Management and Processing of Respiratory Care Information in Respiratory Care Departments

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BACKGROUND: Though much research has been done to determine best practice and to examine the role of evidence-based guidelines and respiratory therapist (RT) driven protocols in enhancing patient care and reducing health care costs, very little attention has been paid to how respiratory care information is managed and processed. OBJECTIVE: To examine information systems currently used in respiratory care departments to determine if they are effective and efficient in managing and processing respiratory care information. METHODS: To 50 RTs at 16 respiratory therapy departments in New York, Houston, and Miami, we distributed questionnaires designed to determine the strengths, weaknesses, and usefulness of existing respiratory care information systems. There were 2 types of questionnaire: one for respiratory care managers and another for staff RTs. We used a combination of purposive and snowball sampling techniques to choose RTs to whom to send the survey. RESULTS: The response rate was 52%. Of the 26 respondents, 19 were staff RTs and 7 were managers. In the 16 departments that responded, 3 of the information systems were strictly paper-based, 12 were partially automated (combination of paper records and computer files), and 1 was fully automated. The respondents' opinions about the usefulness of their information systems were: 19% said "very useful," 23% said "useful," 46% said "somewhat useful," and 12% said "not useful." All the respondents said that they rely on colleagues, books, and manuals for decision support, rather than on computerized decision-support systems. CONCLUSIONS: This study suggests that the information systems used by the respondent RTs have marginal utility and have problems with data storage and retrieval, because either the systems do not employ computerized databases or the computerized databases do not have full-scale database management systems. Inadequate data storage and retrieval systems often lead to data redundancy and, ultimately, inaccurate information. Development of data models specific to the respiratory care profession may be necessary to build databases with conceptual schemas that accurately reflect the professional activities of RTs. *Key words: decision support system, database, data integrity, data consistency, data redundancy, conceptual schema, informatics, respiratory care department, management.* [Respir Care 2007;52(6):730–739. © 2007 Daedalus Enterprises]

Introduction

Data (raw symbols that simply exist), information (data that are given meaning through relational connection), and knowledge (useful collection of appropriate information)[1] constitute the content of professional communication. Communication plays a central role in health care, and information systems are essential to communication. Accordingly, health care professionals who are actively involved in research that

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contributes to the development of information systems that facilitate better understanding, planning, and documentation of the care they render will maximize patient benefits and advance their professions. Furthermore, since information management and processing and decision making are at the core of clinical practice for all health care professionals, informatics (the study of the management and processing of data, information, and knowledge, which involves the conceptual modeling and computational representation of domain knowledge and data[2]) has become an integral subject of study in some health care professions, such as nursing and medicine. For example, nursing scholars are constantly concerned with representation of nursing knowledge, as demonstrated by the article "Embedded Structures and Representation of Nursing Knowledge," by Harris et al.[3] Shortliffe, a preeminent physician and medical informatics scholar, asserts that information management is intrinsic to medical practice.[4] Shortliffe's assertion is supported by the 2001 report and recommendations from the National Committee on Vital and Health Statistics regarding the development of a national health information infrastructure.[5] Furthermore, a literature review reveals many efforts to develop systems that manage medical information and enhance patient care.[6,7]

Respiratory therapists (RTs) are knowledge workers, meaning that the primary purpose of their jobs involves the creation, distribution, or application of knowledge, and their responsibilities are based on a specialized body of knowledge gained through formal education.[8,9] The executive summary of a study done by The Lewin Group in 1997 on behalf of the American Association for Respiratory Care (AARC) includes the following statement, which supports the assertion that RTs are knowledge workers: "The study clearly demonstrates that RTs are highly valued for, and are often hired because of, their specialized clinical skills."[10] Like all members of the health care team, RTs deliver and manage patient care through continuous communication with patients and their families, other RTs, and other health care providers.

