at which CMR is applied in a systematic review appears to be important. For example, in our review, the horizon estimate for the initial search suggested that we had identified 15% of the relevant articles. However, when the horizon estimate was calculated for the final articles included in the review it suggested that 79% had been retrieved (Table 2). We believe that this observation reflects the low signal to noise ratio seen during the initial screening of article titles and abstracts (due to the presence of many irrelevant articles). Therefore, the analysis performed at the initial search level should not be used to inform search stopping. Instead, performing CMR at the level of final inclusion is likely to give a more valuable estimate of the actual population size since reviewers have eliminated articles that did not satisfy the inclusion criteria. In addition, stopping the search after 2 databases likely improperly estimates the number of missed articles because the magnitude of interaction between the two databases is not estimable in the saturated model (see footnote to Figure 2).

We acknowledge that there are limitations to this study. One, we could find no guidelines when establishing a prespecified threshold for article inclusion. Therefore we decided *a priori* to use an arbitrary threshold for retrieval of 80% based on face validity. Alternative thresholds may be more appropriate depending on the nature of the review. Two, non-statistical dependence between electronic databases may have influenced the horizon estimates. This challenge may be more important for reviews that include articles of heterogeneous methodologies that are published in journals that are indexed in different electronic databases. Dependency can partially be accounted for by searching a minimum of 3 databases (since the first two databases are additive and not statistically independent), but this may further inflate the horizon estimates. Three, by including articles retrieved from PubMed an argument can be made for performing additional horizon estimates using this database. We did not do this because PubMed indexes a subset of journals included in Medline.

Capture-mark-recapture is a technique that can be used to estimate the population (total number) of articles for a given topic (Horizon estimation). Our study demonstrates that CMR can be applied to systematic reviews in critical care as well as reviews that include studies with heterogeneous methodologies. The CMR technique appears to be most effective when applied to articles selected for full text review or final inclusion in the review. Opportunities exist to use CMR to both improve and test the efficiency of literature search strategies.

4.5 Systematic Review

Through this review, we identified 13 facilitators and nine barriers for best practices during ICU rounds. A summary of the identified facilitators suggests that rounds conducted using a *standardized structure* and a *best practices checklist* by a *multidisciplinary group of providers*, with *explicitly defined roles* and a *goal-oriented approach*, is optimal for best practices. Barriers to best practices during the rounding process include *long rounding times* and *interruptions*. Our review provides the first comprehensive summary of the evidence for facilitators and barriers to ICU rounding, and an illustrative guide of practical best practices for administrators and HCP to consider.

This review differs from previous systematic reviews of rounding. Gurses and Xiao[11] reviewed the evidence for the use of information technology during multidisciplinary rounds (not ICU specific). They identified information technology as an important facilitator to communication during rounds, but did not identify potential barriers to using information technology in the ICU. Pronovost et al.[9] conducted a systematic review and meta-analysis of MD staffing patterns and outcomes of ICU patients, and found that an intensive care specialist leading rounds reduced length of stay and mortality in both ICU and hospitals. Cypress et al.[10] reviewed the evidence for including patient families in rounds. They found that including family members on rounds increased family satisfaction and understanding of care, and helped HCP by providing pertinent information. Our results complement all three reviews by highlighting that a multidisciplinary, collaborative and open discussion environment with a standardized structure and goal-oriented approach, and access to relevant patient information for all providers facilitates patient care.

4.6 Implementation Framework: Opportunities for Improvement

Our results highlight potential opportunities to improve rounds in the ICU (Table 14). To facilitate consideration of these opportunities, we reviewed them in the context of the Institute of Medicine's six aims for improving quality (Safety, Effectiveness, Patient-centeredness, Timeliness, Efficiency, and Equity)[16] under the Structure and Process components of Donabedian's model for health care quality[97,98]. These models were selected, after consideration of several alternatives (Appendix E), due to their emphasis on best practices and recognition throughout the medical literature. Results of this synthesis are presented in Table 15.

Structural modifications to rounds include optimizing team composition and the location of rounds. Studies identified that a standardized location, time, and composition of the HCP team improved round *effectiveness* by facilitating greater availability of and participation among team members. Checklists can be used to promote goal-oriented discussion and to facilitate a standardized discussion format. Similarly, a multidisciplinary team of providers, composed of at least a RN, physician and pharmacist, promotes both *effectiveness* and *safety* of rounds by increasing HCP satisfaction, focusing discussion content, and reducing the number of adverse events. An explicit definition of each healthcare provider's role within rounds helps to increase *patient-centeredness*, and facilitate more *effective* discussions. Although most studies described their rounds as being conducted at the bedside (contributing to increased multidisciplinary collaboration and *patient-centeredness* of the discussions), one study described longer rounding times (decreased *timeliness)* and poorer communication at the bedside when compared to discussions held in a conference room[85]. Hosting discussions off the unit (ex. in a conference room) helps reduce the number of interruptions, further improving the *timeliness* of rounds and quality of communication between HCP. With the conflicting evidence of benefits to *patient-centeredness* and *timeliness*, it is unclear what is the best location for rounds. Opportunities to reduce wasteful activities, such as retrieval of patient data during discussions, should be explored to improve *efficiency*. Having relevant patient data available to all HCP in a handout may be one way to improve *efficiency*. Finally, the spatial configuration of the team should facilitate clear visibility of all participants' to ensure *equal* opportunity to participate in discussions.

Process modifications to rounds focus on HCP activities instead of the physical setting or structure of discussions. These modifications include building a goal-oriented discussion environment, with a planned output centered on patient care goals. Discussing and documenting goals in patients' records improves *effectiveness* of communication between providers. Although the evidence is not as strong, an open and collaborative discussion environment facilitates increased HCP participation, improved patient outcomes, and reduced costs to the healthcare system.

We evaluated the evidence using validated guidelines for quality improvement research[38]. There is strong evidence for implementing structured (using a checklist), multidisciplinary rounds, in a standard location, at a standard time, with explicit roles defined for each participating HCP. However, weaker evidence is available for identifying the ideal location for discussions, or value of open discussion environments. With the exception of the location of rounds, we did not identify any potential unintended consequences of these recommendations in our synthesis of the included studies (Table 13). However, studies with longer follow up periods may be required to fully explore the risk of unintended outcomes and sustainability of the best practice recommendations. Local quality improvement evaluations may be helpful to examine how the recommendations perform in individual settings.

4.7 Limitations of Systematic Review

We acknowledge that other opportunities to improve patient care rounds may exist, and there are likely opportunities for improvement to this review. First, our summary of the knowledge base for patient care rounds maybe incomplete if relevant articles were omitted. However, we utilized a comprehensive search strategy developed with the help of an information specialist. In addition, an evaluation of our search using capture-mark-recapture analysis[43,57] suggests that we identified 80% of the total population of potentially relevant articles[99]. Second, there are methodological limitations to some of the studies included in our review, limiting our ability to draw causal inference. Nevertheless, the results presented are a summary of the best evidence currently available. The potential costs or harms for best practices for patient care rounds in the ICU identified in our study are likely minimal; therefore, we suggest that these recommendations to improve the structure and process of rounds are worth pursuing.

4.8 Future Research

The results of this thesis highlight a number of areas for future research. The model we developed to provide best practice recommendations to clinicians and administrators may be applied in the clinical setting, however, further studies should investigate the clinical feasibility of this model. Some gaps in the literature are apparent since a limited number of recommendations could be developed for the processes of rounds. This may also be due to the inherent difficulty of measuring outcomes directly related to these processes. Although these recommendations may have an impact on multiple patient, provider and process related outcomes, developing outcome measures that directly inform researchers about the effectiveness of specific process interventions would ensure better sustainability. Finally, although we suggest that studies from this field of research are considered within a quality improvement and research context, developing methodologies which may be applied in this area of research but are less prone to bias, and more generalizable will facilitate greater improvements in our knowledge for this field.

4.9 Conclusions

This thesis accomplished three important tasks. First, a new methodology was tested that may be applied in future reviews to give an indication of search completeness. Second, our systematic review provides the first synthesis of the evidence for facilitators and barriers to HCPs rounding in the ICU. From this synthesis, we recommend implementing structured (using a checklist), multidisciplinary rounds, with explicit definitions of each provider's role as a minimum to improve the quality of an ICU rounding process. Implementation of other complex interventions to improve rounds will require rigorous evaluation to ensure meaningful impact on patient care and exclude unintended consequences. Third, we synthesised recommendations for improving this process into a framework which can be applied by administrators and providers.

Table 1: How to apply CMR as a stopping rule for systematic reviews in critical care

Step 1	Define an a priori estimate of completeness for literature search or criteria for search stopping rule
Step 2	Perform search in the three (predicted) most productive databases and screen to final inclusion.
Step 3	Calculate the Horizon Estimate.
Step 4	Compare retrieval with the Horizon Estimate to determine if a priori estimate of completeness is satisfied.
Step 5	Continue with searching additional sources until a priori estimate of completeness is satisfied

Modified from Kastner et al[8]

Table 2: Results of the Horizon Estimation at three different levels of study selection for the review

Databases	Article Identified From Search Strategy (n=4462)			Articles Selected for Full Text Review (n=133)			Articles Included in Systematic Review (n=38)		
	Known Articles	Horizon Estimate (95% CI)	% Captured (Lower 95% CI)	Known Articles	Horizon Estimate (95% CI)	% Captured (Lower 95% CI)	Known Articles	Horizon Estimate (95% CI)	% Captured (Lower 95% CI)
Medline + Embase	3725	4,482 (4,479-4,485)	83 (82)	103	107 (105-108)	96 (91)	33	34 (33-34)	97 (85)
Medline + Embase + CINAHL	4451	68,687 (60,292-78,342)	7 (6)	133	170 (153-203)	78 (71)	38	48 (39-131)	79 (65)
Medline + Embase + CINAHL + Cochrane	4462	28,839 (13,393-70,990)	15 (15)	133	169 (152-202)	79 (72)	38	48 (39-131)	79 (65)

Abbreviations: CI, confidence interval

Table 3: Optimal search order of databases searched

Articles Identified From Search Strategy (n=4462)		Articles Selected for Full Text Review (n=133)		Articles Included in Systematic Review (n=38)	
Actual order (new retrieved articles)	Optimal order (CUM % of final HE)	Actual order (new retrieved articles)	Optimal order (CUM % of final HE)	Actual order (new retrieved articles)	Optimal order (CUM % of final HE)
1. Medline (2473) 2. Embase (1251) 3. CINAHL (727) 4. Cochrane (11)	1. Embase (10) 2. Medline (13) 3. CINAHL (16) 4. Cochrane (16)	1. Medline (76) 2. Embase (27) 3. CINAHL (30) 4. Cochrane (0)	1. Embase (56) 2. CINAHL (78) 3. Medline (83) 4. Cochrane (83)	1. Medline (29) 2. Embase (4) 3. CINAHL (5) 4. Cochrane (0)	1. Embase (63) 2. CINAHL (73) 3. Medline (79) 4. Cochrane (0)

Abbreviations: CUM, cumulative; HE, horizon estimate

Table 4: Characteristics of Included Studies

Study	Purpose	Design*	Type of ICU	Hospital (# centers)	Rounds	Team	Sample Size
Landry et al., 2007	Described differences in satisfaction for bedside versus conference room	Controlled cross-over, randomized	Pediatric	Academic (1)	Morning, conference room & bedside, teaching	MD	27 parents, 21 MDs
Weant et al., 2009	Described cost impact of pharmacist interventions	Before-after time series (chart review)	Neuro	Academic (1)	Daily, morning, multidisciplinary	MD Pharm	2156 pts
Weiss et al., 2011	Tested checklist use prompting	Cohort study prospective	Medical	Academic (1)	Daily, morning, multidisciplinary	MD RN Pharm	548 pts
Kim et al., 2010	Described patient 30 day mortality associated with intensivist & multidisciplinary led teams	Cohort study retrospective	General	Academic and Non-academic (112)	Described multiple different practices for different centers.	MD RN RT Pharm	107,324 pts
Young et al., 1998	Described patient & cost outcomes of a structured multidisciplinary care model	Cohort study retrospective	General	Academic (1)	Twice daily, morning & evening, multidisciplinary, bedside	MD RN RT Pharm PT RD SW	374 pts.
Leape et al., 1999	Described association between pharmacist participation & rate of adverse drug reactions.	Before-after controlled (chart review)	General	Academic (1)	Daily, morning, multidisciplinary	MD RN Pharm	275 pts
Cummings et al., 2008	Described pharmacist participation in discussions when	Before-after uncontrolled (observation tool &	Pediatric	Non-academic (1)	Multidisciplinary, bedside	MD RN Pharm	4 days 3 Pharm (213 min)

	provided a mobile computer	HCP survey)					
Dodek et al., 2003	Evaluated structured process for discussions	Before-after uncontrolled (HCP survey)	General	Academic (1)	Daily, morning, multidisciplinary, bedside	MD RN RT Pharm	2654 surveys
DuBose et al., 2008	Tested checklist	Before-after uncontrolled (observation tool & chart review)	Trauma	Academic (1)	Not described	MD RN	1147 pts
Hewson et al., 2006	Tested checklist	Before-after uncontrolled (HCP survey)	General	Non-academic (1)	Daily, morning, multidisciplinary, bedside	N/A	25 surveys
Lyons et al., 2010	Evaluated structured approach	Before-after uncontrolled (observation tool)	Neuro	Academic (1)	Daily, morning, multidisciplinary, bedside	MD	6 HCP (30 rounds discussions)
Narasimhan et al., 2006	Tested checklist	Before-after uncontrolled (HCP survey)	Medical	Academic (1)	Daily, morning, multidisciplinary, bedside, teaching	MD RN RT RD SW Pharm	76 surveys
Phipps et al., 2007	Tested checklist	Before-after uncontrolled (HCP survey)	Pediatric	Academic (1)	Daily, morning, multidisciplinary	MD RN	48 surveys
Pronovost et al., 2003	Tested checklist	Before-after uncontrolled (HCP survey & semi-structured interviews)	Medical-Surgical	Academic (1)	Daily, morning, multidisciplinary	MD RN RT Pharm	9 HCP (104 pts)

