Critical Thinking in Respiratory Care Practice: A Qualitative Research Study

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INTRODUCTION: Recent publications indicate that critical thinking should be an integral part of respiratory care education. However, we know very little about critical thinking in the context of respiratory care. The critical thinking abilities and decision-making characteristics of practicing respiratory therapists have not been studied. PURPOSE: Identify and describe the critical thinking skills and traits of respiratory therapists, using a qualitative, descriptive research methodology. METHODS: Critical thinking was defined as the combination of logical reasoning, problem-solving, and reflection. The sample was selected through nominations of experts, using reputational-case selection. The research involved observations of 18 registered respiratory therapists, followed by in-depth interviews. Data were collected over a 1-year period and there were 125 hours of observation and 36 hours of interview. The observations were the basis for identifying and describing context-bound situations that require critical thinking, as well as the essential skills and related traits. RESULTS: The data set consists of over 600 single-spaced pages of interview transcripts and participant-observation field notes, in addition to 36 audio tapes. Field notes and interview transcripts were continuously analyzed throughout the study, using the constant-comparative method described by Glaser and Strauss. CONCLUSIONS: The findings suggest that critical thinking in respiratory care practice involves the abilities to prioritize, anticipate, troubleshoot, communicate, negotiate, reflect, and make decisions. *Key words: critical thinking, respiratory care.* [Respir Care 2003;48(5):500–516. © 2003 Daedalus Enterprises]

Introduction

Current medical literature emphasizes the importance of critical thinking, because processing information and making decisions are at the center of clinical practice.[1–5] It is imperative that practitioners master the thinking and reasoning skills needed to process and use information, to function effectively in today's complex health care delivery systems. Clinicians not only need a broad knowledge base, they must also have critical thinking that incorporates logical reasoning, problem-solving, judgment, decision-making, scientific reasoning, reflection, and lifelong learning. Recently, medicine,[1,6–8] nursing,[9] and allied health professions[10–12] have given attention to fostering critical thinking in an effort to improve clinical judgment and decision-making.

The respiratory therapist applies scientific knowledge, technical expertise, and theory to practical clinical problems, and is often required to exercise clinical judgment. There is strong emphasis on preparing respiratory therapist trainees with critical thinking skills; this is evident in the outcome-oriented essentials for accreditation of respiratory therapist education programs[13] and the credentialing examinations for the RRT (registered respiratory therapist). The need for critical thinking skills is further evidenced in American Association for Respiratory Care documents,[14–18] such as the proceedings of the Educational Consensus Conferences.[16,17] These pertinent sources identify critical thinking as an essential ability and call for

education strategies that enhance critical and analytical thinking.[14–18]

Continued health care reform and restructuring place additional emphasis on the need for respiratory therapists with developed critical thinking skills, who can make independent judgments and take decisive action.[19–21]

Without knowing what critical thinking looks like in professional work, it is difficult to provide professional and continuing education that can foster critical thinking that can transfer to practice. The majority of critical thinking studies have been conducted in colleges and universities, with a focus on the intellectual aspects and performance in academic domains, but we know very little about how these findings relate to practical settings on the job.

The purpose of this study was to identify and describe the critical thinking skills and traits of experienced RRTs. Critical thinking was defined as a combination of logical reasoning, problem-solving, and reflection. The study asked:

1. What are the situations that require critical thinking?
2. How are critical thinking skills used?
3. What are the traits of critical thinking?

Methods

Study Design

Qualitative methodology was chosen because the purpose was to investigate the particular phenomenon of critical thinking in the context of the respiratory care health profession.[22] The focus of qualitative research is to identify, describe, discover, understand, or gain insight into the features and characteristics of a particular phenomenon.[23–25] The purpose of research questions, which ask *how* and *why*, require inductive inquiry, because the focus is on *process*, as opposed to *product*.[23,26] Qualitative studies emphasize trying to understand how people make sense of something, so they are ideal for building theory from the bottom up, rather than testing theory.[26] In addition, qualitative methodology is best for considering context.[27,28] One major assumption was that findings from studies of critical thinking in academic settings do not necessarily transfer to the context of actual practice.

Sample

Nonprobability purposeful sampling was used to select a sample from which the most could be learned.[23,29,30] Purposive sampling is similar to criterion-based sampling and requires the establishment of specific criteria, bases, or units for sample selection.[31] Clinical competence, clinical decision-making, critical thinking, and expertise evolve with years of experience and types of experiences.[32–34] Therefore participants in this study were recognized experts who met the following sample criteria: earned the RRT credential; worked full-time in intensive care units (ICU); had at least 5 years of clinical experience; and earned either an associate or baccalaureate degree.

The sample was selected through nominations of 65 experts, using reputational-case selection, in which "instances are chosen on the recommendation of experienced experts in an area."[31(p82)] Letters requesting nominations of therapists meeting the sample criteria were mailed to 30 respiratory care directors, assistant directors, educational directors, and critical care coordinators at hospitals throughout a southeastern state. The individuals who gave nominations were instructed to maintain the integrity of the study by withholding all information from their staff.

RRTs work in a variety of settings, with various duties. The context in which the individual works may impact the degree to which critical thinking skills are necessary and the level of clinical decision-making required. Therefore, participants were selected from a variety of clinical settings, with various numbers of beds, scope of practice, and levels or types of responsibilities. Participants were selected if they worked in any type of ICU in a hospital that had at least 250 beds and a 24-hour full-service respiratory care department, on the assumption that practice in that type of setting incorporated the majority of responsibilities and duties performed by advanced respiratory therapists. It was also assumed that critical thinking skills would be more evident when the RRTs were caring for the sickest patients requiring intensive care. In addition, it was thought that gender might affect critical thinking in respiratory care practice. The respiratory care profession has approximately equal numbers of men and women, and participants were selected to achieve approximately equal numbers of men and women.

Data Collection

In qualitative studies the researcher is the primary instrument for data collection and analysis. The world view and persuasive strategies of qualitative research are such that the qualitative researcher must provide "thick description," in enough detail to show that the conclusions make sense.[23,35] The strengths of qualitative inquiry include (1) the concrete description of detail, (2) the portrayal of process in the active mode, and (3) attention to the perspectives of those studied.[30] The qualitative investigator "must have an enormous tolerance for ambiguity, must be a good communicator, and must be highly sensitive to the context, to the data, and to personal bias,"[23(p52)] so qualitative methodology is not suitable for every researcher.[26,28]

Informed consent was obtained from each participant prior to data collection. The research consisted primarily of observations of 18 RRTs working in intensive care, followed by in-depth 1–2 hour interviews[23,30,36] conducted

to clarify information, ask additional questions, and validate the findings. Participants were observed practicing respiratory care in 25 intensive care units at 8 hospitals. The data were collected over a period of 1 year, with 125 hours of observation and 36 hours of interviews.