Respiratory care data may be quantitative, qualitative, or complex. Quantitative data such as respiratory rate (obtained from patient assessment), blood gas values (such as pH, P_{CO_2}, P_{O_2}), lung compliance measurements, and fraction of inspired oxygen are important to the RT. These quantitative data give important information regarding the patient's symptoms, changes in signs and symptoms over time, changes in physiologic function over time, and rationale for treatment. Qualitative data may have 2 or more values, and a response may be exclusive or nonexclusive, such as when several responses may be selected from a list. A binary (or Boolean) qualitative variable is an exclusive variable with 2 states (eg, the answer to a question related to a patient's smoking history may be yes or no). On the other hand, documenting breath sounds could require the RT to choose several responses from a list. RTs also require whole text data for patient assessment, progress notes, and care plans. The latter are examples of complex data that are very difficult to code and are therefore processed with a technique called natural language processing.

As clinicians, RTs must analyze and synthesize empirically and contextually relevant evidence to maximize quality and cost-effectiveness of care. According to Mishoe, the RT applies scientific knowledge, technical expertise, and theory to practical clinical problems, and is often required to exercise clinical judgment.[11] Furthermore, based on the competencies outlined in the National Board for Respiratory Care's (NBRC) Registered Respiratory Therapist (RRT) Examination Matrix,[12] RTs must be able to interpret results from various sources to determine the appropriateness of, and participate in developing and recommending modifications to a patient's respiratory care plan. For example, RTs must be able to interpret results from clinical diagnostics, including physical examination, pulmonary function testing, blood gas analysis, radiologic studies, pulmonary mechanics studies, and respiratory monitoring. Additionally, the advanced RT monitors, evaluates, and records patient responses to respiratory care interventions. Clearly, then, ensuring that RTs have the ability to access new and past results from clinical diagnostic procedures, as well as records that indicate a patient's response to respiratory care interventions, would increase patient safety and the effectiveness of care. This implies the need for a database in which the response time is optimized. That is to say, since the demand for output will exceed the demand for input, data retrieval must be faster than data storage.

Given the description of respiratory care within the technological milieu presented above, it would be reasonable to assume that research related to the management and processing of respiratory care data, information, and knowledge is given a high priority among expert RTs. However, though there has been a proliferation of ad hoc respiratory care information systems, the respiratory care profession has not invested in the creation and development of respiratory care vocabularies/classifications to support the knowledge work and informatics application associated with patient care. Consequently, it is difficult to capture and retrieve respiratory care data needed for analysis of the patient care processes and outcomes, as well as resource consumption. This may have led the Centers for Medicare and Medicaid Services to underestimate the use of respiratory care services in subacute care facilities, which resulted in the omission of respiratory therapy services as a designated rehabilitation service as part of the Resource Utilization Groups system and, consequently, a severe reduction of benefits for respiratory rehabilitation.[13]

Frequently, ad hoc, stand-alone departmental respiratory information systems address only basic information

needs of RTs, such as providing a more organized list of patients receiving respiratory care and providing computerized support for respiratory charges. Moreover, since many of these information systems are not compatible with the main hospital information system, the opportunity for information-sharing between RTs and other health care professionals is severely limited, which hampers collaboration between RTs and other health care professionals. Information systems should be interoperable and should accurately define and describe the data, information, and knowledge unique to the respiratory care profession. The development of robust respiratory care information systems would help RTs to better document and understand the care they deliver to their patients and, ultimately, to bridge the gap between research and practice.

The purpose of the present study was to examine existing respiratory care information systems to determine if they are effective and efficient in managing and processing respiratory care information. We asked:

1. Do existing respiratory care information systems accurately define and describe the data, information, and knowledge unique to the respiratory care profession?
2. Do these information systems optimize management and processing of respiratory care information?