Rivkin et al., 2011	Described clinical impact of pharmacist interventions	Before-after uncontrolled (chart review)	General	Academic (1)	Daily, multidisciplinary	MD Pharm	266 pts
Stone et al., 2011	Tested goals checklist	Before-after uncontrolled (chart review)	General	Academic (1)	Daily, morning, multidisciplinary	MD RN RT	366 pts
Vats et al., 2011	Described impact of lean approach to improving efficiency	Before-after, uncontrolled (observational tool & HCP survey)	Pediatric	Academic (1)	Morning, multidisciplinary, bedside, teaching	MD Pharm RD	240 pts. (240 rounds discussions)
Wright et al., 1996	Tested nurse presentation	Before-after uncontrolled (HCP survey)	Medical	Academic (1)	Daily, multidisciplinary	MD RN Pharm PT	5 HCP (45 surveys)
Al-Jazairi et al., 2008	Described pharmacist interventions & acceptance by rounding team	Case series (chart review)	Mixed	Academic (1)	Daily, morning, multidisciplinary, bedside	MD RN RT Pharm	600 pts
Bradshaw et al., 1984	Described data accessed by HCP	Case series (chart review)	General	Academic (1)	Daily, morning, multidisciplinary, teaching	MD RN	60 pts (121 rounds discussions)
Stockwell et al., 2007	Described perceived physician management performance & completion of goals	Case series (HCP survey)	Pediatric	Academic (1)	Twice daily, morning & afternoon, multidisciplinary	MD Pharm	8 MD, 827 surveys
White et al., 1998	Described costs associated with pharmacist interventions	Case series (HCP survey)	Cardio	Academic (1)	Twice daily, morning, multidisciplinary	MD Pharm	23 days
Ventura Ribal et al.,	Described HCP satisfaction with	Cross sectional survey	General	Academic (2)	Daily, multidisciplinary,	MD RN	60 surveys

2002 [Sp]	unidisciplinary & multidisciplinary discussions				bedside		
Walden et al., 1998	Discussed perceived barriers to RN participation	Cross sectional survey	Neonate	Academic (1)	Daily, multidisciplinary, bedside	N/A	87 HCP
Alvarez et al., 2005	Examined interruptions	Ethnographic observation	General	Academic (1)	Twice daily, morning & evening, multidisciplinary	MD RN	9 HCP (24 hrs)
Cardarelli et al., 2009	Described time allocated to discussions & associated salary costs.	Ethnographic observation	Pediatric	Academic (1)	Weekly, multidisciplinary, bedside, teaching	MD RN RT Pharm RD	22 rounds discussions observed
Collins et al., 2010	Assessed goal documentation	Ethnographic observation	Neuro	Academic (1)	Daily, morning, multidisciplinary	MD RN RT	28 pts (77 rounds discussions)
Collins et al., 2011	Developed model of information exchange	Ethnographic observation & interviews	Neuro	Academic (1)	Daily, morning, multidisciplinary	MD RN Pharm	5 interviews 1 focus group (59.5 hrs)
Coombs et al., 2003	Discussed HCP contributions to decision making	Ethnographic observation & interviews	General	Both (3)	Bedside, multidisciplinary	MD RN	62 pts (18 interviews)
Friesdorf et al., 1994	Described discussion content	Ethnographic observation & focus group	Surgical	Academic (1)	Three times daily, multidisciplinary, bedside, teaching	MD RN	65 pts (225 rounds discussions
Friesdorf et al., 1994 [Ger]	Performed physician task analysis	Ethnographic observation	General	Academic (1)	Daily, morning	N/A	135 pts (131 min)
Hill et al., 2003	Identified RN contribution to	Ethnographic observation &	General	Non-academic	Daily, morning, multidisciplinary,	MD RN	8 RN (18 hrs)

	discussions	interviews		(1)	bedside		
Ho et al., 2007	Developed design guidelines for EHR	Ethnographic observation & interviews	Pediatric	Academic (1)	Daily, morning, multidisciplinary, bedside	MD RN	47 pts (15 hrs)
Miller et al., 2009	Described content differences in unidisciplinary vs. multidisciplinary discussions	Ethnographic observation	General	Academic (2)	Unidisciplinary & multidisciplinary, bedside	MD RN	10 pts (45 rounds discussions)
Morrison et al., 2008	Described effect of EHR on interprofessional interactions	Ethnographic observation & interviews	Cardio	Academic (1)	Daily, morning, multidisciplinary, bedside, teaching	MD RN Pharm PT RD	18 pts
Patel et al., 2006	Described clinical impact & cost savings of pharmacist interventions	Ethnographic observation & chart review	Burn	Academic (1)	Daily, multidisciplinary, bedside	MD Pharm	76 pts
Vats et al., 2010	Described waste & opportunities to improve physician efficiency	Ethnographic observation of rounds & Lean analysis	Pediatric	Academic (1)	Daily, morning, multidisciplinary, bedside, teaching	NS	12 MD (>60 hrs)
Knoll et al., 2008 [Ger]	Described HCP experience	Qualitative interviews	General	Academic (1)	Daily, multidisciplinary, bedside	MD RN	8 HCP
Manias et al., 2001	Described interprofessional power relations	Qualitative interviews & Focus Group	General	Academic (1)	Unidisciplinary & multidisciplinary, conference room & bedside	MD RN	6 RN (12 interviews, 3 focus groups)

*Table sorted by strength of study design, then alphabetically by the lead authors last name.

Abbreviations: EHR, electronic health record; [Ger], German language article; HCP, healthcare provider; hrs, hours; ICU, Intensive Care Unit; MD, Medical Doctor; min, minutes; N/A, not available; pts, patients; Pharm, Critical Care Pharmacist; PT, Physiotherapist; RD, Registered Dietician; RN, Registered Nurse; RT, Respiratory Therapist; SW, Social Worker; [Sp], Spanish language article

Table 5: Results and Key Outcomes of Quantitative Studies

Study*	Measures	Results and Statistically Significant Outcomes
Described Practices		
Al-Jazairi et al., 2008	Reason for pharmacist intervention & its acceptance with medical team	Unprescribed medication (33.2%), Inappropriate dosage (28.9%), No indication (14.3%), prevention of adverse drug toxicity, 3.2%; duplicate ordering, 1.1%; miscellaneous, 12.6%. 394 interventions proposed, 94.3% accepted
Bradshaw et al., 1984	Recorded data accessed by HCP during rounds.	Lab data (31.5%), medications (23%), patient observations (21%), bedside monitor (12.5%), blood gas (9.5%), & other (2.5%)
Cardarelli et al., 2009	Median rounding time, number of participants, & average of associated costs	15 min was spent per patient (4 min for patient data presentation, 10.5 min for discussion of pts clinical status, teaching, & planning). 13.5 participants per round. Cost per patient $140.87
Friesdorf et al., 1994	Time allocation assessment of discussion topics & interruptions	Length of discussion = 5 min/patient. 27% medical history, 53% preoperative case history, 56% surgical intervention, 33% course in ICU, 100% acute status, 88% planning. Average 2 interruptions/patient
Friesdorf et al., 1994 [Ger]	Rounding task analysis	Length of rounds = 131 min. 40% documentation, 29% information collection, 26% treatment, 5% communication with HCP
Current Rounding Practices		
Alvarez et al., 2005	Frequency of interruptions, communication patterns (time & channel)	Interruptions accounted for 42.3% of total communication time (14/ hr). Majority of time (75%) spent on communication during rounds (62% for RN, 81% for MD). 88% of communication done face-to-face or by telephone
Landry et al., 2007	Parent & resident satisfaction with bedside vs. conference room discussions	Higher parent satisfaction with bedside discussions (96% vs. 92%). No significant difference in satisfaction for residents based on location of discussion.
Lyons et al., 2010	Content difference with bedside versus not bedside discussions. Impact of distractions on rounding time	Content of discussions more complete with conference room discussions (6.2/7) vs. bedside discussions (5.5/7). Correlation between distractions & patient discussion time, & total round time
Vats et al., 2010	Impact of Lean waste reduction on rounding time	Variation in rounding time attributed to physician preference (ex. teaching varied from 3-64 minutes). Scenario analysis indicated standardized rounds focused on essential activities, conducted in linear order, led by trainees, &

		with minimal teaching could improve efficiency & reduce rounding time by 42%
Vats et al., 2011	Impact of Lean exercise on timeliness & HCP satisfaction	Total rounding time decreased by 23% (36 min), decreased attending MD man-hours (7.6-4), increase HCP satisfaction score ($p<0.05$)
Walden et al.1998	Delphi survey of facilitators & barriers influencing RN participation (% agreement)	Facilitators: Rounds at bedside (90.5), RN available (89.2), Open environment (86.9), RN input valued (85.8), Mentor new MD regarding value of RN (84.9) Barriers: RN busy with other patients (90.7), No standard time (73.8), Participation not mandatory (62.6), RN busy with other responsibilities (61.9), & MD's do not request RNs presence/participation (60.9)
	Health Record Use and Documentation	
Collins et al., 2010	Presence of goals & goal-related actions in EHR	75.6% of goals discussed were documented. 74.8% of goal-related actions were documented
Cummings et al., 2008	Impact of mobile computer on time pharmacists spent accessing data, & pharmacist satisfaction	Pharmacists spent 16.3% less time away from rounds & reduced time spent gaining access to EHR following intervention. Satisfaction increased by 15% overall
	Communication Strategies	
Dodek et al., 2003	HCP satisfaction with standardized process & communication	Overall satisfaction with process & outcomes increased from 86.3% to 95.0%. Discussion satisfaction improved from 64.5% to 78.9%
Lyons et al., 2010	Analyzed timeliness & clinical discussion completeness with content score	Standardized approach significantly reduced time between patient discussions (12s vs. 9s) & improved content score (5.9/7 - 6.4/7)
Weiss et al., 2011	Assessed implementation of checklist prompting	Hospital mortality OR = 0.34. ICU mortality OR = 0.36
Wright et al., 1996	RN satisfaction with implementation of RN presentation	95% thought guidelines clear & specific. 96% used guideline daily. 50% felt communication improved
	Tool Use	
DuBose et al., 2008	Assessed checklist for guidelines compliance	Compliance increased for head of bead (35.2% to 84.5%), sedation interruption (78.0% to 86.0%), & peptic ulcer disease (76.2% to 92.3%)

Hewson et al., 2006	Checklist impact on HCP satisfaction	87% of HCP indicated checklist useful
Narasimhan et al., 2006	Checklist impact on HCP understanding of goals and perceived communication (5 point scale), and pts LOS	Understanding increased from 3.9 to 4.8 for RN, 4.6 to 4.9 for MD. Perceived communication increased from 3.6 to 4.3 for RN, 3.4 to 4.7 for MD. LOS decreased from 6.4 days to 4.3 days
Phipps et al., 2007	Checklist impact on HCP perceptions of communication	Reported improvement: MD to RN = 85%, RN to RN = 73%
Pronovost et al., 2003	Checklist impact on HCP understanding of goals	Understanding improved from <10% to >95%
Stone et al., 2011	Checklist impact on VAP rates	VAP incidence rate (per 1,000 ventilator days) decreased from 26.8 to 7.0
Goals and Planning		
Pronovost et al., 2003	Daily goal form impact on patient outcomes	ICU LOS significantly decreased from mean 2.2 days to 1.1 days
Stockwell et al., 2007	Association of physician management & leadership with completion of goals	Positive association between better physician management/leadership & percent of patient goals accomplished (p<0.007). Negative association between length of rounds & percent of patient goals accomplished (p<0.003)
Team Composition		
Kim et al., 2010	Hospital 30-day MR & adjusted odds of death with uni versus multidisciplinary care	Multidisciplinary care associated with reduction in odds of death OR=0.84
Leape et al., 1999	Rate of pharmacist adverse drug event interventions & acceptance with medical team	Pharmacist participation contributed to a 66% reduction in adverse drug events. 398 interventions proposed, 99% accepted
Miller et al., 2009	Verbal content analysis of discussions in uni versus multidisciplinary units	Unidisciplinary rounds discussed interventions in lower-than-expected frequencies (14.5% vs. 28.2%). Multidisciplinary rounds discussed expectations (11% vs. 7.96%) & goals (16% vs. 6.5%) in higher-than-expected frequencies
Patel et al., 2006	Acceptance of interventions & cost savings with pharmacist	165 interventions proposed; 121 improved patient care, 42 prevented drug toxicity, 7 prevented a life-threatening event. Annual cost avoidance of

	participation	$22,162.28
Rivkin et al., 2011	Number of significant drug interactions per patient & MR with pharmacist participation	Drug interactions decreased from 1.36 to 0.81, however, number of interactions requiring intervention showed no change. Mortality decreased from 29.5% to 13.9%
Ventura Ribal et al., 2002 [Sp]	HCP satisfaction with uni versus multidisciplinary rounds	No difference for MD: 6.8 vs. 5.2 (p = 0.11); Significantly greater satisfaction with multidisciplinary for RN: 7.2 vs. 2.1 (p =0.01)
Weant et al., 2009	Cost savings, LOS, MR and readmission rates with pharmacist participation	Total average savings of $1,594 per patient. Early MR decreased from 3.3% to 2.0%. LOS decreased from 8.6 to 7.2 days. Decrease in readmission (p<0.05)
White et al., 1998	Cost savings & clinical benefits of pharmacist interventions	$158.50 saved per day when pharmacist rounded. Benefits included answering drug information questions, discontinuing contraindicated drugs, under dosing, & substitution of more efficacious drugs
Young et al., 1998	Patient LOS, & associated cost savings with structured multidisciplinary care team	Significant decrease in ICU LOS (19.2 vs. 15.0 days) & average savings of $7500 per patient

*Table sorted by theme, then alphabetically by the lead authors last name.
Abbreviations: EHR, Electronic health record; HCP, Health care provider; LOS, length of stay; MR, mortality rate; pts, patients; RN, Registered nurse; VAP, ventilator associated pneumonia

Table 6: Results and Key Outcomes of Qualitative Studies

Study*	Key Outcomes
Effective Information Exchange	
Collins et al., 2011	Standards of care identified as facilitator. System of ad hoc goals, inefficient information retrieval & inefficient documentation identified as barriers. Developed model of effective information exchange.
Ho et al., 2007	HCP spatial configuration in rounds influences participation & visibility. Presentation format affects information sharing. Circular arrangement of participants, visual presentation of information, use of paper for data input & computer for output recommended by authors.
Knoll et al., 2008 [Ger]	Clear & transparent role of HCP facilitates communication.
Morrison et al., 2008	EHR use causes a shift in HCP body orientation from participants to computer, & restricts ability for consultant to highlight relevant information. Greater focus of HCP on discussion vs. clinical data.
Collaborative Decision Making and Patient Management	
Coombs et al., 2003	RN & MD have different perceptions about decision-making. Decision making shaped by MD knowledge base & authority. Control of rounds by MD leads to RN exclusion & marginalization.
Hill et al., 2003	RN felt presence important but not valued on rounds. Standardized script for reporting helped RN increase involvement in discussion.
Manias et al., 2001	Rounds at bedside facilitate RN contribution to decision making. RN role as solely a supplemental information source limits participation.
Power Relationships	
Collins et al., 2011	Greater HCP autonomy facilitates progression of care & collaboration.
Coombs et al., 2003	RN & MD aware of power & conflict challenges around clinical decision-making.
Hill et al., 2003	Empowering RN may increase contributions to decision-making
Knoll et al., 2008 [Ger]	Flattening of hierarchical structures & power imbalance creates more constructive decision making relationship & improved communication between RN & MD. Collegiality between MD hinders interaction with RN. Bedside rounds favoured by RN.

