

RESEARCH PRIORITIES IN RESPIRATORY NURSING

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Introduction

In response to a request from National Center for Nursing Research (NCNR) of the National Institutes of Health that specialty nursing groups establish priorities for funding of nursing research, a task force was established by the Section on Nursing of the American Thoracic Society. The charge to this group was to establish priorities for research in pulmonary nursing across settings and the life span and to disseminate these priorities to the appropriate funding agencies. On November 16, 1988, the American Thoracic Society sponsored a workshop in Chicago to which nurses were invited who had doctoral preparation and who were actively engaged in respiratory nursing research. Work groups were formed based on the following areas of clinical inquiry in respiratory nursing: critical care, chronic care, dyspnea, health promotion, disease prevention, and pediatric care. Through consensus each group established priorities for research based on clinical significance, magnitude of the problem, and potential for impact on patient outcome. The priorities were organized using the published priority funding stages of the NCNR. The priority categories are: symptom assessment and management, functional ability/impairment, technology dependence, and health promotion/disease prevention. In this statement each priority area is described in italics followed by a brief justification summarizing the current state of the science.

Symptom Assessment and Management

Research is needed to develop methods for assessment and management of specific symptoms in critically ill and chronically ill children and adults with pulmonary impairment. Phenomena to be studied include dyspnea, secretion retention, cough, and other associated symptoms. Specific issues to be addressed include:

1. *Dyspnea. Describe the prevalence and impact of dyspnea across disease populations and age groups. Develop standardized methods of measurement that are applicable to both critically ill and chronically ill patients. Define and measure multidimensional aspects of dyspnea. Develop and test the efficacy of specific strategies for reducing dyspnea such as relaxation, exercise, symptom-monitoring, breathing strategies, coping, and self-care strategies.*

2. *Secretion retention. Examine techniques to promote effective cough and secretion clearance such as effects of body position, bronchial hygiene, endotracheal suctioning, and hydration.*

3. *Chronic cough. Examine techniques to manage chronic cough in patients with pulmonary impairment.*

4. *Associated symptoms. Other symptoms to be examined include depression, anxiety, fatigue, and anorexia in acute and chronic pulmonary conditions.*

Dyspnea

Dyspnea is one of the most common symptoms of pulmonary disease, yet the exact prevalence is unknown (1). No epidemiologic studies have been reported that explore the prevalence and incidence of dyspnea across diseases. At present, the prevalence can be estimated only by the prevalence of the diseases in which dyspnea occurs most frequently. Although there are many instruments available to measure dyspnea (2-6), each is limited to measuring one specific dimension of dyspnea such as intensity, and most are not adaptable to both chronically and acutely ill adults and children (2, 3). Indeed, with children, the construct of dyspnea is rarely differentiated from fear, anxiety, or fatigue (7-9). Dyspnea is multidimensional in nature (10) and includes sensory, affective, and cognitive components. At present there is no established satisfactory way of measuring the multidimensional nature of dyspnea. Only one such instrument exists, but it is limited in scope (11). A multidimensional scale for dyspnea is needed to evaluate the true impact of specific treatments for relief of dyspnea.

Strategies for the relief of dyspnea have not been tested individually in randomized controlled designs but applied only in the context of large rehabilitation programs (12). Nonpharmacologic strategies that need testing to prove their efficacy in the relief of dyspnea are pursed-lips breathing (13-15), diaphragmatic breathing (16, 17), desensitization (18, 19), exercise conditioning (20), respiratory muscle training (21), symptom monitoring, and other innovative approaches. Behavioral strategies such as meditation, relaxation (22-24), visualization and feedback (25), imagery, and support groups also require specific testing. Previous studies of interventions focused on dyspnea intensity or severity and have not measured the impact of dyspnea distress. Behavioral strategies may be most effective in reducing the distress of dyspnea, and they ultimately have the greatest impact on physical and psychosocial functioning. The separation of distress from intensity would allow the evaluation of the specific effects of using alternative strategies.

Secretion Retention

Retention of secretions is a common problem for patients with airway infection, hypersecretion, and expiratory muscle dysfunction, and for intubated and tracheostomized patients. Bronchial hygiene techniques such as chest percussion, vibration, postural drain-

age, and hydration are commonly advocated, but there are limited data demonstrating their beneficial and adverse effects (26, 27). For children with cystic fibrosis, physical exercise may be helpful in mobilizing secretions, but further evidence is needed (28, 29). For those with neurologic causes of expiratory muscle weakness, new methods need to be developed and tested to promote effective cough and airway clearance (30). For intubated patients, endotracheal suctioning (ETS) is still the only technique to remove accumulated secretions and debris from the trachea and endotracheal tube. Although extensive research has been conducted on ETS techniques, a number of issues remain, and they are discussed under the section on technology dependency.

Chest physiotherapy in newborns has received less attention than chest physiotherapy in pediatric patients with cystic fibrosis (31-37). A number of adverse effects of chest physiotherapy have been documented including hypoxemia, physical distress, and ineffectiveness of percussion alone. Research directions should focus on identifying consistent methods of application, clinical cues indicating the need for chest physiotherapy, and techniques for minimizing associated complications.

Chronic Cough

Severe chronic cough causes syncope (38, 39), chest and abdominal wall pain, emesis, sleep disruption, personal distress, embarrassment, and social isolation (40, 41). When the underlying condition is maximally treated but the cough persists (such as radiation-induced fibrosis), alternative strategies for decreasing the distress of chronic cough are needed (42). At present, the only approaches are pharmacologic and usually involve the use of narcotics, an unacceptable long-term solution to many patients. Techniques for decreasing the distress associated with chronic cough must be developed and tested.