Methods

Study Design

Description, exploration, and discovery are the most common objectives of qualitative research.[14] Therefore, qualitative methodology was chosen, because the purpose was to understand existing information systems used by RTs and to identify any deficiencies discovered. Furthermore, to understand the information system needs of RTs, requirements-discovery techniques must be utilized. Requirements-discovery includes fact-finding techniques to identify or extract system problems and solutions from the user community. Fact-finding techniques include interviews; surveys; sampling of existing documentation, forms, and files; and observation of the work environment. Analysis of the information obtained from the above fact-finding techniques helps to define a system's various functions; it defines *what* the information system does.[15]

Sample

A combination of nonprobability purposive and snowball sampling was used to select a sample from which the most insight into the information needs and uses of RTs could be gained. Purposive sampling aims for insight about the phenomenon, not empirical generalization from a sample to a population. Consequently, cases for study are selected because they are "information rich" and illuminative. That is, they offer useful manifestations of the phenomenon of interest.[16] Therefore, survey participants had to be currently practicing RTs. The sampling procedure entailed approaching our RT colleagues and asking if they would participate in a survey. We explained to potential participants that the survey was intended to gain insight into the information needs of RTs. We stressed that participation was strictly voluntary. Those who agreed to participate were asked if they knew of any other RTs who might be willing to participate. If so, they were given additional copies of the survey questionnaire and asked to return them at their earliest convenience. Additionally, 2 registered nurses (one in Houston, Texas, the other in Miami, Florida) assisted us by recruiting RT colleagues at their institutions; those RTs also recruited some other RT colleagues. Survey questionnaires were distributed to 50 RTs at 16 health care facilities.

Data Collection

Two different survey questionnaires were developed (Appendix), to determine the strengths, weaknesses, and usefulness of existing respiratory care information systems, as well as the information needs and uses of RTs. One questionnaire was designed for respiratory care managers and the other for staff RTs. Some items on the questionnaires were identical, but there were some differences, based on the administrative functions of respiratory care managers. We thought that the 2 different questionnaires would give a more comprehensive idea of information system requirements, since managers' views on data, process, and interface requirements differ from those of staff RTs. Initially, the staff RT questionnaire had 36 open-ended questions, and the manager RT questionnaire had 28 open-ended questions. We thought that open-ended questions would be more appropriate because they would allow more detailed descriptions of what information the respondents need and how they process that information.

To establish content validity and improve the format, both survey questionnaires were pilot-tested by a convenience sample of 8 RTs (2 managers and 6 staff RTs). Based on their responses, the manager questionnaire was converted to a semi-structured format with 30 questions (15 open-ended and 15 closed-ended), including only one contingency question. The staff RT questionnaire was also converted to a semi-structured format, with 37 questions (18 open-ended and 19 closed-ended), including 3 contingency questions.

In addition to the survey questionnaires, the AARC's Uniform Reporting Manuals for Acute and Subacute Care[17,18] and the NBRC RRT Examination Matrix[12] were used to provide insight into the functional requirements for a generic respiratory care information system. The AARC's Uniform Reporting Manuals identify respiratory care pro-

cedures commonly performed in acute and post-acute care settings. The RRT Examination Matrix is derived from the NBRC's job analysis for the RRT, and describes the competencies for advanced RTs. Sample forms and paper files used to collect and store data and information in respiratory care departments were also made available by some of the respondents.

Data Analysis

Responses from the returned surveys were segmented and coded using a priori codes. The survey questions were in 7 categories: (1) professional activities (business functions), (2) RTs' information needs and uses, (3) workflow (data and process flow), (4) communication, (5) data storage and retrieval, (6) system utility, and (7) decision support. The responses to the open-ended questions were content analyzed and placed in the above categories. Data analysis began as soon as the first survey questionnaire was returned. Every returned questionnaire was reviewed multiple times to ensure accuracy. The AARC's Uniform Reporting Manuals for Acute and Subacute Care[17,18] and the NBRC's RRT Examination Matrix[12] were reviewed to obtain a global perspective on the professional activities of RTs and to better understand RTs' information needs and uses. Sample forms and paper files used in respiratory care departments were reviewed to get more in-depth information about workflow and data storage and retrieval.

Results

At the end of a 3-month period, the survey response rate was 52% (Table 1). All 26 respondents worked full-time and had earned either the RRT or CRT credential. Seven respondents were respiratory care managers, and 19 were staff RTs. Twenty respondents worked in health care facilities in the New York metropolitan area, 3 worked in New York suburban areas, 2 worked in Houston, Texas, and one worked in Miami, Florida. Of the 16 respiratory care departments surveyed, 12 had semi-automated information systems (ie, the system used a combination of paper-based and computerized records), 3 had paper-based systems, and 1 had a completely computerized information system.