*Table sorted by theme, then alphabetically by the lead authors last name.

Abbreviations: EHR, electronic health record; [Ger], German language article; HCP, Healthcare provider; MD, medical doctor; RN, registered nurse;

Table 7: Facilitators and Barriers Identified by Included Studies

Reference	Facilitators	Barriers
Al-Jazairi et al., 2008	Evaluated current practices	
Alvarez et al., 2005		Interruptions limit communication
Bradshaw et al., 1984	Evaluated current practices	
Cardarelli et al., 2009	Evaluated Current practices	
Collins et al., 2010	Documentation of goals in electronic health record facilitates goal actions.	
Collins et al., 2011	Standards of care and HCP autonomy improve information exchange	System of ad hoc goals, implied and outdated goals, inefficient information retrieval from record, poor documentation, information tasks documented in multiple records.
Coombs et al., 2003		Nurse marginalization and exclusion limits collaboration.
Cummings et al., 2008	Mobile computing platform reduces time to access data and improves pharmacist satisfaction	
Dodek et al., 2003	Standardized responsibilities, reporting assessments, and plans improves communication and satisfaction between HCP	
Dubose et al., 2008	Checklist use increases compliance with prophylactic measures	
Friesdorf et al., 1994	Evaluated current practices	
Friesdorf et al., 1994	Evaluated current practices	
Hewson et al., 2006	Checklist improves staff satisfaction	
Hill, 2003	Standard RN script enhances RN participation Empowerment of RN role enhances RN contributions and collaboration	
Ho et al., 2007	Circular arrangement of rounds improves participation and visibility Visual reference and presentation improves	Verbal recite of information limits information dissemination between HCP

	information transfer Paper based note taking but computer based output improves communication	
Kim et al., 2010	Multidisciplinary rounds reduces odds of death (OR=0.84)	
Knoll et al., 2008		Hierarchical HCP structure decreases RN participation.
Landry et al., 2007	Bedside rounds increase parent satisfaction	
Leape et al., 1999	Pharmacist participation reduces ADE.	
Lyons et al., 2010	Conference room rounds improve communication. Standard format improves communication.	Distractions increase rounding time.
Manias et al., 2001		Conference room rounds reduce RN contributions to pts care and increase RN marginalization
Miller et al., 2009	Multidisciplinary rounds focuses communication on goals, expectations, and interventions.	
Morrison et al., 2008		EHR use during rounds decreases discussions
Narasimhan et al., 2006	Summary worksheet use improves HCP understanding of care, communication, and decreases pts LOS	
Patel et al., 2006	Daily goals sheet improves HCP communication	
Phipps et al., 2007	Daily goals sheet improves HCP communication and satisfaction	
Pronovost et al., 2003	Checklist use improves HCP understanding of care and decreases pts LOS	
Rivkin et al., 2011	Pharmacist participation reduced drug interactions and mortality.	
Stockwell et al., 2007	Effective physician management increases completion of daily goals	Increased rounding time reduces completion of daily goals
Stone et al., 2011	Daily goal focused rounds using a checklist reduces VAP rates.	

Vats et al., 2011	Reducing waste facilitates: Reduced rounding time Reduced time to delivery of care (timeliness) Reduced attending physician man hours Increased MD satisfaction	
Vats et al., 2010	Reduce waste through: Standardized rounds Minimal teaching (one point per pts) Removing radiology review and patient assessment from rounds Conducting rounds in linear order Having trainee MD gather pts resources Conduct teaching following patient care	Increased rounding time associated with delays in deciding patient order, finding RN, or determining which MD would present.
Ventura Ribal et al., 2002	Multidisciplinary rounds increase RN satisfaction	
Walden et al., 1998	RN input valued/respected RN input solicited during rounds Rounds occur at bedside RN available at bedside Open discussion/teaching environment	RN busy with other patients No standard time for rounds RN input not valued or respected MD do not request RN participation/presence RN on break
Weant et al., 2009	Pharmacist participation reduces LOS, readmission, MR, and costs.	
Weiss et al., 2011	Prompting to use checklist improves process of care measures and adherence to using checklist.	Passive implementation of checklist did not promote behaviour changes with intervention.
White et al., 1998	Pharmacist participation decreased costs	
Wright et al.,1996	RN participation increased RN satisfaction with communication	
Young et al.,1998	Collaborative, team care and dynamic clinical guidelines decreases LOS and costs	

*Table sorted alphabetically by the lead authors last name.

Abbreviations: VAP, ventilator associated pneumonia; RN, registered nurse; MD, medical doctor; pts, patient(s); HCP, health care provider; LOS, length of stay

Table 8: Described Practices

Described Practices*
Most studies described once daily (19), multidisciplinary (35), bedside (21) rounds
5 studies described rounding more than once daily, 9 described teaching during rounds
Length of rounds 131 min, length of discussions 5 – 15 min/patient
Rounding consists of information collection, communication with HCP, treatment, and documentation
Discussions consist of patient history, interventions, course in ICU, acute status, and patient planning/teaching of HCP
Interruptions accounted for 42.3% of communication time
13.5 participants contributed to discussions on average
Average $140.87/patient/day spent on HCP salaries during rounds

*Studies describing rounds, but not specifically identifying facilitators or barriers.
Abbreviations: HCP, healthcare provider; ICU, intensive care unit

Table 9: Facilitators to Rounding Best Practice

Facilitator	Outcome	Studies*
Bedside Rounds[31,64,75,89]	Increases RN and family satisfaction, and patient centeredness of discussions	1 cross-over randomized, 1 cross section, 2 qualitative
Conference room rounds[85]	Increased time efficiency, improved communication	1 time series
Open, collaborative discussion environment [75,86-89]	Increases HCP participation in discussion, improves patient outcomes, and decreases costs	1 cross section, 3 ethnographic, 1 qualitative
Reduce nonessential activities [74,84]	Decreases rounding time and time to delivery of care, and increases MD satisfaction	1 before-after uncontrolled, 1 ethnographic
Access to patient data [34,59,81,90]	Increases collaboration between HCP's	1 before-after uncontrolled, 3 ethnographic
Discussion and documentation of goals[27,58]	Increases goal completion and communication	1 before-after uncontrolled, 1 ethnographic
Standardized rounds structure and process[60,84,85,91]	Increases satisfaction of HCP and communication	3 before-after uncontrolled, 1 ethnographic,
Checklist use[27,61,62,67,69,73]	Increases HCP understanding of care and satisfaction, and improves patient outcomes	6 before-after uncontrolled
Pharmacist participating on rounds[65,68,71,76,78,80]	Decreases costs and rate of adverse drug interactions	1 before-after time series, 1 before-after controlled, 1 before-after uncontrolled, 1 case series, 1 ethnographic,
Multidisciplinary rounds[63,66,70,79,91]	Increases RN satisfaction, focuses discussion content, and improves patient outcomes	2 cohort, 1 before-after uncontrolled, 1 cross section, 1 ethnographic
Greater HCP autonomy [86-88]	Improves progression of care and HCP collaboration	3 ethnographic
Explicit HCP roles[60,72,88,89]	Improves communication and goal completion	1 before-after uncontrolled,1 case series, 1 ethnographic, 1 qualitative
Visibility of HCP[34]	Increases participation	1 ethnographic

*Table sorted by strength of study design.
Abbreviations: HCP, healthcare provider; RN, registered nurse

Table 10: Barriers to Rounding Best Practice

Barrier	Outcome	Studies*
Interruptions[21,85]	Disrupt communication and increase rounding time	1 before-after uncontrolled, 1 ethnographic
Bedside Rounds[85]	Increases rounding time	1 time series
Increased rounding time[72]	Decreases completion of patient goals	1 case series
Non-standardized structure[75]	Decreases HCP collaboration and communication	1 cross section
RN exclusion and perceptions of not being valued by MDs[31,75,88]	Decreases HCP collaboration and communication	1 cross section, 1 ethnographic, 1 qualitative
Electronic health record use[34,90]	Restricts HCP visibility and participation in discussions	2 ethnographic
Poor information retrieval and documentation[85,86,90]	Restricts communication and collaboration during rounds	1 time series, 2 ethnographic
Hierarchical HCP structure[89]	Decreases RN participation	1 qualitative
Non-bedside rounds[31]	Decrease RN participation	1 qualitative

*Table sorted by strength of study design.
Abbreviations: HCP, healthcare provider; MD, medical doctor; RN, registered nurse

Table 11: Results of semi-quantitative grading of key themes identified in qualitative studies

Theme	Manias, 2001	Coombs, 2003	Hill, 2003	Ho, 2007	Knoll, 2008	Morrison, 2008	Collins, 2011
Effective Information Exchange							
Location of discussions	++	**0**	**0**	+	**0**	+	**0**
Spatial configuration	**0**	**0**	**0**	++	**0**	++	**0**
Structured discussion	+	**0**	++	+	+	**0**	+
Access to data	**0**	**0**	**0**	++	**0**	+	++
Explicit HCP role	+	+	+	**0**	++	**0**	+
Clinical documentation	**0**	**0**	**0**	+	**0**	+	+
Collaborative Decision Making							
Open discussion environment	++	+	+	**0**	+	**0**	**0**
Goal focused discussions	**0**	**0**	**0**	**0**	**0**	**0**	++
Power Relationships							
HCP autonomy	+	+	+	**0**	+	**0**	++
Inclusive discussion environment	++	+	+	**0**	+	**0**	+
Conflict	++	++	++	**0**	**0**	**0**	+
Hierarchy and power balance	++	++	+	**0**	++	**0**	+

0, no mention of theme; +, some mention of theme but not primary focus; ++, primary objective or fundamental component of the study

Abbreviations: HCP, healthcare provider

Table 12: Quality Assessment of Included Studies

Quality Criteria (Modified from Caldwell, 2005)	Title clearly reflects content	Clear statement of hypothesis/objectives	Ethical considerations stated	Rationale for study design selection stated	Clear description of study population/selection	Clear exposition of data collection method	Context of study outlined	Clear exposition of sound analysis process	Clear presentation of results	Clear link between data interpretation & conclusions	Assessment for plausible alternatives	Limitations considered	% Quality criteria satisfied	
Collins et al., 2010	1	1	1	1	1	1	1	1	1	1	1	1	100%	More Quality Criteria Satisfied
Stone et al., 2011	1	1	1	1	1	1	1	1	1	1	1	1	100%	
Vats et al., 2011	1	1	1	1	1	1	1	1	1	1	1	1	100%	
Walden et al.,1998	1	1	1	1	1	1	1	1	1	1	1	1	100%	
Weiss et al., 2011	1	1	1	1	1	1	1	1	1	1	1	1	100%	
Hill, 2003	1	1	1	1	1	1	1	1	1	1	0	1	92%	
Kim et al., 2010	1	1	0	1	1	1	1	1	1	1	1	1	92%	
Miller et al., 2009	1	1	1	1	1	1	1	1	1	1	0	1	92%	
Stockwell et al., 2007	1	1	1	0	1	1	1	1	1	1	1	1	92%	
Vats et al., 2010	1	1	1	1	1	1	1	1	1	1	1	0	92%	
Collins et al., 2011	1	1	1	1	1	1	1	0	1	1	0	1	83%	
Dodek et al., 2003	1	1	0	0	1	1	1	1	1	1	1	1	83%	
Knoll et al., 2008 [Ger]	1	1	1	1	1	1	1	0	1	1	0	1	83%	
Leape et al., 1999	1	1	0	0	1	1	1	1	1	1	1	1	83%	
Manias et al., 2001	1	1	0	1	1	1	1	1	1	1	0	1	83%	
Narasimhan et al., 2006	1	1	1	1	1	1	1	0	1	1	0	1	83%	
Phipps et al., 2007	1	1	1	0	1	1	1	1	1	1	0	1	83%	
Pronovost et al., 2003	1	1	0	1	1	1	1	1	1	1	0	1	83%	
Rivkin et al., 2011	1	1	1	0	1	0	1	1	1	1	1	1	83%	
Coombs et al., 2003	1	1	1	1	0	1	1	1	1	1	0	0	75%	Less Quality Criteria Satisfied
Hewson et al., 2006	1	1	1	0	0	1	1	0	1	1	1	1	75%	
Ho et al., 2007	1	0	0	1	1	1	1	1	1	1	0	1	75%	
Patel et al., 2006	1	1	1	1	1	0	0	0	1	1	1	1	75%	
Young et al., 1998	1	1	1	1	1	1	0	1	1	1	0	0	75%	
Alvarez et al., 2005	1	1	1	1	0	1	0	1	1	1	0	0	67%	
Dubose et al., 2008	0	1	0	1	1	1	1	1	1	1	0	0	67%	
Lyons et al., 2010	0	1	0	0	1	1	1	1	1	1	0	1	67%	
Morrison et al., 2008	1	0	1	1	1	1	1	1	1	0	0	0	67%	
Weant et al., 2009	1	1	1	0	0	0	1	0	1	1	1	1	67%	
Cummings et al., 2008	1	1	0	0	1	1	1	0	0	1	0	1	58%	
Landry et al., 2007	1	1	0	0	1	1	1	0	1	1	0	0	58%	
Ventura Ribal et al., 2002	1	1	0	0	1	1	1	0	1	1	0	0	58%	
White et al., 1998	1	1	0	0	1	1	1	0	1	1	0	0	58%	
Wright et al., 1996	0	1	0	0	0	0	1	0	1	0	0	0	25%	