Observations allowed firsthand witnessing of when and how critical thinking skills emerge in practice and relate to the respiratory therapist's work. The observations and interviews involved specific questions formulated to determine when, how, and why critical thinking is used in respiratory care practice. When possible, questioning took place during the observations, but the interviews were necessary to probe deeper. For 2 reasons the observations were conducted prior to the interviews. First, research effects on the participants' behavior might have been greater if the interviews preceded the observations. Second, conducting the interviews after the observations provided the opportunity to ask questions about observed incidents and critical incidents. Previously collected data were analyzed prior to subsequent data collection, to build on field notes and interviews.[26]

The successful outcome of a participant observation study relies on detailed, accurate, and extensive field notes.[23,26] Therefore, field notes were written in detail as soon as possible after the observations and before talking to anyone else about the observations. Field notes from observations were recorded on a standardized form that included: participant's code name; date, time, and place; type of critical care unit; description of the setting, names of individuals with whom the RRT interacted; RRT activities and quotations; and observer's comments.

During the field work the researcher, who is also an RRT, maintained the role of "observer as participant,"[23] though there was no direct participation in the delivery of respiratory care. Ideally, the researcher is a neutral figure who does not affect the situation or the data,[37] but in actuality that is usually not possible. Whenever the investigator's presence is known, he or she has some effect on the phenomenon under investigation,[38] but the extent to which an investigator actually changes the situation studied is not clear.[23] To minimize the researcher's effect on the phenomenon under investigation, the participants were not informed of specific details of the study.

An observation and interview guide (Appendix) was used to gather comparable data at each site.[26] "Interviewing is necessary when we cannot observe behavior, feelings, or how people interpret the world around them."[23(p72)] Although it is possible to observe critical thinking through behavior in practice, to understand what is going on inside another person's mind requires honest communication.[23,30]

The interviews provided the opportunity to ask specific questions about incidents observed earlier, to either confirm or challenge if and how critical thinking was required. The interview guide (Appendix) indicated the general or-

der and types of questions. A semi-structured interview format with predetermined but open-ended questions allowed enough flexibility so that data could be collected on unexpected dimensions of the topic.[26] All interviews were recorded using a small, unobtrusive pocket-size recorder. Each participant was assured of the confidentiality of his or her responses and the security of the tapes and transcripts.

Additional questions were asked to determine how the therapists organize their work, what types of clinical decisions they make, what they do when they are unclear or in disagreement with a medical order, how they respond to emergencies, and how they would respond to several hypothetical scenarios or critical incidents. Focusing on critical incidents is useful to obtain information, explanations, and reactions.[30] The critical incidents were examined to confirm findings from the observations and further address the research questions.

Data Analysis

The data set consists of over 600 single-spaced pages of interview transcripts and participant-observation field notes, in addition to 36 audio tapes. All tapes were transcribed verbatim from the in-depth interviews, for data analysis. Each audio tape was reviewed at least twice, and the transcripts were reviewed numerous times. The constant comparative approach described by Glaser and Strauss[39,40] was used, whereby data were continuously collected, coded, and analyzed. Data analysis began with the initial interviews and observations and continued throughout the duration of the study. Observation sessions were planned to build on previous observations, interviews, transcripts, and field notes. Data collection and analysis occurred simultaneously throughout all phases of the research.

Other Strategies to Ensure Validity and Reliability

Methodological triangulation was used as a means to increase internal validity and reliability of the data.[23,30,41] All qualitative data (interviews, questionnaires, observation, performance records, and physical evidence) are potentially biased and have specific threats to validity. Employing multiple methods improves the likelihood that the findings can survive confrontation.[42]

Member checks, peer consultation, audit trails, journal writing, and reflections on the researchers' subjectivity were also incorporated. Member checks were conducted during the latter phases of the data collection, to ask participants if emerging themes and categories accurately reflected the findings, and to guard against misinterpretation or misrepresentation of the information gathered.[23,38] Peers, experts, and others were consulted to comment on the findings as they emerged, to provide opportunities while

the study was in progress to raise concerns and questions, to verify understanding, and to talk through problems.[23,43] Adult education and respiratory therapy faculty at 2 research universities helped to validate the findings, provide better examples to support the findings, and review additional data to answer questions and concerns.

The researcher kept a journal and an audit trail to help achieve a plausible account of the investigation.[23,36] The journal helped to identify researcher biases before, during, and after the study and to report on how subjectivity may have affected various aspects.[44] The audit trail made it possible to examine the study's procedures to verify credibility from the detailed account of the entire research process, which included raw notes, edited notes, records of research meetings, data documents, guidelines used to analyze the data, decision rules to categorize data, interview guides, and complete documents.[43] The audit trail may be the single most important technique for trustworthiness,[45] because it deliberately organizes the evidence so that someone external to the study can review the data and processes to form an independent opinion on the credibility and consistency of the results.

Results

Participants and Research Settings

The 18 RRT participants worked full time and had earned either an associate or baccalaureate degree. Half of them had ≥ 10 years of experience and 3 participants had ≥ 15 years of experience. Their ages ranged from 27 to 49 years. The RRTs worked in 25 ICUs at 8 different hospitals in a southeastern state. Table 1 describes the research settings. Table 2 describes the participants, who are designated with 2-letter codes, to protect confidentiality.

Situations That Required Critical Thinking

There were numerous situations observed in respiratory care practice that initiated or required critical thinking (Table 3). Situations requiring critical thinking involved technology, patients, and other health professionals. Many situations involved technical problems such as equipment malfunction, using new equipment, alarms, and equipment shortages. Critical thinking was also required when therapists selected, gathered, or recommended equipment or interacted with nurses, physicians, or other therapists. Critical thinking was often required when the RRTs shared information, participated in decision-making, or made recommendations regarding patient care.

Many situations were observed in which the RRTs were able to perform their work with spontaneous, routine actions, and in these situations critical thinking was not required; rather, respiratory care was delivered without substantial critical deliberation. This occurred when the clinical situations fell within the boundaries of what the therapists have learned to treat as normal and the intended outcomes were achieved. Examples of situations when critical thinking was not required included: oxygen therapy or postoperative mechanical ventilation when there were no complications or problems; treatment of mild to moderate hypoxemia; mechanical ventilation of patients with disease states that do not involve problems such as air trapping, mucus plugging, pulmonary edema, high airway resistance, and/or decreased lung compliance; treatment of bronchospasm responsive to aerosol therapy; and routine suctioning to maintain a patent airway.

There were also situations when breakdowns, malfunctions, and unpredicted events occurred with equipment and supplies and the therapists used critical thinking to address technological problems. Likewise, when there was a rare clinical event, an unexpected patient response, complications, a rare disease, or a recommendation for a novel approach to care, then critical thinking was essential. A surprise or an unexpected outcome often initiated or required critical thinking in practice. In those situations the therapists used critical thinking to frame the problem, figure out what happened, restructure strategies of action, and derive solutions. In the process, the therapists explored their underlying understandings, assumptions, and actions.

Essential Skills for Critical Thinking

The findings suggest that critical thinking in respiratory care practice involves the abilities to:

1. Prioritize the expected and the unexpected
2. Anticipate problems and solutions
3. Troubleshoot technical problems
4. Communicate according to the therapists' styles and the demands of the situation
5. Negotiate responsibilities and medical orders for patient care
6. Make individual, shared, and consultative decisions
7. Reflect on the patients, the decisions, and the profession

Personality traits and the organizational context also affected critical thinking in respiratory care practice, but these additional findings are beyond scope of this report.