Table 2 summarizes the survey results. Information retrieval from the computerized portion of the information systems takes 5–10 min, whereas it often takes more than an hour with the paper-based portion.

Table 3 summarizes the responses regarding information retrieval and system utility. Sixty percent of the RTs surveyed are responsible for charging patients for the respiratory care services rendered. This is done by manually entering information into a computer connected to the hospital's central computer. All the RTs surveyed are notified about new or modified respiratory orders via the institution's paging system and telephone, or a combination of the paging system, the telephone, and computer-generated orders. Eighty-five percent of the RTs surveyed obtain information about a patient's progress and care plan through verbal interaction with other members of the health care team and from written notes. The remaining 15% obtain information through the above means as well as from computer records. None of the RTs surveyed indicated that their information systems provide computerized decision support.

Table 1. Survey Population and Types of Information Systems

Surveys sent	50
Total responses	26
Staff RT respondents	19
RT manager respondents	7
Locations of departments that responded*	
New York City	10
New York suburbs	3
Houston	2
Miami	1
Types of information systems in the responding departments	
Paper only	3
Computerized only	1
Combination (paper plus computerized)	12

*All 16 departments that received the survey responded.
RT = respiratory therapist

Analysis of the survey responses and a review of samples of existing documents pertaining to respiratory care information systems revealed that these 16 respiratory care information systems are suboptimal. Table 4 summarizes the responses about the shortcomings of these information systems, using Wetherbe's PIECES Problem-Solving Framework and Checklist.[19] The shortcomings can be summarized as follows: The inability of RTs to aggregate, organize, move, and represent respiratory care information in an economical and efficient way affects patients, RTs, nurses, physicians, other health care providers, and reimbursement systems. The consequences of this problem may include patient dissatisfaction with respiratory care received; inefficient delivery of respiratory care services; lack of respiratory therapy/hospital collaboration; insufficient clinically-based knowledge discovery, distribution, and application; perceived lack of quality in the respiratory care delivered; RT discontent; and loss of revenue.

Discussion

The results of this study suggest that there is minimal use of computer technology in the management and pro-

Table 2. Summary of Survey Responses

Question Category	Respiratory Therapy Managers (n = 7)	Staff RTs (n = 19)
Professional activities (business functions)	Develop policies and procedures, staff scheduling, performance appraisals, staff development, patient and family education, inventory control, protocol and care plan development, develop budget and staffing plans, performance improvement, ensure departmental compliance with regulatory agencies, equipment preventive maintenance, in-service education	Oxygen therapy, ventilator management, patient assessment, develop care plans, case management, bronchial hygiene, airway management, PFT, BiPAP, ABG sampling and analysis, inhaled nitric oxide, noninvasive ventilation, patient education, disease management, discharge planning, hyperbaric oxygenation, surfactant replacement, pulmonary rehabilitation
Information needs and uses	Daily census, policies and procedures, respiratory diagnosis, duration of stay, duration of therapy, equipment history, staffing plan, staff competencies	Respiratory diagnosis, modes of therapy, duration of therapy, outcome of therapy, medical history, patient response to therapy, test results, policies and procedures
Work flow (data and process flow)	Manager makes monthly schedule; posts daily assignment for RTs; checks departmental records to determine number of patients receiving various respiratory interventions; checks patient charts and departmental records to determine RT compliance with charting; ensures equipment and supplies are adequate for the number of patients; ensures functionality and safety of respiratory devices through preventive maintenance program; ensures continued competency of staff through in-service education.	Physician generates respiratory care order. Order transmitted to RC department via paging system, telephone, and/or computer. RT picks up order, checks patient's chart to verify order, assures appropriateness of order based on patient's diagnosis and patient assessment, gathers appropriate equipment for ordered respiratory intervention, executes ordered intervention, and manually inputs charges for services rendered.
Communication	Managers communicate with each other, respiratory care staff, and other members of the health care team. verbally, via telephone, paging system, and writing.	RTs communicate with each other, their managers, and other members of the health care team verbally, via telephone, paging system, and writing.
Data storage and retrieval	Two managers said their data storage is paper-based. 5 managers said their data storage is a combination of both paper files and computer files.	Ten staff RTs said their data storage is paper-based, 5 staff RTs said their data storage is a combination of paper and computer files, and 4 staff RTs said their data storage is strictly computer-based.
System utility	Two managers said their existing information system is very useful, 1 said it is useful, 3 said it is somewhat useful, and 1 said it is not useful.	Three staff RTs said their existing information system is very useful, 5 said it is useful, 9 said it is somewhat useful, and 2 said it is not useful.
Decision support	All 7 managers said they use books, manuals, colleagues, and other health care professionals for decision support. None used computerized decision support.	All 19 staff RTs said they use books, manuals, co-workers, supervisors, and other health care professionals for decision support. None used computerized decision support.