*Table sorted by percent quality criteria satisfied (n=12), then by alphabetically by lead authors last name

Table 13: Strength of Recommendations

Strength of Recommendation JAMA User Guide[36,37]	Improvement in Patient-important Outcomes OR Efficiency	Follow-up & Sustainability Clearly Addressed	Generalizability addressed	Potential Unintended Consequences Present and Not Considered	**Total Efficacy of Intervention [a]**	Hassle of Intervention Moderate to High	Harm from Intervention Possible	Costs of Intervention High	**Total Costs/Harms of Recommendation [a]**	Intervention represented by Unit of Analysis	Data Quality Good	Validity of Results	**Strength of Recommendation**	**Total Quality of Evidence Score [a]**	**GRADE [a]**	**Kappa**
Implement multidisciplinary rounds (including at least MD, RN, Pharm)	+	+	+	0	+++	+	0	+	**Low-Mod**	+	++	+++	Strong	**A**	**↑↑A**	0.52
Develop and implement structured tool (best practices checklist)	+	+	+	0	+++	0	0	0	**Low**	+	++	++	Strong	**B**	**↑↑B**	0.62
Define explicit roles for each HCP participating on rounds	+	0	+	0	++	0	0	0	**Low**	+	++	++	Strong	**B**	**↑↑B**	0.62
Standardize location, time, and team composition	+	0	+	0	++	+	0	0	**Low-Mod**	+	++	++	Strong	**B**	**↑↑B**	1.00
Reduce inefficient activities	+	0	+	0	++	+	0	+	**Mod-High**	+	+	++	Strong	**B**	**↑↑B**	0.60
Document all discussed daily patient care goals	+	+	+	0	+++	0	0	0	**Low**	+	+	++	Strong	**C**	**↑↑C**	1.00
Minimize unnecessary interruptions	+	0	+	0	++	+	0	0	**Low**	+	+	++	Strong	**C**	**↑↑C**	1.00
Conduct discussions at bedside to promote patient centeredness	+	0	0	+	**0**	+	+	+	**Mod-High**	+	++	++	Weak	**A**	**↑?A**	1.00
Establish open, collaborative discussion environment	+	0	0	0	+	+	0	0	**Low-Mod**	+	++	+	Weak	**C**	**↑?C**	0.74
Conduct discussions in conference room to promote efficiency and communication	+	0	+	+	+	+	+	+	**High**	+	++	++	Weak	**C**	**↑?C**	1.00
Ensure clear visibility between all HCP	+	0	0	0	+	0	0	0	**Low**	+	+	+	Weak	**D**	**↑?D**	0.78
Empower all HCP to ensure autonomy and flatten hierarchal structure	0	0	+	0	**0**	+	0	0	**Low-Mod**	+	+	+	Weak	**D**	**↑?D**	0.80
Produce visual presentation of patient information	+	0	0	0	+	+	0	0	**Low**	+	+	++	No Specific Recommendation	**D**	**??D**	1.00

Abbreviations: GRADE, Grades of Recommendation Assessment, Development, and Evaluation; HCP, Healthcare Provider; +, Low; ++, Moderate; +++, High;
↑↑, strong recommendation; ↑?, weak recommendation; Quality of Evidence: A, High; B, Moderate; C, Low; D, Very Low.
[a] GRADE, evaluating the balance between evidence for efficacy of intervention, anticipated costs/harms, and quality of evidence

Table 14: Recommendations for Best Practices During ICU Rounds

Best Practice	Strength of Recommendation [a] (JAMA GRADE [b])
Implement multidisciplinary rounds (including at least a Medical Doctor, Registered Nurse, and Pharmacist)	Strong - definitely do it (↑↑A)
Standardize location, time, and team composition	Strong - definitely do it (↑↑B)
Define explicit roles for each HCP participating on rounds	Strong - definitely do it (↑↑B)
Develop and implement structured tool (best practices checklist)	Strong - definitely do it (↑↑B)
Reduce wasteful activities (including teaching)	Strong - definitely do it (↑↑B)
Minimize unnecessary interruptions	Strong - definitely do it (↑↑C)
Focus discussions on development of daily goals, and document all discussed goals in health record	Strong - definitely do it (↑↑C)
Conduct discussions at bedside to promote patient centeredness	Weak - probably do it (↑?A)
Conduct discussions in conference room to promote efficiency and communication	Weak - probably do it (↑?C)
Establish open, collaborative discussion environment	Weak (probably do it) (↑?C)
Ensure clear visibility between all HCP	Weak (probably do it) (↑?D)
Empower all HCP to ensure autonomy and flatten hierarchal structure	Weak (probably do it) (↑?D)
Produce visual presentation of patient information	No specific recommendation (??D)

Abbreviations: GRADE, Grades of Recommendation Assessment, Development, and Evaluation; HCP, healthcare provider;

[a] Based on GRADE system evaluating the efficacy of the intervention, balance between desirable and undesirable effects, costs (resource allocation) and quality of evidence

[b] ↑↑, strong recommendation; ↑?, weak recommendation; Quality of Evidence: A, Very Strong; B, Strong; C, Moderate; D, Weak

Table 15: Best Practice Model for ICU Rounds

Donabedian / IOM	Structure	Process
Safety	-Include pharmacists in discussions -Implement best practices checklist (and prompting to use checklist)	-Empower all HCP to ensure team collaboration
Effectiveness	-Standardize location and team composition -Conduct multidisciplinary rounds (with explicitly defined roles) -Conduct patient care goal oriented discussions -Implement best practices checklist	-Document all patient care goals
Patient-Centeredness	-Conduct discussions at bedside -Define explicit HCP roles	-Establish an open, collaborative discussion environment
Timeliness	-Standardize time -Conduct discussions away from bedside (ex. conference room) -Minimize unnecessary interruptions -Minimize length of rounds	
Efficiency	-Implement multidisciplinary rounds -Patient data handout to all HCP -Reduce wasteful activities (including teaching)	
Equity	-Ensure clear visibility of all HCP	-Empower all HCP to ensure autonomy and team collaboration

Abbreviations: HCP, healthcare providers; IOM, Institute of Medicine six aims for improving healthcare quality; RN, registered nurse

Figure 1: Capture-mark Recapture Study Flow Diagram

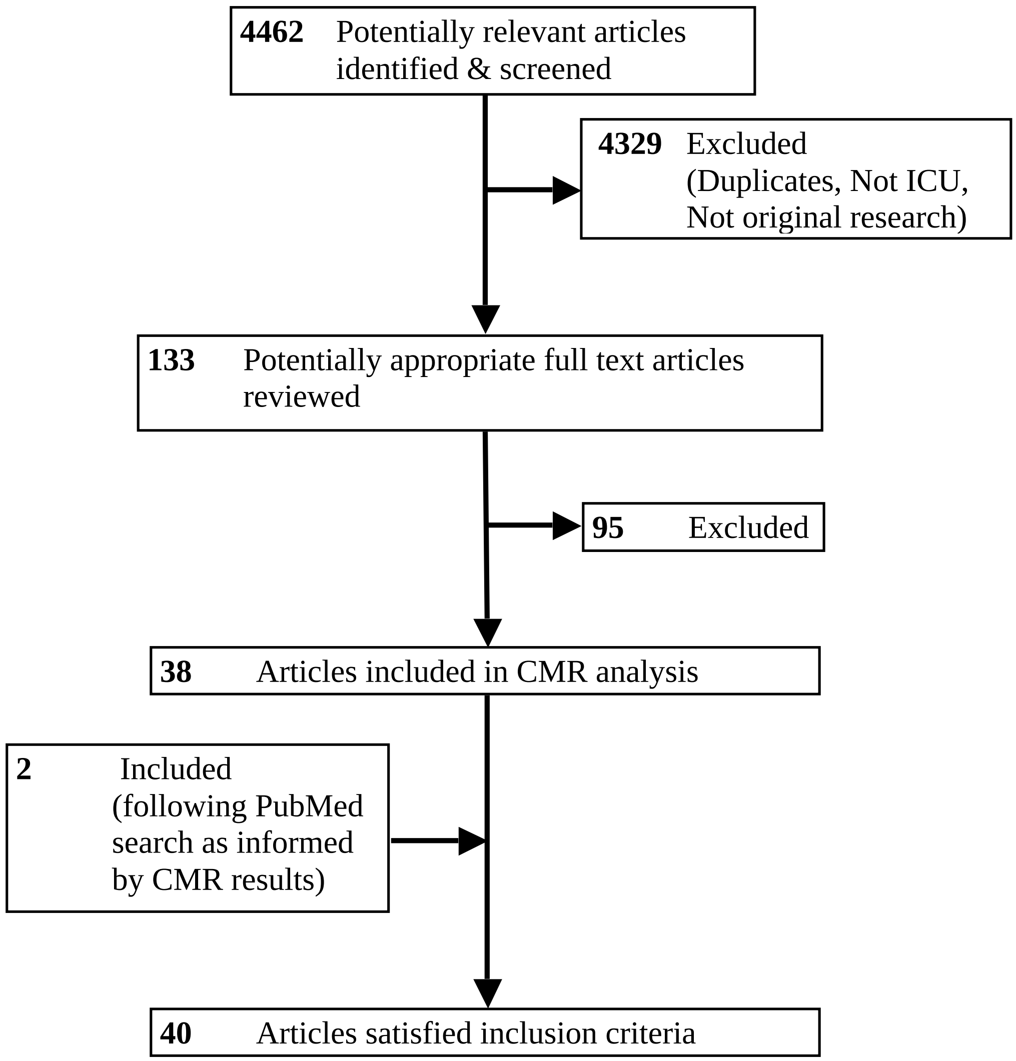
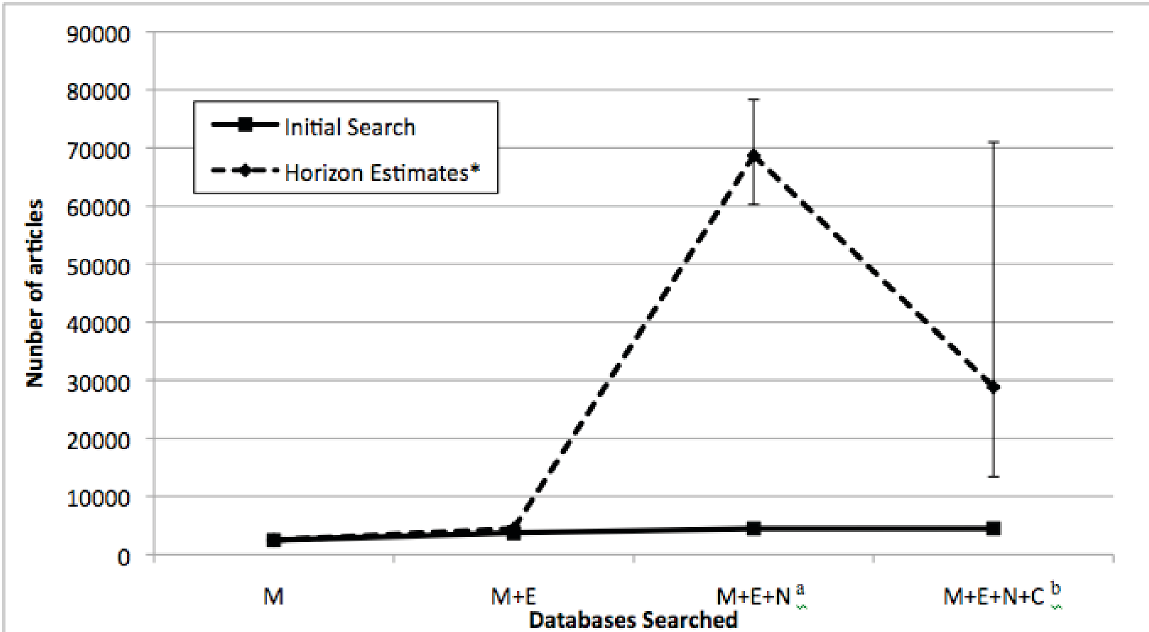
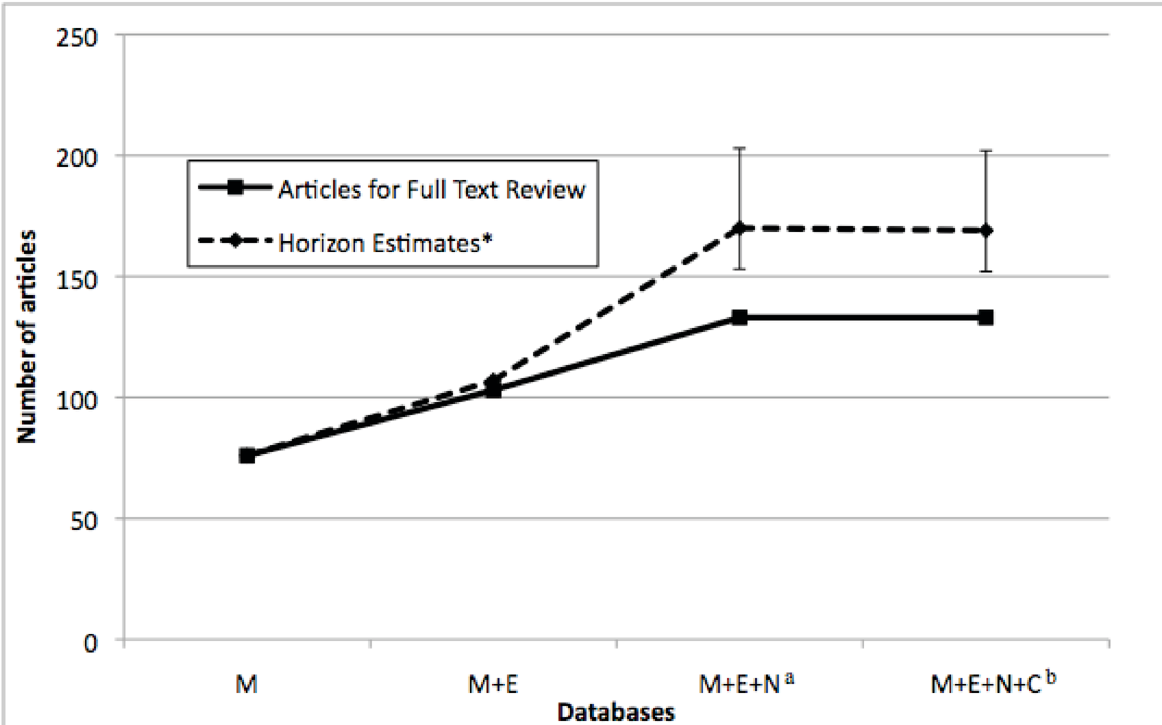