Prioritizing. Prioritizing is the ability to arrange scheduled work, which is expected, and to respond to evolving circumstances, which are unexpected, according to their importance. Critical thinking in practice allows the therapist to plan and perform work in an optimal order and to make rapid adjustments in the initial plan according to the demands of the situation. The therapists had various styles for organizing work load, and all of them were able to demonstrate and articulate their plans, the reasons they did

Table 1. Research Settings

Hospital	Type	Approximate Number of Beds	Staff Size	Scope of Practice	Climate of Department	Medical Director Support	Role Delineation	Participant's Designation
1	Public	650	22 RRTs, 23 CRTs	Adequate	Status quo	Little support	No	AA AB AC AD
2	Private	400	23 RRTs, 20 CRTs	Adequate	Current/satisfactory	Good support	No	BE BF
3	Teaching	500	27 RRTs, 39 CRTs	Wide variations	Current/satisfactory with pockets of progressive care	Inconsistent support	Minimum	CG CH
4	Teaching	500	32 RRTs, 17 CRTs	Extensive and liberal	Progressive	Very strong support	Yes, distinct and separate	DI DJ
5	Teaching	400	32 RRTs, 21 CRTs	Extensive and liberal	Strong department administration, progressive	Excellent support	Yes, distinct and separate	EK EL
6	Private	300	60 RRTs, 10 CRTs	Average and adequate	Above average administration with pockets of progressive care	Minimum support	Yes, distinct and separate	FM FN
7	Teaching	500	34 RRTs, 36 CRTs	Adequate	Current/satisfactory with pockets of progressive care	Minimum support	Yes, distinct and separate	GO GP
8	Private with residency training programs	300	8 RRTs, 7 CRTs	Wide variations	Current/satisfactory with pockets of progressive care	Minimum support	Yes, distinct and separate	HQ HR

RRT = registered respiratory therapist
CRT = certified respiratory therapist

their work in a particular order, and why they had to be able to make quick adjustments. Prioritizing required the therapists to make decisions or judgments and to act quickly in emergencies, which they described as being "responsive," "quick on your feet," and "able to respond to emergencies." Prioritizing the expected work can be described as organized thinking, whereas prioritizing the unexpected problems and emergencies can be described as rapid thinking.

The participants would begin prioritizing their scheduled work during shift report, by deciding which patients were the most critical and whom they would therefore see first. For example, therapist BF said, "How am I going to organize my work load? I listen closely during report and am familiar with my patients so that I already know the ones who are most critical. Then I go first to the patients that I know are the most critical."

Most of the RRTs began their shifts by taking a quick tour of the assigned patients and then a brief look at the charts, mainly to check orders. The unstable patients were the first priority. Patients on mechanical ventilation were a higher priority than patients who were able to breathe on their own. After initial assessment, checking, and charting involving care of ventilator-dependent patients, the RRTs performed more routine tasks. Then they took a more indepth look at the chart, lab data, chest radiographs, and other clinical information.

The RRTs were often faced with conflicting demands and emergencies that required them to make a quick judgment and act in the order of importance. There were many instances when an observed RRT was being called simultaneously by nurses, other respiratory therapists, and/or physicians, and they had to prioritize to decide in what order to respond. The RRT would have to judge, within seconds, which situation demanded immediate attention. Many, including BE, considered prioritizing to be the most important skill in their work

BE: "Just the biggest thing to me is setting your priorities in the order of what is most needed and what is

Table 2. Research Participants

Hospital Participant's Designation	Age	Gender	Degree	Years of Experience	Intensive Care Settings
Hospital 1					
AA	29	F	BS	8	Coronary care unit
AB	39	F	BS	8	Medical surgical unit
AC	37	F	BS	10	Neonatal unit, labor and delivery
AD	32	F	AS	10	Adult units
Hospital 2					
BE	33	F	BS	9	Burn unit
BF	36	F	BS	13	Medical surgical unit
Hospital 3					
CG	37	M	BS	10	Neonatal unit, labor and delivery, ECMO team
CH	31	M	BS	6	Adult units
Hospital 4					
DI	34	F	AS	7	Medical and pediatric units
DJ	35	M	AS	10	Open heart recovery
Hospital 5					
EK	28	M	BS	8	Medical unit
EL	37	F	BS	18	Neonatal unit
Hospital 6					
FM	34	F	AS	15	Open heart recovery and coronary care unit
FN	27	F	AS	5	Open heart and coronary care units
Hospital 7					
GO	32	M	AS	10	Progressive care unit
GP	49	M	AS	5	Adult units
Hospital 8					
HQ	28	M	BS	8	Neonatal unit, emergency room, labor and delivery
HR	33	M	BS	16	Neonatal and medical units, labor and delivery

BSc = bachelor of science degree
AS = associates degree
ECMO = extracorporeal membrane oxygenation

secondary. You have to be able to think on your feet and act quickly in an emergency."

The ability to prioritize was most critical in situations where the RRT's role was clearly delineated and he or she carried an important responsibility for airway and ventilator management. Here is how one RRT describes the relationship between his role in patient care and the ability to prioritize.

DJ: "It seems the therapists who don't make it here are the ones who just can't prioritize. They can be very smart and have good [clinical] skills, but if they can't prioritize, they won't last [working here]."

Assessing and maintaining the airway was by far the most important priority, especially in the neonatal intensive care unit (NICU). Expert RRTs know that if there is any question about the airway, they must take quick and decisive action. When HR was asked about his first priority, he said, "Airway, airway, airway." During a high-risk delivery CG further elaborated on the airway as the first priority. When HQ was asked if all therapists would consider the airway as their first priority, he said that, "you'd be surprised by the number of therapists and even physicians who should know better, but get distracted or swayed during emergencies and cannot prioritize."

Anticipating. Anticipating is another critical thinking skill that is important in respiratory care practice. Anticipating involves the ability to foresee or think ahead so that RTs can avoid problems or find solutions earlier. Anticipating can be described as future thinking. Respiratory therapists not only prioritize their work, they also think into the future and try to be one step ahead to prevent problems and come up with solutions. Anticipating differs

Table 3.   Situations in Respiratory Care Practice in Which Critical Thinking Is Essential

Technology
   Equipment malfunction
   Shortages of equipment
   Selecting and gathering equipment/supplies
   Equipment not easily located
   Evaluating, using, and troubleshooting new technology
   Alarms activated
   Recommending technology/therapy
   Modifying equipment for novel care
   Equipment not set up or available when needed in an emergency
Patients
   Rare diseases
   Emergencies (eg, cardiac arrest, respiratory failure, inadvertent extubation, emergency intubation, patient transports and admissions)
   Novel approaches to respiratory care
   Neonatal delivery and transports
   Patient assessment
   Coaching, reassuring, and instructing patients
   Modification of respiratory care
   Unexpected response to respiratory care
   Problems with patient management (eg, patient fighting the ventilator, patient not adequately oxygenated and/or ventilated)
   Multiple patient problems or situations demanding the therapist's time simultaneously
   Responding to patient's questions and reactions
   Mistakes or problems with patient care
Other Clinicians
   Questions from nurses, physicians, or clinicians
   Medical order not coinciding with patient care or with proposed care plan
   Making suggestions and recommendations
   Conflicting requests/demands from other clinicians
   Unclear or inappropriate medical order
   Another clinician's behavior threatening the patient
   Multiple persons talking to or asking for the respiratory therapist at the same time
   Asking questions
   Sharing in decision-making

from prioritizing when the emphasis is on planning routine work or responding quickly to a problem. The intent of anticipating is to avoid a problem in the first place.