RT = respiratory therapist
PFT = pulmonary function testing
BiPAP = bi-level positive airway pressure
ABG = arterial blood gas

cessing of information in these 16 respiratory care departments. More importantly, these information systems (paper-based, semi-automated, and automated) do not manage and process respiratory care information effectively or efficiently, which is, to some extent, attributable to the lack of full-scale database management systems. This is an important finding because accepted computer science database theory asserts that an inadequate data storage and retrieval system compromises data integrity and consistency of data.[20,21]

Though computer technology plays an important role in the management and processing of respiratory care data, information, and knowledge, it is not itself sufficient to ensure effective and efficient management of respiratory care information. Graves and Corcoran assert that:

> Management of information also requires an application of the concepts fundamental to the science of information. Raw data must be transformed into information, and information into knowledge to elicit meaning from the data. Building computer programs to automate or even support transformation between states requires an understanding of (a) the nature and structure of the information to be processed, (b) the transformations that will be useful in [respiratory care], and (c) the heuristics (rules of thumb) used by experts [RTs] to transform information from one state of complexity to another for use in practice, research, and the development of theory.[22]

To build an optimal computerized respiratory care information system, a logical model that depicts respiratory

Table 3. Responses About Information Retrieval and System Utility

		Manager RTs (*n*)	Staff RTs (*n*)	All Respondents (*n*)
Problems with information retrieval	Yes	4	10	14
	No	3	9	12
System utility	Very useful	2	3	5
	Useful	1	5	6
	Somewhat useful	3	9	12
	Not useful	1	2	3

RT = respiratory therapist

Table 4. Shortcomings of the Surveyed Respiratory Care Information Systems

Performance	Throughput: not enough information generated when needed
	Response time: too long a delay between request for information and response to the request
Information and Data	Outputs
	Lack of necessary information
	Lack of relevant information
	Information that is not in a useful format
	Information that is not accurate
	Information that is not timely to its subsequent use
	Inputs
	Data are not captured
	Data are not captured in time to be useful
	Data are not accurately captured: contain errors
	Data are difficult to capture
	Data are captured redundantly: same data captured more than once
	Stored data
	Data are stored redundantly in multiple files and/or databases
	Data stored are not accurate
	Data are not secure from accident or vandalism
	Data are not well organized
	Data are not flexible: not easy to meet new information needs from stored data
	Data are difficult to access or not accessible at all
Economics	Respiratory care costs are unknown
	Costs are untraceable to source
Control and Security	Input data are not adequately edited
	Redundantly stored data are inconsistent in different files or databases
	Data privacy regulations can be violated
	Processing errors (mostly by users)
	Decision-making errors
Efficiency	Data are redundantly input or copied
	Data are redundantly processed
	Information is redundantly generated
	Excessive effort required for tasks
Service	The system produces inaccurate results
	The system produces unreliable results
	The system is not easy to use
	The system is awkward to use
	The system is inflexible to new or exceptional situations
	The system is inflexible to change
	The system is incompatible with other systems
	The system is not coordinated with other systems

care data and processes needs to be developed. However, the lack of a standardized respiratory care language and classification system is a major deficiency that places great constraints on data modeling. Consequently, the respiratory care profession may need to develop a standardized language[23] and classification system to facilitate the construction of a domain ontology for the profession.