Figure 2. Scatter plot of studies identified in initial search strategy vs. database



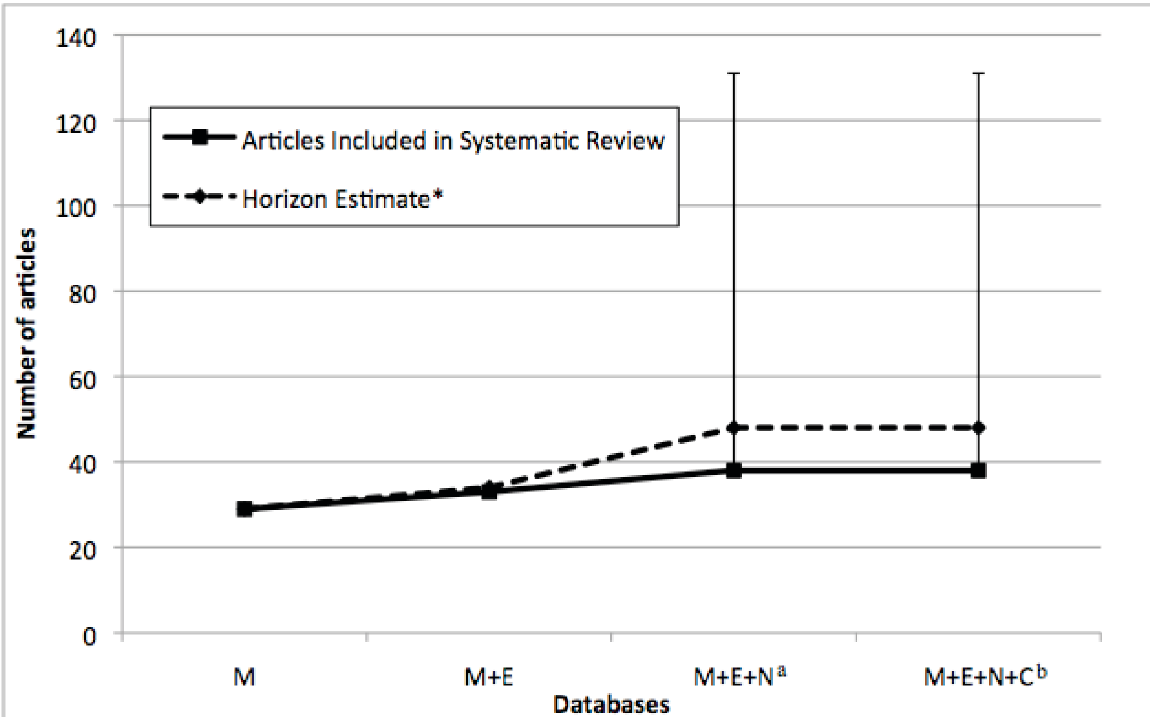
*95% confidence intervals of horizon estimates
Abbreviations: M, Medline; E, Embase; N, CINAHL; C, Cochrane
Best-Fit Models: [a] M+E+N+ME+MN;
[b] M+E+N+C+ME+MN+EN+MC+EC+NC+MEN+MEC
+ The model fitted after two databases (M+E) is saturated and cannot estimate the ME interaction. Notice that a and b both include the ME interaction, suggesting that it is needed to properly estimate the number of missed articles.

Figure 3. Scatter plot of studies selected for full text review vs. databases



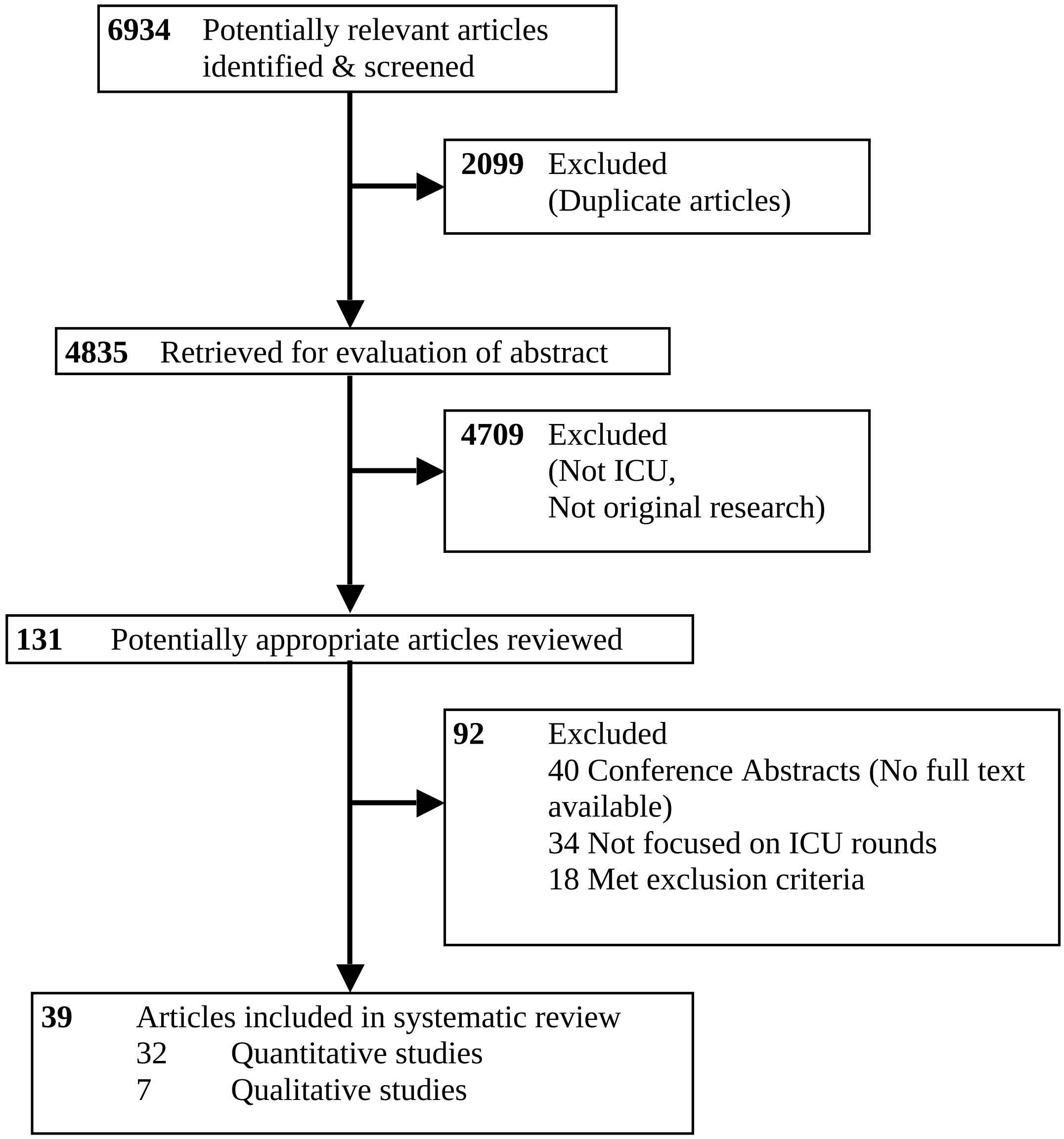
*95% confidence intervals of horizon estimates
Abbreviations: M, Medline; E, Embase; N, CINAHL; C, Cochrane
Best-Fit Models: [a] M+E+N+ME+EN; [b] M+E+N+C+ME+EN+MC+NC

Figure 4. Scatter plot of studies selected for final inclusion in the systematic review vs. databases



*95% confidence intervals of horizon estimates
Abbreviations: M, Medline; E, Embase; N, CINAHL; C, Cochrane
Best-Fit Models: [a] M+E+N+ME+EN; [b] M+E+N+C+ME+EN+ENC

Figure 5. Study Flow Diagram



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APPENDIX A: SAMPLE SEARCH STRATEGY

Database: Ovid MEDLINE(R) <1948 to April Week 1 2011>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <April 13, 2011>
Search Strategy:

----

1 (critical adj care).tw.
2 (critical$ adj ill$).tw.
3 (intensive adj care).mp.
4 ICU?.tw.
5 (cardiovascular adj unit?).tw.
6 (coronary adj care).tw.
7 CCU?.tw.
8 (step-down adj unit?).tw.
9 (burn adj unit?).tw.
10 "high dependency unit?".tw.
11 (neurosurgical adj unit?).tw.
12 (observation$ adj unit?).tw.
13 exp Intensive Care Units/
14 exp Critical Care/
15 Critical Illness/
16 or/1-15
17 round$.tw.
18 (routine adj care).tw.
19 (schedule$ adj care).tw.
20 (care adj conferenc$).tw.
21 (care adj meet$).tw.
22 ((bedside? or bed-side?) adj conferenc$).tw.
23 ((bedside? or bed-side?) adj meet$).tw.
24 huddl$.tw.
25 (clinical adj conference?).tw.
26 Clinical Conference.pt.
27 Patient Care Planning/
28 Advance Care Planning/
29 Case Management/
30 Critical Pathways/
31 or/17-30
32 16 and 31
33 Animals/ not (Animals/ and Humans/)
34 32 not 33

APPENDIX B: SCREENING TOOLS

B.1. Screen 1–Abstract Review Instrument

Citation # ___________

Reviewer Initials: _____

1. Does the citation (based solely on its title and abstract) appear to satisfy the study goal to identify and review existing interventional, observational or qualitative studies on scheduled rounds in patients admitted to critical care areas?

All left hand boxes below must be checked to qualify

- ❑ Does the study appear to be original research?
- ❑ Were the critical care providers operating in high dependency hospital areas such as ICU, CVICU, Burn units, CCU, step-down units?
- ❑ Was the primary objective of the study to discuss **scheduled rounding**?

❑ **Yes**

❑ **No**, exclude citation if the following is satisfied.

- ❑ Does not satisfy inclusion criteria (see above)
- ❑ Primary objective is to study teaching rounds.
- ❑ Other:__________________

B.2. Screen 2 – Full Text Review Instrument

Citation #_____________

1. Does the citation satisfy the study goal to discuss facilitators or barriers to rounding practices in the intensive care unit?

All left hand boxes below must be checked to qualify

❑ Study identified as original research

❑ Was the study population characterized as:
❑ Critical Care Patients **OR** ❑ Healthcare Providers

Study design identified as one of the following:
❑ Observational **OR** ❑ Interventional **OR** ❑ Qualitative

❑ Scheduled rounding discussed and at least one of the following identified (check all that apply)
❑ current practice ❑ strategies for improvement
❑ facilitators ❑ barriers

❑ Study reports processes or outcomes of patient care with one of the following measures of outcome:
❑ process centred
❑ patient/family centred (quality of life, mortality, etc.)
❑ provider centred (inter professional satisfaction)

❑ **Yes** **Continue next page**

❑ **No** (exclude citation if any of following are satisfied): **Stop**
❑ Discussion of rounding concerned with teaching primarily
❑ Rounds not inclusive of patient care
❑ Focus of study is on non-scheduled activities

APPENDIX C: HORIZON ESTIMATE CALCULATION

C.1. Horizon Estimation of Initial Search:

Analyses completed using Stata 11 using *poisson* command. The fitted estimates of the cell counts were calculated using *predict n*.

We will begin by looking at Medline + Embase.

Count	Medline(M)	Embase(E)
1251	0	1
933	1	0
1540	1	1
?	0	0

The total number of articles is 3724. When fitting the additive model the deviance is 0 as expected and the coefficient of the constant is 6.630566 (std. error 0.0014864), which is a rate ratio of 758 (95% CI: 755 – 761). As such, the Horizon estimate at this stage would be 3724 + 758 (3724+755 to 3724+761) = 4482 (95% CI: 4479 – 4485).

Raw STATA Output

```
poisson MEInitial M1 E1 [fw= MEInitial]

Iteration 0:   log likelihood =  -16724.92
Iteration 1:   log likelihood = -16724.815
Iteration 2:   log likelihood = -16724.815

Poisson regression                                Number of obs   =       3724
                                                  LR chi2(2)      =  173798.00
                                                  Prob > chi2     =     0.0000
Log likelihood = -16724.815                       Pseudo R2       =     0.8386

------------------------------------------------------------------------------
   MEInitial |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          M1 |   .2078392   .0010299   201.81   0.000     .2058207    .2098577
          E1 |   .5011325   .0012532   399.89   0.000     .4986763    .5035887
       _cons |   6.630566   .0014864  4460.79   0.000     6.627653    6.633479
------------------------------------------------------------------------------

. lincom _cons,rr

 ( 1)  [MEInitial]_cons = 0

------------------------------------------------------------------------------
   MEInitial |        RRR   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |    757.911   1.126566  4460.79   0.000     755.7062    760.1223
------------------------------------------------------------------------------
```

Next, we will consider Medline + Embase + CINAHL.