The importance of anticipating is evident in a comment by GO, who usually works in adult critical care; he explains why he no longer likes to work in NICU.

GO: "I don't particularly like [the NICU]. I don't work there regularly. It's just been too many years. I might be pulled in there maybe once every 3 months and I just don't feel comfortable enough. I can do it. I can go through the motions, but I just think they [the babies] deserve better than that."

SM [researcher]: "What is different from going through the motions?"

GO: "Well, understanding what is happening. Like when a baby is going down. Recognizing it ahead of time, seeing the signs early. I wouldn't see those."

Anticipating problems and solutions depends on the therapists' ability to continuously and holistically assess their patients, which was described as being able to "see the big picture," "sense impending doom," "pick up on subtle changes," and "predict what will happen." To anticipate problems and solutions the RRTs must continuously assess their patients. Patient assessment is critical to effective respiratory care practice. The following comment illustrates how these experts were able to compare and contrast their practice with others, and also describes holistic assessment of the patient in order to anticipate problems.

BE: "There are just a lot of therapists who don't see their patient as a whole and just check the ventilator, suction them, and leave. . . but I think a good therapist should know the patient as a whole. . . . You're aware of the things around you and look to see if you can head off a problem before it gets there."

The RRTs did not have a "wait and see" approach to their work; rather they continuously and holistically assess their patients, the data, the equipment, and the situation to prevent problems and come up with solutions. As one participant described it, these therapists were "able to look down the road and see the long view." HQ succinctly described the importance of anticipation when he said, "If I'm prepared for the worst, then I'm prepared for anything!" After making some change in respiratory care, the therapists anticipated the desirable patient response. As BF stated, "You have to be able to foresee [that] *this* [action] is going to have *this* effect, whereas if I do *this* it will have *this* effect." By mentally comparing the patient's response to an expected response the therapists could prevent problems from occurring.

Anticipating was also used whenever the therapists were facing a new situation, such as expecting a transfer patient from the emergency department, the operating room, or somewhere else in the hospital. The therapists anticipated what equipment they needed and also what they would probably need to do when the patient arrived. There were many instances when they anticipated the need for additional ventilators or equipment and made sure that working equipment was available. It was common to see the RRTs take inventory and restock equipment and supplies, not only for the duration of their shift, but for the next shift.

Anticipation was also used to prepare what they intended to discuss with physicians when the physicians made rounds or came to the units to see their patients. AA described how she anticipates what she will discuss with physicians: "I check my patients early, first thing in the

morning, before the doctors get here, so that way I'm ready with my suggestions and questions."

Troubleshooting. Respiratory care is a highly technical profession, so it is not surprising to find that critical thinking in practice involves troubleshooting. Troubleshooting can be described as technical thinking and refers to the ability to locate and correct technical problems. The study participants were able to introduce new technology, modify equipment for novel care, and correct equipment malfunctions or breakdowns in the process of delivering respiratory care.

When there were shortages of equipment, or the equipment did not work properly, or the equipment could not be located quickly, it could become an emergency that could evoke panic. You can sense the urgency and seriousness of this type of problem in a comment by EL, who describes the situation when a newborn baby comes to the hospital through the emergency department and equipment is hard to locate.

EL: "I think some of the scariest problems are when we get called to the emergency department and the mother delivered in an ambulance or delivers when you get down there, because you have nothing to work with. . . . It's just those unplanned things where you don't have equipment that you need right at hand . . . [and] everybody is in the way. It's a free-for-all: very chaotic. They've got this airway thing down there that is useless because no one really knows how to use it. I mean, you have to put too much thought into it."

The "airway thing" that EL refers to is a fold-out kit that is arranged by sections, based on the baby's size, and contains practically everything that could be needed in an emergency. The problem with the kit is that there are so many equipment pieces and supplies in each section that it is very difficult to quickly find what is needed in an emergency and things tend to get scattered. EL tried to have the kit eliminated, but when her requests were repeatedly denied, she solved the problem by "hiding her airway box" in the emergency department. She said, "you have to do what you have to do." This comment demonstrates how a therapist solved a technical problem and a process problem by going around the system, which illustrates a common behavior of keeping back-up equipment in a special location.

Others rely on the RRT's technical expertise and expect them to respond to alarms and technology problems. CG and his supervisor in the NICU captured the essence of the respiratory therapist's technical expertise when they agreed that "you gain a lot of respect from the nurses and physicians by knowing your equipment and being able to explain it." Sometimes nurses would incorrectly assume that there was a problem with the respiratory care technology and would call for the respiratory therapist to troubleshoot

the equipment. The following comment illustrates how AA handled a simple problem with an oxygen flow meter.

AA: "So the nurse tried to turn on the flow meter, but [there was] no flow. It was leaking. . . . Engineering came and checked the quick-connect, [but there was] nothing wrong with [it]. [So they] call respiratory. . . and I look at it. The little "Christmas tree" [wing tip adapter] is just not screwed on tight [laughs] . . . and when I find something silly like that, I always let the nurse know."

The RRT was amused that neither the nurse nor the engineer was able to solve such a simple problem. The comment illustrates how solving even simple problems presupposes that individuals understand the logic of the discipline. A problem that an experienced respiratory therapist finds easy to solve may pose a challenge to a novice or another clinician. Likewise, a problem that is easy for the nurse to solve may be unsolvable for the therapist.

Communicating. Critical thinking in practice requires the respiratory therapist to gather and give information through verbal and nonverbal communication with nurses, physicians, patients, patients' families, other respiratory therapists, and other clinicians. Gathering appropriate and sufficient information to analyze, evaluate, and make judgments in clinical practice depends on effective communication. Effective communication is also dependent on working relationships with others. Therefore it is not surprising that critical thinking in actual practice not only involves communication skills; it is also affected by personality traits.

Communicating in respiratory care practice is practitioner-specific and situation-specific. There is a tremendous amount of skill involved in knowing what to say, how to say it, and when to say it in each specific situation. Every therapist communicated in a way that was consistent with the therapist's personality and the situation. Approximately 75% of the participants have outgoing, extroverted personalities. Only one RRT seemed to lack assertiveness, which decreased her effectiveness. Critical thinking in practice was very dependent on communication skills. GP said, "You get more information from communicating with your co-workers than if you look in a book or study. Every patient reacts differently. That's the best way in reality to get information." FN said, "I think communication is number one!" Here is how AD responded to my questioning when I asked her what skill she considered most important when a problem arises.

AD: "Communication. When something goes wrong with the baby and there is a problem, you have to know how to communicate. . . . By far, communication is most important."

DI expressed a similar viewpoint. She described her role in patient care and ventilator management.

DI: "Probably the most important skill I learned was communicating with doctors, because I never felt like they cared about my opinions before [working here]. You know, they [the physicians] never expected anything of me [before], whereas therapists here are asked a lot of questions. . . about the ventilators and respiratory and blood gases and the way we do things."