The limited use of computer technology in the respiratory care departments surveyed is consistent with the findings of several studies regarding adoption of information technology by health care organizations and professionals in the United States.[24,25] Ash et al found that there is still minimal use of computerized physician-order-entry in United States hospitals.[26] The slow adoption of information technology in health care organizations persists, despite several studies that found that computer technology enhances health care delivery by reducing medication errors through alerts and reminders, enables faster access to medical records, and reduces duplication of tests. Garg et al, for example, reported that many computerized decision support systems improve practitioner performance.[27] That report was based on a systematic review of randomized and nonrandomized controlled trials that evaluated clinical decision support systems.

Since all of the RTs surveyed indicated that they had no computerized decision support, building computerized decision-support systems for RTs should be a priority, given the trend toward evidence-based guidelines and RT-driven protocols. This requires that RTs both construct an appropriate domain ontology and link that ontology to an appropriate problem-solving method. It would be advantageous for expert RTs and informaticians to come together to study the structuring and processing of respiratory care information to arrive at clinical decisions and to build systems to support and/or automate that processing.

We are aware that bias is inevitable and may arise from multiple sources and at any stage in qualitative research. An appropriate way to consider the results of qualitative research is to view results from any one particular research situation as adding to the pool of knowledge about similar problems, upon which meta-analysis can then be performed.[28] Given the present study's small sample size, the

nonprobabilistic nature of the sampling technique, and the fact that most of the survey respondents were from New York City, the generalizability of the findings is limited. Nevertheless, this exploratory study can be used as a starting point for a more in-depth, scientific inquiry into the management and processing of respiratory care data, information, and knowledge.

Conclusions

An information system (computerized or otherwise) is useful only if it meets the needs of those who use it. It follows therefore, that an effective and efficient respiratory care information system is one that delivers the right information, in the right time frame, in the right format, to the right user.[29] The implications from this study are (1) building robust computerized respiratory care information systems that accurately define and describe the data, information, and knowledge unique to the respiratory care profession requires creating data and process models that accurately represent professional activities and (2) standardization of the language used by RTs and the development of classification systems are essential. Future research aimed at developing a unified respiratory care language would greatly facilitate the creation of classification systems for the respiratory care profession and, ultimately, automated respiratory care information systems that are effective and efficient.

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Appendix

Information System Survey Questionnaire for Respiratory Therapists

1. Please indicate the health-care setting in which you work: □ Hospital □ Nursing Home □ Outpatient Clinic □ Subacute Care □ Home Care

2. Please indicate the age group of the patients with whom you currently work (check all that apply). □ Neonatal □ Pediatric □ Adult □ Geriatric

3. What type of information system do you currently use? □ Paper-based □ Computerized □ Combination (computerized and paper-based)

4. What exactly does your current information system help you do (eg, find information about a patient, admit a patient, track workload, etc)?:_____

5. How do you know what your assignment will be each day when you arrive at work? □ Assignment posted by manager (monthly, bi-weekly, weekly, daily) □ Assignment done daily by senior/lead therapist □ Permanent assignment to a particular area (eg, neonatal, PFT) □ Communication board

6. After you get your assignment, how do you get information about the patients you are assigned to take care of (eg, name, location, prescribed therapy, etc)? □ Paper-based record kept in department (eg, Kardex system) □ Patient records from computerized database in department □ Patient's chart

7. Approximately how long does it take you to get enough information about your patients so that you can start rendering care? □ < 5 min □ 5–10 min □ 10–15 min □ 15–30 min □ 30–60 min □ > 1 hour

8. Please describe the kind of information about your patients that you need on a daily basis to do your job effectively.