Count	Medline(M)	Embase(E)	CINAHL(N)
882	1	0	0
1237	0	1	0
727	0	0	1
1347	1	1	0
14	0	1	1
51	1	0	1
193	1	1	1
?	0	0	0

Model	Deviance	d.f.
Constant + M + E + N	2068.0561	3
Constant + M + E + N + ME	231.2891	2
Constant + M + E + N + MN	1168.6122	2
Constant + M + E + N + EN	928.4812	2
Constant + M + E + N + ME + MN	**86.5882**	**1**
Constant + M + E + N + MN + EN	737.3265	1
Constant + M + E + N + ME + EN	167.0276	1
Constant + M + E + N + MEN	660.1382	1

The total number of articles is 4451. The models do not fit the data very well with this combination of databases. When using the bolded model above the coefficient of the constant is 11.07031 (std. error 0.0714464), which is a rate ratio of 64236 (95% CI: 55841 – 73891). As such, the Horizon estimate would be 4451 + 64236 (4451+55841 to 4451+73891) = 68687 (95% CI: 60292 – 78342). The addition of CINAHL has dramatically increased the Horizon estimate as compared to using Medline + Embase.

Raw STATA Output

```
. poisson CountMEN MInitial EIntitial NInitial MEini MNini [fw= CountMEN]

Iteration 0:   log likelihood = -24989.344
Iteration 1:   log likelihood = -20893.598
Iteration 2:   log likelihood = -20674.074
Iteration 3:   log likelihood = -20660.212
Iteration 4:   log likelihood = -20660.189
```

```
Iteration 5:   log likelihood = -20660.189

Poisson regression                                Number of obs   =       4451
                                                  LR chi2(5)      =  564290.34
                                                  Prob > chi2     =     0.0000
Log likelihood = -20660.189                       Pseudo R2       =     0.9318

------------------------------------------------------------------------------
    CountMEN |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    MInitial |  -4.292304   .0714554   -60.07   0.000    -4.432354   -4.152254
   EIntitial |  -3.949869   .0714418   -55.29   0.000    -4.089893   -3.809846
    NInitial |  -4.481387   .0714331   -62.74   0.000    -4.621393   -4.341381
       MEini |   4.379283   .0714546    61.29   0.000     4.239235    4.519332
       MNini |   2.445442   .0716116    34.15   0.000     2.305086    2.585798
       _cons |   11.07031   .0714464   154.95   0.000     10.93028    11.21035
------------------------------------------------------------------------------

. lincom _cons,rr

 ( 1)  [CountMEN]_cons = 0

------------------------------------------------------------------------------
    CountMEN |        RRR   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |   64235.64   4589.405   154.95   0.000     55841.98    73890.97
------------------------------------------------------------------------------
```

Finally, we will consider Medline + Embase + CINAHL + Cochrane.

Count	**Medline**	**Embase**	**CINAHL**	**Cochrane**
20	1	1	1	1
173	1	1	1	0
25	1	1	0	1
1322	1	1	0	0
0	1	0	1	1
51	1	0	1	0
3	1	0	0	1
879	1	0	0	0
0	0	1	1	1
14	0	1	1	0
1	0	1	0	1
1236	0	1	0	0
2	0	0	1	1
725	0	0	1	0
11	0	0	0	1
?	0	0	0	0

Model	**Deviance**	**d.f.**
Constant + M + E + N + C	2154.47	10

Constant + M + E + N + C + ME + MN	249.95	8
Constant + M + E + N + C + ME + MN + EN + MC + EC + NC	4.28	4
Constant + M + E + N + C + ME + MN + EN + MC + EC + NC + MEN	3.38	2
Constant + M + E + N + C + ME + MN + EN + MC + EC + NC + MEC	3.74	2
Constant + M + E + N + C + ME + MN + EN + MC + EC + NC + ENC	6.69	2
Constant + M + E + N + C + ME + MN + EN + MC + EC + NC + MEN + MEC	**1.13**	**1**

The total number of articles is 4462. When using the bolded model above the coefficient of the constant is 10.10139 (std. error 0.5122503), which is a rate ratio of 24377 (95% CI: 8931 – 66528). As such, the Horizon estimate would be 4462 + 24377 (4462+8931 to 4462+66528) = 28839 (95% CI: 13393 - 70990).

In conclusion the % capture of the Horizon was 4462 / 28839 = 15.47% of the Horizon retrieved by the initial search strategy.

Raw STATA Output

```
poisson InitialSearch M E N C ME MN EN MC EC NC MEN MEC [fw= InitialSearch]

Iteration 0:   log likelihood = -30240.795
Iteration 1:   log likelihood = -20026.956
Iteration 2:   log likelihood = -19302.809
Iteration 3:   log likelihood =   -19271.1
Iteration 4:   log likelihood = -19268.892
Iteration 5:   log likelihood = -19268.841
Iteration 6:   log likelihood = -19268.841

Poisson regression                                Number of obs   =       4462
                                                  LR chi2(12)     =  658801.38
                                                  Prob > chi2     =     0.0000
Log likelihood = -19268.841                       Pseudo R2       =     0.9447

------------------------------------------------------------------------------
InitialSea~h |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           M |  -3.322601   .5122515    -6.49   0.000    -4.326595   -2.318606
           E |   -2.98175   .5122509    -5.82   0.000    -3.985743   -1.977757
           N |  -3.515214   .5122484    -6.86   0.000    -4.519202   -2.511225
           C |   -7.70349   .5041189   -15.28   0.000    -8.691545   -6.715435
          ME |   3.389866   .5122538     6.62   0.000     2.385867    4.393865
          MN |   .6682546   .5126248     1.30   0.192    -.3364715    1.672981
          EN |  -.9653644   .5172051    -1.87   0.062    -1.979068    .0483389
          MC |   2.023318   .6043577     3.35   0.001     .8387983    3.207837
          EC |   .5841142   1.119766     0.52   0.602    -1.610588    2.778816
          NC |   1.810466   .0642961    28.16   0.000     1.684448    1.936484
         MEN |   1.778714   .5176764     3.44   0.001     .7640872    2.793341
         MEC |   1.128033   1.170381     0.96   0.335    -1.165871    3.421937
       _cons |   10.10139   .5122503    19.72   0.000     9.097393    11.10538
------------------------------------------------------------------------------
```

```
. lincom _cons,rr

 ( 1)  [InitialSearch]_cons = 0

------------------------------------------------------------------------------
InitialSea~h |        RRR   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |   24376.76      12487    19.72   0.000     8931.981    66527.96
------------------------------------------------------------------------------
```

C.2. Horizon Estimate of Full Text Review:

We will begin by looking at Medline + Embase.

Count	Medline	Embase
27	0	1
9	1	0
67	1	1
?	0	0

The total number of articles is 103. When fitting the additive model the deviance is 0 as expected and the coefficient of the constant is 1.288369 (std. error 0.1180686), which is a rate ratio of 4 (95% CI: 2 – 5). As such, the Horizon estimate at this stage would be 103 + 4 (103+2 to 103+5) = 107 (95% CI: 105 – 108).

Next, we will consider Medline + Embase + CINAHL.

Count	Medline	Embase	CINAHL
5	1	0	0
27	0	1	0
30	0	0	1
43	1	1	0
0	0	1	1
4	1	0	1
24	1	1	1
?	0	0	0

Model	Deviance	d.f.
Constant + M + E + N	99.23	3
Constant + M + E + N + ME	16.87	2
Constant + M + E + N + MN	229.37	2

Constant + M + E + N + EN	59.20	2
Constant + M + E + N + ME + EN	**15.07**	**1**
Constant + M + E + N + MN+ EN	180.00	1
Constant + M + E + N + ME + MN	NR*	
Constant + M + E + N + MEN	250.4214	1

*Could not be fit due to issues of collinearity.

The total number of articles is 133. When using the bolded model above the coefficient of the constant is 3.624341 (std. error 0.3218868), which is a rate ratio of 37 (95% CI: 20-70). As such, the Horizon estimate would be 133 + 37 (133+20 to 133+70) = 170 (95% CI: 153 - 203).

```
. poisson CountMEN1 M1 E1 N1 ME1 EN1 [fw= CountMEN1]

Iteration 0:   log likelihood = -347.33993
Iteration 1:   log likelihood = -344.04455
Iteration 2:   log likelihood = -344.02893
Iteration 3:   log likelihood = -344.02892

Poisson regression                                Number of obs   =        133
                                                  LR chi2(5)      =     553.81
                                                  Prob > chi2     =     0.0000
Log likelihood = -344.02892                       Pseudo R2       =     0.4459

------------------------------------------------------------------------------
   CountMEN1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          M1 |  -2.014903   .2522124    -7.99   0.000     -2.50923   -1.520575
          E1 |  -.3285037   .3240105    -1.01   0.311    -.9635527    .3065453
          N1 |  -.2231432   .3201562    -0.70   0.486    -.8506378    .4043514
         ME1 |   2.480266   .2559759     9.69   0.000     1.978562    2.981969
         EN1 |  -.3600031   .3236926    -1.11   0.266     -.994429    .2744228
       _cons |   3.624341   .3218868    11.26   0.000     2.993454    4.255227
------------------------------------------------------------------------------

. lincom _cons,rr

 ( 1)  [CountMEN1]_cons = 0

------------------------------------------------------------------------------
   CountMEN1 |        RRR   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |   37.49999   12.07075    11.26   0.000     19.95449    70.47282
------------------------------------------------------------------------------
```

Finally, we will consider Medline + Embase + CINAHL + Cochrane.

Count	Medline	Embase	CINAHL	Cochrane
1	1	1	1	1
23	1	1	1	0
1	1	1	0	1
42	1	1	0	0
0	1	0	1	1
4	1	0	1	0
0	1	0	0	1
5	1	0	0	0
0	0	1	1	1
0	0	1	1	0
0	0	1	0	1
27	0	1	0	0
1	0	0	1	1
29	0	0	1	0
0	0	0	0	1
?	0	0	0	0

Model	Deviance	d.f.
Constant + M + E + N + C	100.99	10
Constant + M + E + N + C + ME + EN	18.28	8
Constant + M + E + N + C + ME + EN + MC + NC	**16.78**	**6**
Constant + M + E + N + C + ME + EC + NC + EN	**16.99**	**6**
Constant + M + E + N + C + MN + NC + EC + EN	174.93	6

The total number of articles is 133 meaning that Cochrane did not uniquely contribute any new articles to Screen 1. When using either of the bolded models above the coefficient of the constant is 3.590439 (std. error 0.3220079), which is a rate ratio of 36 (95% CI: 19 - 69). As such, the Horizon estimate would be 133 + 36 (133+19 to 133+69) = 169 (95% CI: 152 - 202).

In conclusion the % capture of the Horizon was 133 / 169 = 78.70% of the Horizon retrieved by screen 1.

```
Raw STATA Output
poisson Screen1 M E N C ME EN NC MC [fw= Screen1]

Iteration 0:   log likelihood = -345.78954
Iteration 1:   log likelihood = -337.95616
```

```
Iteration 2:   log likelihood = -337.62943
Iteration 3:   log likelihood = -337.62673
Iteration 4:   log likelihood = -337.62673

Poisson regression                                Number of obs   =        133
                                                  LR chi2(8)      =     685.11
                                                  Prob > chi2     =     0.0000
Log likelihood = -337.62673                       Pseudo R2       =     0.5036

------------------------------------------------------------------------------
     Screen1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           M |  -1.981001   .2523669    -7.85   0.000    -2.475632   -1.486371
           E |  -.2946025   .3241308    -0.91   0.363    -.9298873    .3406823
           N |  -.2231436   .3201562    -0.70   0.486    -.8506382    .4043511
           C |  -3.969471   1.733103    -2.29   0.022    -7.366291   -.5726517
          ME |   2.422834    .256179     9.46   0.000     1.920733    2.924936
          EN |  -.3790319   .3239711    -1.17   0.242    -1.014003    .2559398
          NC |   .6021754   1.415082     0.43   0.670    -2.171334    3.375685
          MC |   .2318016   1.415302     0.16   0.870    -2.542139    3.005742
       _cons |   3.590439   .3220079    11.15   0.000     2.959316    4.221563
------------------------------------------------------------------------------

. lincom _cons,rr

 ( 1)  [Screen1]_cons = 0

------------------------------------------------------------------------------
     Screen1 |        RRR   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |      36.25   11.67278    11.15   0.000     19.28477    68.13992
------------------------------------------------------------------------------
```

C.3. Horizon Estimation for Final Inclusion:

We will begin by looking at Medline + Embase.

Count	**Medline**	**Embase**
4	**0**	**1**
3	**1**	**0**
26	**1**	**1**
?	**0**	**0**

The total number of articles is 33. When fitting the additive model the deviance is 0 as expected and the coefficient of the constant is -0.773 (std. error 0.418), which is a rate ratio of 0.46 (95% CI: 0 - 1). As such, the Horizon estimate at this stage would be 33 + 1 (33+0 to 33+1) = 34 (95% CI: 33 - 34). This estimation was not robust, however, because we know that there is a significant dependence between Medline and Embase but the interaction term was dropped in STATA due to collinearity.

Next, we will consider Medline + Embase + CINAHL.

Count	**Medline**	**Embase**	**CINAHL**

2	**1**	**0**	**0**
4	**0**	**1**	**0**
5	**0**	**0**	**1**
16	**1**	**1**	**0**
0	**0**	**1**	**1**
1	**1**	**0**	**1**
10	**1**	**1**	**1**
?	**0**	**0**	**0**

Model	Deviance	df
Constant+M+E+N+ME+MN+EN	*NR	3
Constant+M+E+N+ME+EN	**2.5**	**2**
Constant+M+E+N+ME+MN	*NR	2
Constant+M+E+N+ME	2.806191	1
Constant+M+E+N+EN	15.780597	1
Constant+M+E+N+MN	42.317426	1
Constant+M+E+N	21.911985	1

*Could not be fit due to issues with collinearity

Using the bolded model above, the total number of articles is 38. When fitting the model, the coefficient of the constant is 2.303 (std. error 1.135782), which is a rate ratio of 10 (95% CI: 1 - 93). As such, the Horizon estimate would be 38 + 10 (38 + 1 to 38 + 93) = 48 (95% CI: 39 - 131).