Every RRT participant in this study said that it was important that you "know your doctors." During the observations it was evident that the therapists had different ways of communicating with different doctors. With some physicians there were lengthy discussions, joking, teasing, and socializing. In many instances the therapists and physicians interacted on a first-name basis. With other physicians there were brief, specific, and serious communication. It seemed that the therapists would modify communication depending on the way a doctor responded at a particular time. For example, during my observations in NICU, CG said, "The secret to working here is to try to think like the doctors do. If you're in stride with their thinking, then you will do well."

The frequency and length of communication with physicians was greatest in NICUs and in other ICUs in which therapists had major responsibilities.

There was a great degree of mutual respect observed in the communication between nurses and respiratory therapists. During all of the observations there was only one instance, involving one nurse, in which communication seemed ineffective and with some amount of conflict. The respiratory therapists and nurses continuously shared information about the patients, asked one another questions, worked together, and expressed mutual appreciation.

Nurses and respiratory therapists frequently shared lab data, patient assessment information, and changes in patients' status or treatment as they cared for patients. As EL nicely stated, "It's not an *option* to communicate and work well together." All of the therapists were able to demonstrate and articulate how they communicated with nurses as an essential requirement for critical thinking and effective respiratory care practice. Much of the communication was nonverbal. It became evident that the nurses and therapists had well developed working relationships and could "read one another" well. To the observer, the slightest gesture or facial expression exchanged at the bedside was important. Body language was used deliberately when the therapists and nurses did not want the patient or physician to hear them or when quick action was needed.

The RRTs were also experienced in recognizing differences in tone of voice and would use that information to prioritize. Whenever asked how they knew which patients to go to when several nurses called for assistance at the same time, I was repeatedly told that they could tell by the tone of voice or expressions on the nurses' faces. For example, during one of the observations CG suddenly quit

talking and abruptly proceeded to another baby's bed. The nurse thought that the endotracheal tube had come out. When asked how he knew to go quickly, since nurses called him continuously throughout the day, he said: "I could tell by her tone of voice that it was urgent." The majority of therapists in this study answered this question the same way.

Communicating effectively with patients was also important to critical thinking. The therapists communicated with patients to obtain information, make assessments, inform, explain, coach, or reassure. Offering reassurance was by far the major purpose for communicating with patients. Since most of the critically ill patients were intubated and could not speak, communication with patients was nonverbal. The therapists were adept at reading lips, facial expressions, and body gestures. Very often the therapists asked patients direct questions that could easily be answered by a nod or shake of the head. Several said they had to learn how to ask simple yes or no questions to get appropriate responses from patients. It was very common to see the therapist hold a patient's hand or pat the patient's arm or shoulder to offer reassurance. To assess the patient's level of awareness and ability to cooperate, the therapist would ask the patient to squeeze his or her hand.

Communicating was not only essential to obtain information required for critical thinking, but also critical thinking was essential in determining how to best communicate with patients. FM described in detail how her own hospital experience as a critically ill patient helped her learn to communicate effectively with patients. The RRTs would try to give the patients some control and would modify the ways they communicated based on their perceptions of the patient's level of awareness, ability to cooperate, degree of anxiety, and overall coping mechanisms.

Negotiating. Critical thinking in practice is required of the respiratory therapists to negotiate patient care medical orders and responsibilities. Negotiating is initiating discussion in an attempt to influence others. Negotiating can be considered shared thinking. Although negotiating requires communication skills, not all communication is negotiation. Negotiation differs from communication in that the intent is not only to impart information and ask questions, but to influence others' decisions and actions. The following comment from GP illustrates how the therapists' ability to negotiate with physicians influences the medical orders.

GP: "You can say, 'how about if we do that?' and call the attending or resident to give the orders. . . . I will talk to the doctor. We [respiratory therapists] call them because there's nothing to be afraid of. All they can do is say no. But if you're *logical* when you approach them and they see you have a good [idea], then they'll usually accept it.

But I can say 90% of the time they accept [my suggestion]."

In the next comment HQ describes how therapists must give reasons when negotiating with physicians to change or write medical orders for patient care.

HQ: "[When you] call a doctor and ask him, 'can we do this?' you have to be able to tell him why: give reasons. If you give them reasons [about] what you want to do, most times they will listen to you."

It appears that these experts were well aware of the power structures and approached making recommendations in the least threatening and most effective manner. The data set includes many examples of this. The RRTs demonstrated and described how they learned to make suggestions in the form of a question, because that approach was generally most effective. The participants also realized that there was more than one way to solve a problem or treat a patient. In the course of asking questions and the ensuing conversations, they often reconsidered their own recommendations and suggestions when given additional information or reasons for certain patient care decisions or medical orders. Every RRT said that it is important that you "know your doctors" and can "think like the doctors" before making recommendations. It was striking how they modified their suggestions based on which physician they were communicating with, rather than based on their own preference or best judgment. The following comment shows how FM is able to compare how she negotiates with different physicians.

FM: "I have to learn how to deal with every personality of every physician. . . . We have one physician who is wonderful and he likes all of the information. He wants to know everything. He loves having a conference with you and getting your feelings on it [patient care]. . . . But then we have Dr [X] who wants to know the least. He wants you to. . . get to the point, say what you want to do, and get on with it."

The data suggest that critical thinking in respiratory therapy practice involves knowing when to negotiate and with whom. It became obvious that the participants relied on their past experiences and did not make recommendations or attempt to negotiate with certain physicians or groups of physicians who had not been receptive in the past. However, even with these physicians the therapists negotiated if a situation was clearly life-threatening. For example, CH described in detail that a particular physician group was not open to suggestions, so he only contacts them if he believes a situation is life-threatening. The therapists were more likely to challenge physicians (including residents) when they felt strongly about what was happening to the patient or when they believed they would have support from the hospital's administration, medical director, and other physicians. CH summed up the participants' sentiments, saying, "I try to avoid conflict, but that doesn't

mean I'm going to roll over and let them put tire tracks on my back."

The findings also suggest that if the RRTs were too busy or simply not prepared for the encounter, they avoided negotiations with physicians. There are numerous examples from the data that demonstrate how respiratory therapists think critically either to initiate or avoid negotiations, particularly with the medical staff.

When it was a matter of conflicting medical ethics, the therapists would negotiate, because continuing to treat the patient was too painful or too risky to assume personal responsibility. Under these circumstances the therapists negotiated their responsibilities by refusing to provide respiratory care services. When they could not negotiate effectively, they sometimes felt responsible when things went wrong. For example, AA described an incident in which she extubated a patient even though it was against her better judgment. The patient could not be reintubated and an emergency tracheotomy was attempted but was unsuccessful. The patient died shortly thereafter. She continues to reflect on that incident and wishes she had negotiated more effectively because she feels partly responsible for that outcome.

The respiratory therapists also had to negotiate back-up when problems occurred. They negotiated responsibilities when evolving work load exceeded their capabilities to respond to patient care needs in a timely manner. In these circumstances the therapists had to communicate with nurses, their supervisors, and other therapists to gain assistance and to make sure patient care responsibilities were covered. Sometimes they acted decisively and worked outside of the medical order in an emergency and negotiated later. As AC stated, "If the patient is at the point of coding, you don't need an order!" DI spoke similarly: "That is pretty much routine here: if you know that the child is critical, you don't have to have an order." CG said, "You do what you have to do and you worry about the order later."