9. What other information do you need at the beginning of each shift to carry out your responsibilities?

10. Does formal shift report take place in your department? □ Yes □ No

11. If you answered yes to the above, how is this shift report given? □ verbally □ written □ via computer □ video/audiotape □ other (please specify)

12. What are your responsibilities as a respiratory therapist in your institution (check all that apply)? □ Oxygen therapy □ Ventilator management □ Patient assessment □ Participate in multi-disciplinary care planning □ Case management □ Bronchodilator therapy □ Develop individual respiratory care plans □ CPR □ Airway management □ Bronchial hygiene □ Pulmonary function testing □ Assist with bronchoscopy □ Sleep studies □ BiPAP therapy □ CPAP therapy □ ABG sampling □ ABG analysis □ CPT □ Inhaled Nitric Oxide therapy □ Non Invasive Ventilation □ Hyperbaric oxygenation □ Surfactant replacement therapy □ Patient education □ Discharge planning □ QA □ Pulmonary rehabilitation □ Disease management □ Consultation □ Other

13. Please list all the activities you engage in at work on a daily basis while fulfilling your responsibilities as a respiratory therapist

14. When a patient needs respiratory care services, how is it communicated to you?

15. Please describe the chain of events that take place from the time you are notified that a patient needs respiratory care services until the time the patient receives those services:_____ _____

16. How is a patient's respiratory care plan communicated to you and your colleagues within your department across shifts? □ Progress notes in patient's chart □ Informal verbal interaction among RTs □ Formal shift report □ Multi-disciplinary care plan meetings □ Computer records □ Other

17. How is a patient's progress communicated within your department? □ Progress notes in patient's chart □ Informal verbal interaction among RTs □ Formal shift report □ Multi-disciplinary care plan meetings □ Computer records □ Other

18. What kinds of information do you usually store about patients who are receiving respiratory care services?

19. Where is this information stored (check all that apply)? □ Paper-based chart □ Electronic medical records □ Paper-based files in respiratory care department □ Computerized database in respiratory care department □ Other

20. How would you retrieve information about a patient who is currently receiving respiratory care?:_____

21. How are you notified if a patient's treatment regimen is modified? □ Paging system □ Computer-generated orders (networked to computer in your department) □ RN or clerk telephones your department □ Relayed to RT verbally by MD or RN □ Via fax □ Other:_____

22. How do you know when a patient no longer needs respiratory care services?:_____

23. Do you maintain a record of patients who previously received respiratory care services? □ Yes □ No

(Continued)

24. If you answered yes to question 23, where are these records maintained? □ Electronic medical records □ Paper-based medical records □ Paper-based files in respiratory care department □ Computerized database in respiratory care department □ Other

25. What information might you need about patients you are no longer caring for?:_____

26. How would you retrieve information about those patients?:_____

27. Do you yourself charge for the services you render? □ Yes □ No

28. If you answered yes to the above question, please describe the steps involved in charging a patient for a procedure

29. To the best of your knowledge, on average, how long does it take you to charge one patient for all the respiratory care services you rendered on your shift? □ < 5 min □ 5 min □ 5–10 min

30. Where do you get information regarding departmental and institutional policies and procedures?

31. On a day-to-day basis, do you encounter any problems in obtaining necessary information that helps you perform your job efficiently and effectively? □ Yes □ No

32. If you answered yes to the above question, please describe the problems:_____

33. Please indicate by checking the appropriate box, how easy you think it is to use your current system of capturing and maintaining information about respiratory care services. □ Very difficult □ Difficult □ Easy □ Very easy

34. Please explain your answer:_____

35. Please indicate by checking the appropriate box, how useful is your current system of capturing information about respiratory care services, in terms of whether it helps you obtain necessary information in a timely manner. □ Very useful □ Useful □ Somewhat useful □ Not useful

36. Please explain your answer:_____

37. What resources do you have at work to help you make patient care decisions (eg, management of status asthmaticus, ARDS, acute chest, etc) at the point of care?