Raw Stata Output

```
poisson Final M E N ME EN [fw=Final]

Iteration 0:   log likelihood = -76.933049
Iteration 1:   log likelihood = -76.603971
Iteration 2:   log likelihood = -76.599396
Iteration 3:   log likelihood = -76.599387
Iteration 4:   log likelihood = -76.599387

Poisson regression                                Number of obs   =         38
                                                  LR chi2(5)      =     113.93
                                                  Prob > chi2     =     0.0000
Log likelihood = -76.599387                       Pseudo R2       =     0.4265

------------------------------------------------------------------------------
       Final |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           M |  -1.609438   1.019804    -1.58   0.115    -3.608217     .389341
           E |  -.9162907    1.16297    -0.79   0.431    -3.195671    1.363089
           N |  -.6931472   1.118034    -0.62   0.535    -2.884454    1.498159
          ME |   2.995732   1.051858     2.85   0.004     .9341275    5.057337
          EN |   .2231436   1.124236     0.20   0.843    -1.980318    2.426605
       _cons |   2.302585   1.135782     2.03   0.043     .0764939    4.528676
------------------------------------------------------------------------------

. lincom _cons, rr

 ( 1)  [Final]_cons = 0
```

```
------------------------------------------------------------------------------
       Final |        RRR   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |         10   11.35782     2.03   0.043     1.079496    92.63585
------------------------------------------------------------------------------
```

Finally, we will consider Medline + Embase + CINAHL + Cochrane.

Count	Medline	Embase	CINAHL	Cochrane
1	1	1	1	1
9	1	1	1	0
1	1	1	0	1
15	1	1	0	0
0	1	0	1	1
1	1	0	1	0
0	1	0	0	1
2	1	0	0	0
0	0	1	1	1
0	0	1	1	0
0	0	1	0	1
4	0	1	0	0
0	0	0	1	1
5	0	0	1	0
0	0	0	0	1
?	0	0	0	0

Model	Deviance	d.f
Constant+M+E+N+C	24.2883556	10
Constant+M+E+N+C+ME+EN+NC	4.4000048	7
Constant+M+E+N+C+ME+EN	4.9834401	8
Constant+**M+E+N+C+ME+EN+ENC**	**4.1333378**	**5**

Using the bolded model above, the total number of articles is 38 meaning that Cochrane did not uniquely contribute any new articles to Final inclusion. When using the best fit model, the coefficient of the constant is 2.302584 (std. error 1.135781), which is a rate ratio of 10 (95% CI: 1 - 93). As such, the Horizon estimate would be 38 + 10 (38 + 1 to 38 + 93) = 48 (95% CI: 39 - 131).

In conclusion the % capture of the Horizon was 38 / 48 = 79.17% of the Horizon retrieved.

Raw Stata Output

```
poisson Final M E N C EN ME ENC [fw= Final]

Iteration 0:   log likelihood = -73.763061
Iteration 1:   log likelihood = -73.270841
Iteration 2:   log likelihood = -73.265758
Iteration 3:   log likelihood = -73.265754

Poisson regression                                Number of obs   =         38
                                                  LR chi2(7)      =     124.90
                                                  Prob > chi2     =     0.0000
Log likelihood = -73.265754                       Pseudo R2       =     0.4602

------------------------------------------------------------------------------
       Final |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           M |  -1.609437   1.019803    -1.58   0.115    -3.608214    .3893411
           E |  -.9162895    1.16297    -0.79   0.431    -3.195668    1.363089
           N |  -.6931459   1.118033    -0.62   0.535    -2.884451    1.498159
           C |  -2.708049   1.002219    -2.70   0.007    -4.672362   -.7437355
          EN |   .1823203   1.125517     0.16   0.871    -2.023653    2.388293
          ME |   2.931193   1.052114     2.79   0.005     .8690876    4.993297
         ENC |   .5108256   1.420136     0.36   0.719    -2.272591    3.294242
       _cons |   2.302584   1.135781     2.03   0.043     .0764938    4.528674
------------------------------------------------------------------------------

. lincom _cons,rr

 ( 1)  [Final]_cons = 0

------------------------------------------------------------------------------
       Final |        RRR   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |   9.999988    11.3578     2.03   0.043     1.079495    92.63564
------------------------------------------------------------------------------
```

APPENDIX D: ANALYSIS OF ABSTRACTS NOT INCLUDED IN REVIEW

Abstract	Purpose	Study Design	Results
Budz, B., C. McConechy, et al. (2007). "Quality improvement initiative: clinical bedside rounds... Dynamics of Critical Care 2007, Regina, Saskatchewan, October 21-23, 2007." Dynamics 18(2): 11-12.	To increase the frequency of rounds from 3 to 7 days a week, and implement daily documentation and goals sheet.	Before-after case series	Significant difference in improving communication and keeping family informed of daily goals.
Butorac, L., C. Santiago, et al. (2010). "The development, implementation, and evaluation of a best-practice checklist for ICU rounds to improve team communication." Dynamics 21(2): 32-33.	To produce an evidence-based, unit-specific tool that can be easily used by interprofessional team during rounds,	Before-after case series	96% of clinicians thought checklist was an important mechanism to organize and document goal setting 81% thought checklist improved communication. 86% thought checklist was comprehensive and improved understanding of daily goals.
Daly, M., G. Benoit, et al. (2008). "The impact of a 24-hour, multidisciplinary rounding model in a surgical intensive care unit." Critical care nurse 28(2): e34-e34.	To design a model to improve daily goal planning and team cohesiveness while increasing satisfaction.	Before-after uncontrolled	Multidisciplinary rounding model improved patient and staff satisfaction from 60-70 percentile.
Hacon, J., D. Hutchins, et al. (2010).	To assess the value of the daily goals sheet in a general adult ICUand understanding of providers.	Before-after Uncontrolled	Overall understanding of goals by providers is better than what is recorded on goals sheet.

Hannich, H. J., M. Wendt, et al. (1985). "Rounds-conversation in an ICU. First results of an empiric study." 35(Web Page): 95-98.	To assess the degree in which patients receive information and emotional support through conversational analysis.	Ethnographic observations	Doctor to doctor conversation remains incomprehensible to patient. Nurse is not integrated into this conversation.
Hassan, Y., N. A. Aziz, et al. (1992). "An analysis of clinical pharmacist interventions in an intensive care unit." 17(Web Page): 347-351.	To analyze pharmacist interventions in ICU	Case Series	Most pharmacist interventions occurred during rounds (75.9%).
Hough, R., P. Shore, et al. (2009). Lippincott Williams and Wilkins. 37: A323.	To assess the effect of implementing bedside goal sheets on time to complete tasks.	Before-after Uncontrolled	After implementation of goal sheets, more goals were completed in less than 1 hour (NS) and fewer were completed in greater than 3 hours (NS).
Johnson, V., A. Mangram, et al. (2009). Is there a benefit to multidisciplinary rounds in an open trauma intensive care unit regarding ventilator-associated pneumonia? United States	To examine the effect of MDRs on ventilator-associated pneumonia in trauma patients in open ICUs	Before-after Uncontrolled	VAP rates decreased from 34.4 to 23.4 per thousand ventilator days (p=0.04).
Kalyanaraman, M., C. Aizley, et al. (2010).	To determine if nurse presentation of patients during rounds will improve the perception of the role of nurses in the PICU by physicians and nurses.	Before-after Uncontrolled	Nurses presentation of patients during rounds is well received by Residents, nurses and attendings.
Kloecker, K. M., N. Schindler, et al. (2009). Springer Verlag. 35: S111.	To evaluate the concentration and memory of physicians during rounds.	Ethnographic observations	Patients discussed at the beginning of the round had 69.77% of the information passed on in

			24h. Middle, 55.05%. End, 38.54%
Kuwamoto, R., J. Pamplin, et al. (2010). Lippincott Williams and Wilkins. 38: A29.	To determine if entering answers to daily checklist questions into a process improvement database can improve adherence to EBM	Before-after Uncontrolled	Increased compliance with oral care (40% to 81.25%
LaRochelle, J. M., M. Ghaly, et al. (2011). "Clinical pharmacy faculty interventions in a pediatric intensive care unit." Journal of Investigative Medicine. Conference: American Federation for Medical Research Southern Regional Meeting, AFMR 2011 New Orleans, LA United States. Conference Start: 20110217 Conference End: 20110219.Conference Publication: 59(2): 422-423.	To describe clinical pharmacy faculty interventions in a tertiary care pediatric ICU	Case Series	Pharmacists intervened an average of 13 times/day, or 5.3 interventions/patient.
Monaco, V. and J. Patel (2008). Supporting the work of rounding: an analysis of paper-based rounding templates from neonatal intensive care units. United States: 1060.	Discussed the use of different rounding templates.	Case Series	No results shown.
Pamplin, J., D. Allen, et al. (2010). Lippincott Williams and Wilkins. 38: A244.	To assess a daily goals Door communication care for improving goal alignment among members of	Before-after Uncontrolled	Goal alignment was overall low and did not improve after intervention.

	Multidisciplinary healthcare team		
Passos, R. H., D. Guimares, et al. (2009). BioMed Central Ltd. 13.	To assess the effectinesss of daily MDR in promoting compliance with prophylactic measures of VAP, DVT, and other complications.	Before-after Uncontrolled	Implementation of MDR facilitated all improvement with all measures. Decrease in central line duration, ventilator duration, and duration of ICU stay was noted.
Pierce, C., P. Shrof, et al. (2011). "Study of open andclosed ward rounds on a tertiary PICU/NICU." Pediatric Critical Care Medicine.Conference: 6th World Congress on Pediatric Critical Care: One World Sharing Knowledge Sydney, NSW Australia.Conference Start: 20110313 Conference End: 20110317.Conference Publication: 12(3 SUPPL. 1): A158.	To assess the impact of open (with family present) and closed rounds.	Case Series	No results shown.
Priest-Chenowith, C., K. Kitchen, et al. (2011). "Improve patient care by improving interdisciplinary communication." Pediatric Critical Care Medicine.Conference: 8th International Conference of the Pediatric Cardiac Intensive Care Society, PCICS 2010 Miami Beach, FL United States.Conference Start: 20101207 Conference End: 20101210.Conference Publication: 12(4 SUPPL. 1): S93-S94.	To assess the impact of a structured presentation format for nurses during rounds.	Before-after Uncontrolled	Direct involvement of nurses during rounds promotes an atmosphere of respect within team.

Rehder, K., T. Uhl, et al. (2009).	To assess goal agreement among providers at the conclusion of rounds, and interventions to improve communication.	Ethnographic observations	Interventions increased agreement of stated daily goals between attending physican and staff.Reduction in communication barriers attributed to more frequently obtaining nurse input, less frequently interrupting presentations, and less overall group disassociation.
Schuele, D., M. Hujcs, et al. (2008). "Improving RN satisfaction and team communication: The RN in daily rounds and implementation of a Daily Progress Note." Critical care nurse 28(2): e11-e11.	To assess an initiative to define RN role in rounds, generate a tool for RN reporting and improve RN satisfaction with team communication	Ethnographic observations	Overall increased RN satisfaction
Schumacher, E. and B. Liston (2011). "Multidisciplinary team rounding leads to increased patient satisfaction." Journal of Hospital Medicine.Conference: Hospital Medicine 2011, HM 2011 Grapevine, TX United States.Conference Start: 20110510 Conference End: 20110513.Conference Publication: 6(4 SUPPL. 2): S131.	To improve patient care through enhance interprofessional teamwork and communication by instituting a multidisciplinary rounding system on a large hospitalist nonteaching service at an academic center.	Before-after Uncontrolled	No results shown

Shafeeq, H., W. Vincent, et al. (2010).	To assess the improvement in adherence to clinical best practices through the use of a daily pharmacist-driven checklist.	Before-after Uncontrolled	Overall adherence to best practices increased from 82% to 87% ($p<0.002$)
Stafford, A. (2006). "Critical care nurse presentations during bedside rounds." Critical care nurse 26(2): S11-S11.	To assess an intervention to involve nurses in presenting patient information during rounds.	Before-after Uncontrolled	Improvement in accuracy of information discussed during morning rounds, better communication, empowerment of nurses to play a more active part in planning patient care.
Stein, J., M. Chesson, et al. (2011). "Combined effect of multidisciplinary bedside rounding and real-time visualization of prophylaxis status on hospital-acquired venous thromboembolism in a surgical intensive care unit." Journal of Hospital Medicine.Conference: Hospital Medicine 2011, HM 2011 Grapevine, TX United States.Conference Start: 20110510 Conference End: 20110513.Conference Publication: 6(4 SUPPL. 2): S75.	To examined the effect of MDR on hospital acquired venous thromboembolism.	Retrospective chart review	Decrease in the rate of HA-VTE from 5.84 to 3.10 per 1000 patient days. The rate of potentially preventable HA-VTE decreased from 2 to 0.52.
Swoboda, S., P. Lipsett, et al. (2010). Lippincott Williams and Wilkins. 38: A153.	To assess how provider perception of daily goals sheet may influence the perceived or actual utilization.	Retrospective chart review	95% of all HCW understood patient daily goals at the end of rounds. RN's were more likely to refer to the DGS at least once a day vs. prescribers (60% vs. 37%, $p=0.01$). Only 44% of RN's felt the

DGS was helpful in communicating goals of patient care with the ICU team vs. 73% of prescribers, p=0.01. Neither providers (27%) nor prescribers (42%) felt the tool useful in communication of goals to the primary surgical team, p=0.17.

APPENDIX D: ANALYSIS OF ABSTRACTS NOT INCLUDED IN REVIEW

Abstract	Purpose	Study Design	Results
Budz, B., C. McConechy, et al. (2007). "Quality improvement initiative: clinical bedside rounds... Dynamics of Critical Care 2007, Regina, Saskatchewan, October 21-23, 2007." Dynamics 18(2): 11-12.	To increase the frequency of rounds from 3 to 7 days a week, and implement daily documentation and goals sheet.	Before-after case series	Significant difference in improving communication and keeping family informed of daily goals.
Butorac, L., C. Santiago, et al. (2010). "The development, implementation, and evaluation of a best-practice checklist for ICU rounds to improve team communication." Dynamics 21(2): 32-33.	To produce an evidence-based, unit-specific tool that can be easily used by interprofessional team during rounds,	Before-after case series	96% of clinicians thought checklist was an important mechanism to organize and document goal setting 81% thought checklist improved communication. 86% thought checklist was comprehensive and improved understanding of daily goals.
Daly, M., G. Benoit, et al. (2008). "The impact of a 24-hour, multidisciplinary rounding model in a surgical intensive care unit." Critical care nurse 28(2): e34-e34.	To design a model to improve daily goal planning and team cohesiveness while increasing satisfaction.	Before-after uncontrolled	Multidisciplinary rounding model improved patient and staff satisfaction from 60-70 percentile.
Hacon, J., D. Hutchins, et al. (2010).	To assess the value of the daily goals sheet in a general adult ICUand understanding of providers.	Before-after Uncontrolled	Overall understanding of goals by providers is better than what is recorded on goals sheet.