Decision-Making.   The findings illustrated that decision-making is fundamental to critical thinking in respiratory care practice. Decision-making is the ability to reach a judgment or conclusion; making up one's mind. The participants made clinical decisions (1) on their own, (2) by sharing with nurses and physicians at the bedside, and (3) by consulting with others. The RRTs and nurses frequently ask one another questions, exchange information, and share decision-making regarding patient care. The nurses and therapists often discuss their ideas and suggestions with each other before approaching the physician. When a unique problem is encountered, the respiratory therapists pursue consultation beyond bedside interactions and look for additional opinions from other respiratory therapists, supervisors, the medical director, physicians, and even from

clinicians at other hospitals. However, in many instances the participants themselves were the ones to be consulted regarding patient care.

When making decisions, these RRT experts appear to use Gestalt thinking to get a grasp of the whole situation, including vague subtleties. The following excerpt from AB demonstrates how holistic assessment and Gestalt thinking inform the respiratory therapists' decisions.

AB: "I think you are more aware of things around you and can take it in because it is important. You notice things that other people may not notice initially. You go ahead and start accumulating information based on your first views and you assimilate it in an orderly fashion so that it paints a picture immediately when you walk into the room and see the patient . . . you walk in and the first thing you notice is what the patient is doing, and you put the whole picture together immediately."

Often the therapists could not explain how they made their decisions. They referred to "common sense," "having experience," "clinical sense," "gut feelings," and "intuition" to explain their decisions. They relied on their clinical experience, patient assessment skills, feedback from other clinicians, and related critical thinking skills when making decisions in their practice.

The extent to which expert respiratory therapists used practical knowledge versus textbook knowledge when making decisions was dramatic. The therapists were able to describe how their approach to decision-making drastically changed with experience. They also described how little they use the textbook formulas or theories in their current practice. You can sense EK's emotion in the following comment, in which he vividly described why he values practical knowledge when he makes decisions.

EK: "So much of this is common sense, just good clinical sense . . . a good feel for what is going on. And there is a big difference between knowing all the formulas and equations and having good clinical sense. I know a lot of people who could give you every equation in the book, but when it comes down to taking care of the patient in a bad situation, you wouldn't want them within 10 miles of you. . . . Life isn't a formula, and medicine isn't always a formula either!"

EK went on to say that he told one bright student what he could do with his formulas! He felt the need to be dramatic because the student frequently quoted formulas and tended to overlook the patient. EK tried to impress upon the student that clinical practice is not as simple as using a formula. The other participants expressed similar viewpoints. Here is what EK said when pressed to explain how this student would develop good clinical sense without formulas.

SM [researcher]: "What is he going to replace his reliance on formulas with?"

EK: "Good clinical common sense."

SM: "How is he going to get it?"

EK: "He's got to look at his patients. . . . Then he's got resource people that work with him who he can talk to. I guess that's my main point. He has got a resource person [who] is here to help him and [who] can offer him things that a book can't offer."

SM: "Do you use those formulas now or not? And should we teach them?"

EK: "No, I don't use them. I think people need them. . . . I guess it does give you a starting point . . . maybe he was trying to tell me in his way that he didn't have the clinical sense yet. He didn't have that feel, and the formulas were something that he had."

That comment captures the way the therapists contrasted how novices versus therapists incorporated formulas or textbook knowledge into decision-making. All of the participants stated that they do not use the formulas any more, that they can tell what is happening by looking at the patient and the situation. The majority indicated that they rarely use textbook knowledge in their practice.

It seems that part of the therapists' frustration with novices is the perception that the novices overlook the patient. The therapists indicated that the emphasis on formal theory diminishes opportunities for novices to learn valuable lessons from the experts' practical knowledge, although they recognized that their clinical sense was developed over time, with experience. The following comment from FM captures the therapists' beliefs that their gut feelings or intuition come from clinical experience.

FM: "Good clinical knowledge based on experience is what sometimes weighs a whole lot more. . . making decisions based on instinct and gut feelings. . . . I think our gut feelings come from our past experiences. . . . You can apply it, all this stuff you have learned to that situation."

Regardless of the setting, the therapists would often experiment outside of the medical orders to gather information to assist them in their decision-making and for negotiating. The following comment from AC illustrates how the therapists used trial and error to experiment outside of the medical order and to make individual decisions.

AC: "Before I make recommendations, sometimes I will try certain things. . . , say, pressure support. . . . I like to check it out with my patients before I actually recommend [it] to the physician."

The respiratory therapists experimented to make individual decisions for oxygen and aerosol therapy, ventilator management (including flow rate, respiratory rate, tidal volume, and mode), intubation, reintubation, and extubation. The bedside experiments influenced how they communicated and negotiated. The therapists used phrases such as "trial and error," "experimentation," and "working in the gray zones" to describe their methods for making individual clinical decisions.

The therapists shared decision-making with physicians during rounds, during emergencies, when handling novel cases, and when physicians, nurses, and other therapists asked for their opinions. Only half of them regularly participated in physician rounds, with structured approaches for team decision-making most evident in NICU and in adult critical care units that used patient care plans with protocols. In these settings the RRTs had the greatest roles in decision-making.

The therapists consulted with other clinicians outside of the unit and at other institutions to inform their decisions. Clinicians at other institutions also contacted these experts to give input regarding their experiences, unique problems, and new strategies. Physicians also contacted these expert therapists for suggestions and information regarding patient care. Consultation was obtained when considering new technology, confronting a novel case, or seeking feedback regarding innovative approaches. Consulting helped the therapists to confirm their decisions, but sometimes consultation challenged decisions:

DJ: "I'd say that a lot of times I'm pretty sure of my decisions. But still I like to have a second opinion. If I think it's the right thing, I'll stand by it. I think you can disagree and still get along. [But] I've had some [cases] where I'll ask a second opinion and wish I hadn't because I'll disagree, and in times like that it puts a little doubt in your mind. . . . Lord, did I really make the right decision?"

It appears that the desire to share decision-making and to interact with physicians is related to personal characteristics of the clinicians. Several of the participants referred to the less motivated respiratory therapists as "knob turners." BF captured the participants' sentiments when she said that, "most of the time I don't think the knob turner interacts with the physician."

Reflecting. Reflecting is the ability to "think about one's thinking," to examine assumptions, opinions, biases, and decisions, which is essential to critical thinking. Reflection can be described as retrospective thinking or introspective thinking. Reflection was evident in the ways the RRTs responded to questioning and often reconsidered during the observations and interviews, saying "it depends," "each situation is different," and "there is more than one way to treat this." The therapists reflected on their work, patients, decisions, and profession. The participants were able to describe how reflection changed over the courses of their careers. As the therapists became more experienced and made fewer mistakes, they reflected less about their decisions. However, at the same time they began to reflect more about the broader context of their profession and health care. There were many rich examples of RRTs seeing things from others' perspectives and realizing through reflection that there are gray zones to patient care, which are open to multiple interpretations.

Every therapist described how he or she reflected less than they used to about his or her clinical decisions. They gave vivid examples of how they think things over, again and again, whenever problems or mistakes occurred. However, as they gained experience, they made fewer mistakes and became familiar and comfortable with the problems and difficulties in practice. CG described how his reflection changed over time and how he learned from his mistakes.