Information System Survey Questionnaire for Respiratory Care Managers

1. Please indicate the health-care setting in which you work □ Hospital □ Nursing home □ Outpatient Clinic □ Subacute Care □ Home care

2. Please indicate the age group of the patients with whom you currently work (check all that apply). □ Neonatal □ Pediatric □ Adult □ Geriatric

3. What type of information system do you currently use? □ Paper-based □ Computerized □ Combination (computerized and paper-based)

4. How are respiratory care charges captured? □ Automated capture by computer □ Manually entered in computer

5. Please describe the steps involved in charging a patient for a procedure:_____ _____ _____

6. Please indicate by checking the appropriate boxes, what your responsibilities are as a respiratory care manager in your institution. □ Scheduling □ Develop policies and procedures □ Employee recruitment □ Orientation and training of new employees □ Performance appraisals □ Staff development □ Patient and family education □ Inventory control □ Facilitate staff meetings □ Daily staff assignments □ Protocol and care plan development □ Budgeting and staffing plan □ Performance Improvement □ Ensure departmental compliance with regulatory agencies □ Equipment preventive maintenance □ In-service education to other health-care providers □ Risk management □ Other

7. Please list all the activities you engage in at work on a daily basis while fulfilling your responsibilities as a respiratory care manager. _____

8. Are there any other important administrative activities that you engage in that are not needed on a daily basis?

9. When a patient needs respiratory care services, how is it communicated to your department?

10. Please describe the chain of events that take place from the time your department is notified that a patient needs respiratory care services until the time the patient receives those services:_____

11. How is a patient's respiratory care plan communicated to each respiratory therapist within your department? □ Progress notes in patient's chart □ Informal verbal interaction among RTs □ Formal shift report □ Multi-disciplinary care plan meetings □ Computer records □ Other

(Continued)

12. How is a patient's progress communicated within your department? □ Progress notes in patient's chart □ Informal verbal interaction among RTs □ Formal shift report □ Multi-disciplinary care plan meetings □ Computer records □ Other

13. What kinds of information do you usually store about patients who are receiving respiratory care services?

14. Where is this information stored? (Check all that apply) □ Paper-based chart □ Electronic medical records □ Paper-based files in respiratory care department □ Computerized database in respiratory care department □ Other

15. How would you retrieve information about a patient who is currently receiving respiratory care? _____

16. How are you notified if a patient's treatment regimen is modified (check all that apply)? □ Paging system □ Computer-generated orders (networked to computer in your department) □ RN or clerk telephones your department □ Relayed to RT verbally by MD or RN □ Via Fax □ Other

17. How do you know when a patient no longer needs respiratory care services? _____

18. Do you maintain a record of patients who previously received respiratory care services? □ Yes □ No

19. If you answered yes to the above question, where are these records maintained? □ Electronic medical records □ Paper-based medical records □ Paper-based files in respiratory care department □ Computerized database in respiratory care department □ Other

20. What information might you need about patients you are no longer caring for? _____ _____

21. How would you retrieve information about patients you are no longer caring for? _____ _____

22. Approximately how long would it take you to retrieve this information? □ < 5 min □ 5–10 min □ 10–15 min □ 15–30 min □ 30–60 min □ > 1 hour

23. Where is information regarding departmental and institutional policies and procedures maintained? _____

24. On a day-to-day basis, do you encounter any problems in obtaining necessary information that helps you perform your job efficiently and effectively? □ Yes □ No

25. If you answered yes to the above question, please describe the problems:_____

26. Please indicate by checking the appropriate box, how easy you think it is to use your current system of capturing and maintaining information about respiratory care services. □ Very difficult □ Difficult □ Easy □ Very easy

27. Please explain your answer:_____

28. Please indicate by checking the appropriate box, how useful is your current system of capturing information about respiratory care services, in terms of whether it helps you to obtain necessary information in a timely manner. □ Very useful □ Useful □ Somewhat useful □ Not useful

29. Please explain your answer:_____

30. What resources are available in your department to assist your staff in making patient care decisions (eg, management of status asthmaticus, ARDS, acute chest syndrome, etc) at the point of care?