Hannich, H. J., M. Wendt, et al. (1985). "Rounds-conversation in an ICU. First results of an empiric study." 35(Web Page): 95-98.	To assess the degree in which patients receive information and emotional support through conversational analysis.	Ethnographic observations	Doctor to doctor conversation remains incomprehensible to patient. Nurse is not integrated into this conversation.
Hassan, Y., N. A. Aziz, et al. (1992). "An analysis of clinical pharmacist interventions in an intensive care unit." 17(Web Page): 347-351.	To analyze pharmacist interventions in ICU	Case Series	Most pharmacist interventions occurred during rounds (75.9%).
Hough, R., P. Shore, et al. (2009). Lippincott Williams and Wilkins. 37: A323.	To assess the effect of implementing bedside goal sheets on time to complete tasks.	Before-after Uncontrolled	After implementation of goal sheets, more goals were completed in less than 1 hour (NS) and fewer were completed in greater than 3 hours (NS).
Johnson, V., A. Mangram, et al. (2009). Is there a benefit to multidisciplinary rounds in an open trauma intensive care unit regarding ventilator-associated pneumonia? United States	To examine the effect of MDRs on ventilator-associated pneumonia in trauma patients in open ICUs	Before-after Uncontrolled	VAP rates decreased from 34.4 to 23.4 per thousand ventilator days ($p=0.04$).
Kalyanaraman, M., C. Aizley, et al. (2010).	To determine if nurse presentation of patients during rounds will improve the perception of the role of nurses in the PICU by physicians and nurses.	Before-after Uncontrolled	Nurses presentation of patients during rounds is well received by Residents, nurses and attendings.
Kloecker, K. M., N. Schindler, et al. (2009). Springer Verlag. 35: S111.	To evaluate the concentration and memory of physicians during rounds.	Ethnographic observations	Patients discussed at the beginning of the round had 69.77% of the information passed on in

			24h. Middle, 55.05%. End, 38.54%
Kuwamoto, R., J. Pamplin, et al. (2010). Lippincott Williams and Wilkins. 38: A29.	To determine if entering answers to daily checklist questions into a process improvement database can improve adherence to EBM	Before-after Uncontrolled	Increased compliance with oral care (40% to 81.25%
LaRochelle, J. M., M. Ghaly, et al. (2011). "Clinical pharmacy faculty interventions in a pediatric intensive care unit." Journal of Investigative Medicine. Conference: American Federation for Medical Research Southern Regional Meeting, AFMR 2011 New Orleans, LA United States. Conference Start: 20110217 Conference End: 20110219.Conference Publication: 59(2): 422-423.	To describe clinical pharmacy faculty interventions in a tertiary care pediatric ICU	Case Series	Pharmacists intervened an average of 13 times/day, or 5.3 interventions/patient.
Monaco, V. and J. Patel (2008). Supporting the work of rounding: an analysis of paper-based rounding templates from neonatal intensive care units. United States: 1060.	Discussed the use of different rounding templates.	Case Series	No results shown.
Pamplin, J., D. Allen, et al. (2010). Lippincott Williams and Wilkins. 38: A244.	To assess a daily goals Door communication care for improving goal alignment among members of	Before-after Uncontrolled	Goal alignment was overall low and did not improve after intervention.

	Multidisciplinary healthcare team		
Passos, R. H., D. Guimares, et al. (2009). BioMed Central Ltd. 13.	To assess the effectinesss of daily MDR in promoting compliance with prophylactic measures of VAP, DVT, and other complications.	Before-after Uncontrolled	Implementation of MDR facilitated all improvement with all measures. Decrease in central line duration, ventilator duration, and duration of ICU stay was noted.
Pierce, C., P. Shrof, et al. (2011). "Study of open andclosed ward rounds on a tertiary PICU/NICU." Pediatric Critical Care Medicine.Conference: 6th World Congress on Pediatric Critical Care: One World Sharing Knowledge Sydney, NSW Australia.Conference Start: 20110313 Conference End: 20110317.Conference Publication: 12(3 SUPPL. 1): A158.	To assess the impact of open (with family present) and closed rounds.	Case Series	No results shown.
Priest-Chenowith, C., K. Kitchen, et al. (2011). "Improve patient care by improving interdisciplinary communication." Pediatric Critical Care Medicine.Conference: 8th International Conference of the Pediatric Cardiac Intensive Care Society, PCICS 2010 Miami Beach, FL United States.Conference Start: 20101207 Conference End: 20101210.Conference Publication: 12(4 SUPPL. 1): S93-S94.	To assess the impact of a structured presentation format for nurses during rounds.	Before-after Uncontrolled	Direct involvement of nurses during rounds promotes an atmosphere of respect within team.

Rehder, K., T. Uhl, et al. (2009).	To assess goal agreement among providers at the conclusion of rounds, and interventions to improve communication.	Ethnographic observations	Interventions increased agreement of stated daily goals between attending physican and staff.Reduction in communication barriers attributed to more frequently obtaining nurse input, less frequently interrupting presentations, and less overall group disassociation.
Schuele, D., M. Hujcs, et al. (2008). "Improving RN satisfaction and team communication: The RN in daily rounds and implementation of a Daily Progress Note." Critical care nurse 28(2): e11-e11.	To assess an initiative to define RN role in rounds, generate a tool for RN reporting and improve RN satisfaction with team communication	Ethnographic observations	Overall increased RN satisfaction
Schumacher, E. and B. Liston (2011). "Multidisciplinary team rounding leads to increased patient satisfaction." Journal of Hospital Medicine.Conference: Hospital Medicine 2011, HM 2011 Grapevine, TX United States.Conference Start: 20110510 Conference End: 20110513.Conference Publication: 6(4 SUPPL. 2): S131.	To improve patient care through enhance interprofessional teamwork and communication by instituting a multidisciplinary rounding system on a large hospitalist nonteaching service at an academic center.	Before-after Uncontrolled	No results shown

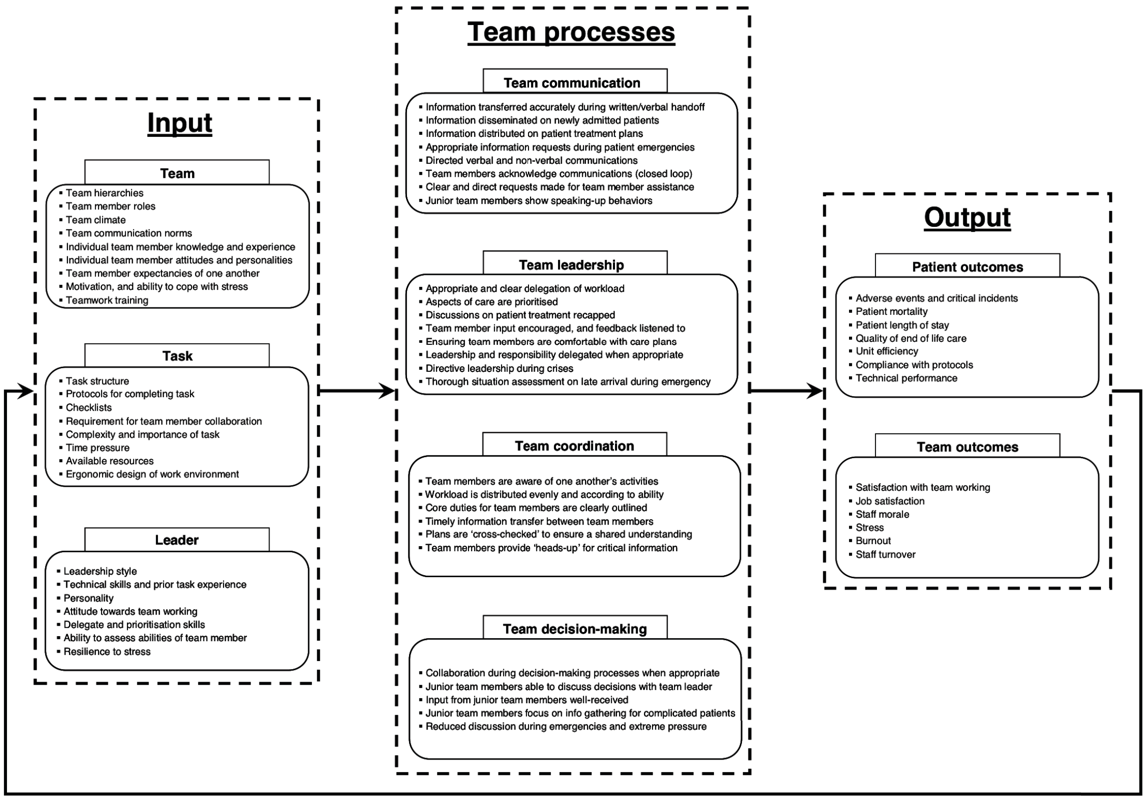
Shafeeq, H., W. Vincent, et al. (2010).	To assess the improvement in adherence to clinical best practices through the use of a daily pharmacist-driven checklist.	Before-after Uncontrolled	Overall adherence to best practices increased from 82% to 87% ($p<0.002$)
Stafford, A. (2006). "Critical care nurse presentations during bedside rounds." Critical care nurse 26(2): S11-S11.	To assess an intervention to involve nurses in presenting patient information during rounds.	Before-after Uncontrolled	Improvement in accuracy of information discussed during morning rounds, better communication, empowerment of nurses to play a more active part in planning patient care.
Stein, J., M. Chesson, et al. (2011). "Combined effect of multidisciplinary bedside rounding and real-time visualization of prophylaxis status on hospital-acquired venous thromboembolism in a surgical intensive care unit." Journal of Hospital Medicine.Conference: Hospital Medicine 2011, HM 2011 Grapevine, TX United States.Conference Start: 20110510 Conference End: 20110513.Conference Publication: 6(4 SUPPL. 2): S75.	To examined the effect of MDR on hospital acquired venous thromboembolism.	Retrospective chart review	Decrease in the rate of HA-VTE from 5.84 to 3.10 per 1000 patient days. The rate of potentially preventable HA-VTE decreased from 2 to 0.52.
Swoboda, S., P. Lipsett, et al. (2010). Lippincott Williams and Wilkins. 38: A153.	To assess how provider perception of daily goals sheet may influence the perceived or actual utilization.	Retrospective chart review	95% of all HCW understood patient daily goals at the end of rounds. RN's were more likely to refer to the DGS at least once a day vs. prescribers (60% vs. 37%, $p=0.01$). Only 44% of RN's felt the

DGS was helpful in communicating goals of patient care with the ICU team vs. 73% of prescribers, p=0.01. Neither providers (27%) nor prescribers (42%) felt the tool useful in communication of goals to the primary surgical team, p=0.17.

APPENDIX E: ALTERNATE MODELS CONSIDERED FOR THIS THESIS

E.1. Reader: Team Performance Model

Reader, T., Flin, R., Mearns, K., & Cuthbertson, B. (2009). Developing a team performance framework for the Intensive Care Unit. Critical Care Medicine, 35, 1789-1793.



E.2. Collins: EHR interdisciplinary information exchange of ICU common goals

Collins, S., Bakken, S., Vawdrey, D., Coiera, E., & Currie, L. (2011). Model fevelopment for EHR interdisciplinary information exchange of ICU common goals. International Journal of Informatics, 80, e141-e149.

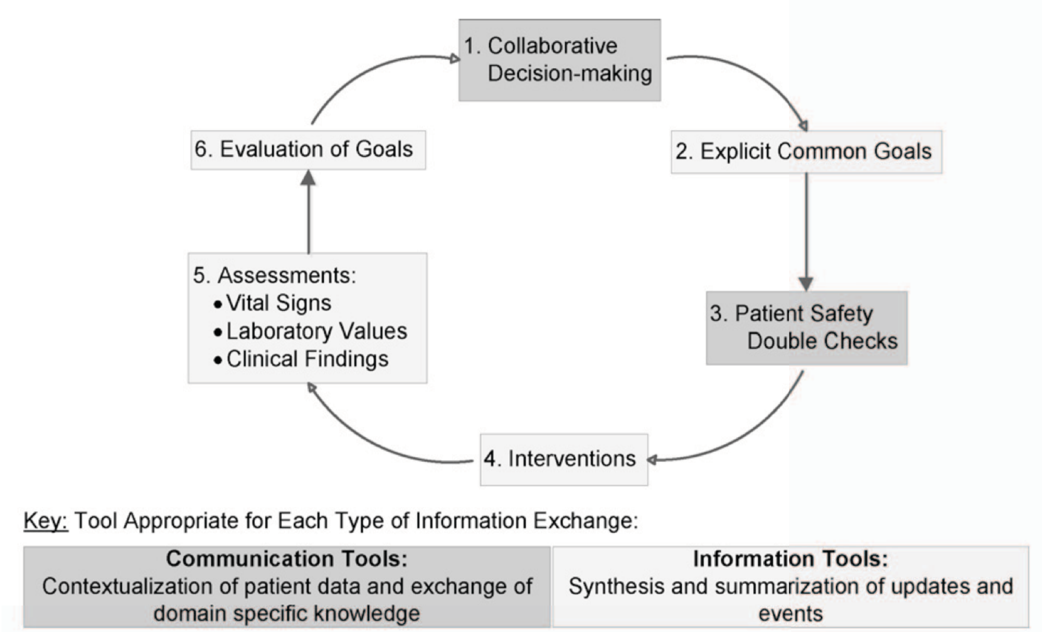


Fig. 2 – Model of EHR interdisciplinary information exchange of ICU common goals.

E.3. Dodek: Ideal Rounding Process Model

Dodek, P., & Rabound, J. (2003). Explicit approach to rounds in an ICU improves communication and satisfaction of providers. Intensive Care Medicine, 29, 1584-1588 (supplementary material).