CG: "I feel like I've run the gamut of mistakes. I don't make as many mistakes as I used to. Time is very forgiving, really. When you make a mistake, you should let it run its course. Let the mistake run its course and fully saturate into your mind so that you've learned something."

Problems and emergencies that present dilemmas for the novice were not as difficult for the expert. The experts rarely encountered new problems and difficulties that they have not experienced before. However, when a novel case or new problem was encountered, the experts would reflect on the problem to search for an answer. The experts also reflected on their decisions and actions when dealing with a unique problem, to inform future decisions. Through reflection the therapists derived solutions. Also, by reflecting they either confirmed or challenged their decisions and actions. GP characterized the role of reflection in critical thinking in respiratory care practice:

GP: "If there is something that relates to work and I have no answer, then I think about it a lot. Or if there's some mistake I made, then I'm always thinking about it. . . . I think about what can I do [for the patient] with my authority and ability. What can I do to make it better?"

That comment demonstrates how the therapists reflect on challenging problems to come up with solutions. Reflection also helped them to accept the fact that at times there is no solution and that they had done all that they could do for the patient. The comment also illustrates how reflection helps clarify their role in and contributions to patient care.

Since respiratory care is a health care profession that specializes in life-support technology, sickness and death are encountered daily in practice. Through reflection the respiratory therapists developed coping strategies. Notice in the following comment how EK's reflections on the rewards of the profession are seen in the perspective of reflections on death.

EK: "God, you see so many things go wrong and so many people die. . . . Generally, if you come up with a game plan for a patient and it seems to really work, that always gives you a pretty nice boost."

By reflecting on their practice, the RRTs are able to cope with the fact that although their expertise often saves lives, in some instances they actually prolong pain and suffering. They reflected on instances when respiratory care technology prolongs life but also prolongs suffering.

The following comment from HR illustrates the role of reflection in developing coping strategies.

HR: "I get immediate gratification from giving aid to somebody and helping somebody feel better. . . but to simply prolong extreme agony by resuscitating an adult we both know is terminally ill. . . I feel it is tragic that we are pushing things to the limit with those patients."

It appears that reflection on these instances helped the RRTs to develop coping strategies and realizations that there is a limit to what they can do. Through reflection the therapists were able to comprehend when and why a patient's death is inevitable and must be accepted as the best outcome under certain circumstances. Furthermore, reflecting on their practice is how the therapists' medical ethics are developed and refined, which influences their critical thinking.

By reflecting about patients, the therapists developed greater compassion. It was impressive to see the degree to which the RRTs could empathize with their patients. It appears that the greatest satisfaction derived from respiratory care practice comes from relating to patients and helping the patients and their families. The therapists also reflected on the broader context of their profession and health care issues related to costs, services, accessibility, reform, and restructuring.

Discussion

This study was limited by the constraints of time and resources. Qualitative work is extremely labor-intensive. Ideally it is desirable to engage in collaborative work with a team of other investigators to collect, code, and analyze data, because that can give the data more scope, meaning, and accuracy.[46] The question of generalizability is a particular concern with qualitative research.[23,30] Generalizability, in the traditional, scientific application of the term, is a limitation of this study; however, reader generalizability is possible.[47] Reader generalizability allows the user of the research to determine the extent to which the findings of the study apply to other situations. To enhance reader generalizability, detailed description of the study's context is provided.[23,45,47]

This study was conducted to describe the logical reasoning, problem-solving, and reflection aspects of critical thinking in respiratory care practice. The findings describe 7 skills that are essential for critical thinking in respiratory care practice: prioritizing, anticipating, troubleshooting, communicating, negotiating, decision-making, and reflecting. Whether one can define general skills of critical thinking is controversial.[5,48–50] One viewpoint is that dilemmas and problems interact with the knowledge base and context and, therefore, critical thinking must be developed explicitly during the process of acquiring skills and knowledge.[51,52] The findings further illustrate that individuals must have domain-specific knowledge, including the content and procedures to solve real problems in practice.[52–55]

Physicians[56,57] and nurses[32] who make accurate decisions in their areas of expertise are not as likely to make accurate decisions when considering problems in another specialty. The findings indicate that RRTs who are specialists in adult critical care cannot necessarily think critically in neonatal respiratory care. Only 3 of the participant therapists were competent to work in both adult and neonatal critical care areas. The others were generally unfamiliar with the tools, concepts, and culture of both adult and neonatal specialties. This research demonstrates that problems in practice that were considered routine or simple by respiratory therapists were more difficult or unsolvable for physicians and nurses, and vice versa.

The available literature does not address the importance of prioritizing or anticipating in clinical practice, as related to critical thinking. It appears that the present findings are novel. However, it is documented that expert nurses can anticipate and prioritize better than novices.[32] Novice nurses tend to respond to every request or demand with almost equal intensity and speed,[32] but they eventually learn how to prioritize, juggle multiple demands, and anticipate problems. The findings indicate that some of the skills important to critical thinking in respiratory care practice are similar to the domains and competencies of nursing practice.[32,58]

Not only do respiratory therapists need to prioritize their work, but also they need to think into the future and try to be one step ahead in order to prevent problems and come up with solutions. Anticipating involves the ability to foresee or think ahead so that problems can be avoided by the respiratory therapists' actions and so that solutions can happen earlier. Anticipating differs from prioritizing because the intent is to avoid a problem, not to merely respond or react quickly to a problem.[32,33] However, these skills are interrelated. The ability to anticipate influences the therapists' ability to prioritize and vice versa. The therapists are better able to prioritize and respond appropriately to problems or routine aspects of their work when they are also able to anticipate what might happen as a result of their actions or decisions. On the other hand, the ability to prioritize allows the therapists to use their time more effectively. Consequently, they can have greater opportunity to avoid problems through anticipation. The skill of anticipating appears to require global or Gestalt thinking in order to get a grasp of the whole situation and effectively come up with plans and solutions to prevent problems from occurring in practice.

Troubleshooting is a fundamental component of critical thinking in respiratory care practice, and troubleshooting is necessary to introduce, modify, use, evaluate, and adapt patient-care technology. The ability to prioritize equipment needs and anticipate technical problems or equip-

ment shortages influences the therapists' troubleshooting expertise. Nurses and physicians rely on the respiratory therapists' technical and troubleshooting expertise, expecting that they can respond appropriately to alarms or equipment malfunctions.

There is evidence suggesting that improvement of cognitive skills and use of mental models can improve troubleshooting skills.[59–61] A comparative review of studies on troubleshooting across many disciplines concluded that a cognitive model must be incorporated to explicitly include knowledge, skills, processes, and metacognitive strategies required to perform the task.[61,62] In addition, the troubleshooter's performance is largely influenced by the person's knowledge of the system or device to be repaired.[63–65]

The findings demonstrate how basic skills and related communication skills are deeply interrelated to critical thinking as a whole. Cognitive performance on a clinical simulation exam requires making the right clinical decision after assessing appropriate data. In the real world if respiratory therapists cannot communicate effectively, there will be insufficient information to interpret, analyze, evaluate, infer, explain, or judge (which are essential to critical thinking). Effective communication depends on good working relationships, so it is not surprising that critical thinking in actual practice involves communication skills and personality traits. Communication was considered the most important skill in practice by the majority of the participants.

Critical thinking in practice requires problem-solving, decision-making, and related skills, including reading, writing, and speaking.[66,67] Effective speaking conveys thoughts in such a way that those listening can apply them in their own experiences. Effective listening requires analyzing the speaker's logic. Intellectually disciplined speaking, reading, writing, and listening require that we "work explicitly with the logic we are constructing or reconstructing, using our grasp of the standards of critical thinking to communicate accurately and precisely, effectively solve problems, and rationally make decisions".[66(pp6–7)]

Communication and negotiation within health care organizations are unusual because of the urgency of the activities (ie, emergencies), the differences in status and education levels, gender socialization differences, and cultural differences.[68,69] In every organization there are status and power differences among workers, but in hospitals these differences are accentuated.[69] However, the present study shows the degree to which health care professionals interact and collaborate to optimize decision-making and improve the quality of patient care.[69–72]

Respiratory therapists must be able to make good clinical decisions if they are to deliver safe and effective patient care. Therefore, decision-making underlies all aspects of practice and is fundamental to critical thinking in respiratory care

practice. Shared cognition is a characteristic feature of clinical practice; therefore, part of the therapists' decision-making is knowing when and how to seek assistance and/or feedback. This study illustrates the relevance of decision-making to critical thinking in practice, which guides the respiratory therapists' beliefs and actions.[73–75]

Although the expert respiratory therapists could demonstrate decision-making and critical thinking, they often could not describe the reasons for their decisions. A beginner makes inferences and decisions using strict rules, but with experience he or she develops into an expert who sees situations intuitively, without consciously applying rules or making inferences at all.[76] The present study illustrates that asking an expert for strict rules tends to force the expert to regress to the level of a beginner and state the rules that are remembered but no longer used.[77] However, judgment errors are often due to overuse of generally correct intuitive strategies and underutilization of formal, logical, statistical strategies.[78] Consequently, experts can incorporate detrimental biases and ineffectiveness, as well as true expertise, into their practice.[79] Although clinicians are often forced to rely on practice theories, sole reliance on intuition is questionable when empirical evidence is available.[5,80–82]

Research suggests that cognitive skills can be enhanced,[83,84] which can result in improved decision-making.[5,82] Clinical decision-making can be improved in both novices and experts by increasing content and procedural knowledge and by enhancing their skills in evaluating and using evidence.[5,80–82] Integrating information from diverse sources is a critical process in clinical decision-making and can be facilitated through the use of scientific reasoning. Furthermore, the fact that experts may make the same mistakes as novices when confronting unfamiliar problems suggests the need for cognitive skills and metacognitive strategies.[85–87]

An adult may be intelligent and yet not have learned critical thinking skills or creative thinking.[88] Critical thinking in practice involves inductive reasoning about a large number of loosely structured problems that have no single solution. Decisions must be made in a context of uncertainty. The criteria on which to base decisions are often in dispute, and empirical evidence on effectiveness of different treatments is often lacking.[5,80–82,89] The findings indicate that expert respiratory therapists consider practical matters and rely on practical knowledge when solving problems and making decisions in their practice. These findings support the reflection-in-action theory,[33,34] descriptions of expert nurses in practice,[32] and theories in use.[77]

To be effective in practice, the therapist must also have practical skills and be able to communicate and negotiate effectively. If a therapist is unable to negotiate, there is limited access to the therapists' professional expertise and critical thinking skills. The therapist must be a skilled negotiator to participate in decision-making and influence patient-care medical orders. Negotiation skills can be enhanced through

practice and the "realization that reasonable people disagree."[90(p297)] Respiratory therapists must reflect on their decisions, beliefs, and actions to further develop critical thinking skills and traits. Through reflection, practitioners can enhance all other critical thinking abilities, including cognitive skills and metacognitive strategies.

The findings demonstrate that when expert respiratory therapists make individual decisions, they are often unaware of the tacit understandings, assumptions, and decisions in their practice,[33,34,89,91] and that they no longer reflect on many of their individual decisions and actions. This lack of reflection could limit the professional's growth and expertise. The RRTs tended to reflect on the rare, unusual, or novel problems, which generally involved shared decision-making and shared cognition. Consequently, these experts can fall into single-loop learning and no longer question their tacit understandings or habitual ways of performing.[33,77,91] Under these circumstances attempts to solve problems can be ineffective.

Ideally, when faced with complex problems, practitioners conduct informal action experiments, evaluate the results of their experiments, and modify their approaches based on the results.[33,34] The participants in this study demonstrated and described how they often experimented outside of the medical orders to make decisions regarding respiratory care.[92] The RRTs would test their hypotheses, evaluate the results of their experiments, and modify their approaches to clinical practice based on their results.

Summary

To summarize, critical thinking in actual practice is more than intellectual or cognitive abilities. Rather, the nature of critical thinking in practice is multidimensional, involving skills, traits, and contextual factors. The implication from this study is that respiratory therapists should be given greater opportunities to engage in critical discourse in order to improve communication, negotiation, decision-making, and reflection.[93–96] By incorporating the core principles of critical thinking identified in the present study, education programs can improve respiratory therapy training and subsequent patient care. Respiratory therapists should continually examine their assumptions and appreciate multiple perspectives. Problem-based learning, small-group discussion, and case-based approaches are teaching/learning strategies that could be incorporated into education programs to prepare respiratory therapists with the critical thinking skills needed for clinical practice.[21,96–100]

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Appendix

Observation Guide

1. What are the typical and atypical activities that are evident in respiratory care practice? What respiratory care activities appear to require critical thinking, including logical reasoning, problem solving, communication, and reflection?

2. How much of the textbook knowledge is evident in respiratory care practice? What are the situations or circumstances that initiate or require the respiratory therapist to go beyond textbook knowledge?

3. How do respiratory therapists organize and perform their work? Why?

4. What is the role of the respiratory therapist during emergencies such as cardiac arrest?

5. What role do respiratory therapists play in patient care such as ventilator management?

6. When and how do physicians, nurses, and other health care professionals interact with respiratory therapists?

7. When and how do other health care workers consult with respiratory therapists in the management and care of critically ill patients?

8. What types of clinical decisions do respiratory therapists make? How do they go about making clinical decisions?

9. What do respiratory therapists do when they are unclear or in disagreement with a medical order?

10. What mechanisms exist for respiratory therapists to make suggestions or recommendations regarding medical orders and patient care plans?

Interview Guide*

1. Let's talk about some of the experiences you had today during my observations. I am really interested in learning what you were thinking and feeling during your work.

2. Describe a recent experience when you were required to act in an emergency. Why was it an emergency and what skills were required?

3. Describe a typical work day or recent experience where you were required to go beyond textbook knowledge.

4. Describe a recent problem that you had at work. Why was it a problem? What skills were required? How did you resolve it?

5. What do you consider the most important skills in your work? Why?

6. What opportunities do you have for recommending and managing respiratory care? What impacts your role in patient care? Why?

*The observation field notes form was used to document critical incidents in respiratory care practice. Then, several specific questions were asked related to what was observed during the respiratory therapists' work, to gain further insight into critical thinking in respiratory care practice. Questions focused on the specific situations that appeared to require problem solving, reasoning, communication, and reflection, as a basis for identifying critical thinking. Interview questions were asked to challenge or confirm when and how critical thinking emerged in practice.