Associated Symptoms

Patients with pulmonary disease experience additional symptoms including depression, anxiety, fatigue, and anorexia. These symptoms need to be studied systematically to determine their influence on health, daily functioning, and growth and development (43-49). Once the impact of these factors is known, interventions need to be tested.

Functional Ability Impairment

Research is needed to identify factors that are related to functional ability in both chronically and critically ill children and adults with pulmonary impairment. Factors to be considered include: degree of pulmonary impairment, symptom intensity and distress, nutritional status, psychologic-emotional factors, and social support. This includes research to:

1. *Describe the scope of the problem and*

its impact on cognitive function, psychosocial development, family functioning, and interaction.

2. *Examine specific interventions to promote functional ability and limit functional impairment. Particular emphasis should be directed toward the components of pulmonary rehabilitation that promote both psychologic and physical functioning such as exercise training, patient education, breathing strategies, nutritional repletion, energy conservation, bronchial hygiene, and group support.*

In chronic lung diseases it is clear that airflow obstruction, functional ability, and quality of life gradually deteriorate, and patients are not able to perform their normal activities of daily living without excessive discomfort. However, the relationship between airflow obstruction and functional ability is very weak, and little is known about specific factors that influence the decline in functional ability and quality of life in these patients. Exercise intolerance is a major factor that influences functional ability, and for most patients with COPD exercise tolerance is limited by ventilatory capacity (50, 51). Recent findings suggest that respiratory muscle dysfunction and nutritional depletion in patients with COPD may contribute to decrement in lung function and exercise intolerance, but the role of each is not precisely known (52-56). Moreover, functional ability may be influenced by additional physiologic, psychologic, social, economic, and educational factors, and further research is needed to elucidate the contribution of these factors to functional ability and quality of life. Although it is generally accepted that chronic lung disease reduces quality of life, there is little definitive data describing the specific effects of chronic lung disease on cognitive function, psychosocial development, and family functioning (57, 58). Adults and children experience similar problems, but children face additional problems related to growth and development (59, 60).

Interventions for improving functional ability in adults with COPD are usually offered as part of a structured or unstructured pulmonary rehabilitation program and typically include patient education, pursed-lips breathing (13-15, 61, 62), relaxation techniques (23, 25), and exercise conditioning with lower extremity exercises, upper extremity exercises, and inspiratory muscle training. Although patients demonstrate improved exercise tolerance after general exercise conditioning, the mechanism of improvement remains unclear (63-68). Patients also report improvements in breathing after inspiratory muscle training, but the optimal techniques for training have not been established (21, 69-73). There is some evidence that nutritional repletion may improve respiratory muscle function, skeletal muscle strength, and exercise capacity (74-76). Long-term nutritional interventions using traditional approaches with counseling and supplementation have not been effective. Although many of these in-

terventions are employed for children and adults with chronic lung disease, their efficacy has not been rigorously tested.

Health Promotion/Disease Prevention

Research in this area should focus on nurse-delivered interventions designed to help people quit smoking. Smoking cessation should be verified by appropriate biochemical validation and aimed at people in the following settings: hospitals, prenatal clinics, postpartum clinics, ambulatory care clinics, communities, and the work site. Research is needed to:

1. *Describe the process of addiction and relapse with emphasis on the contribution of environmental, affective, physiologic, cultural, ethnic, and social factors.*

2. *Describe the stages of behavioral change as they apply to the transition from chronic smoking to long-term abstinence.*

3. *Examine the effectiveness of strategies to promote smoking cessation during acute illnesses or surgical events and to prevent subsequent relapse.*

Research is needed to develop methods for predicting and preventing pulmonary complications that occur in response to health care problems. This includes research to:

1. *Examine techniques to optimize pulmonary function and prevent pulmonary complications in immunocompromised patients and neurologically impaired patients, postoperative patients, premature infants, and elderly people.*

Smoking Cessation

Cigarette smoking is the most important risk factor for the development of COPD (77). Cigarette smoking is also responsible for 30% of all cancer mortality (78), and lung cancer is the most common tumor worldwide (79). Cigarette smoking is the *single* most important preventable cause of death. Smoking cessation significantly reduces the risk for these debilitating and fatal diseases (77, 78).

In the past, most models of addiction and relapse have focused on univariate factors as contributing to the relapse process. Future examination of relapse must include the contribution of multiple, interacting factors that lead to relapse after initial cessation. These include high-risk, situation-specific cues for smoking (80), neuroendocrine motives for smoking and their interaction with specific situational cues during abstinence (81), and cognitive concern about weight gain as well as actual weight gain as it relates to the relapse process (82). Research must also be conducted that describes the cessation and relapse processes in diverse populations such as Hispanics and blacks (83). Intervention studies that examine the effectiveness of relapse prevention techniques in combination with pharmacologically based approaches are needed (83).

Prochaska and DiClemente (84) have examined how people make the transition to a nonsmoking lifestyle throughout various stages of smoking. These stages include

precontemplation, contemplation, recent quitter, long-term quitter, and relapse. Research is beginning to examine the transitional changes people use as they quit on their own since this group is representative of the smoking population at large (85). Information that is obtained from this population may aid researchers as they design effective smoking cessation and relapse prevention strategies. In addition these findings may have social, legal, and political implications as governing bodies implement legislation to promote long-term abstinence.

Health professionals, especially physicians, have begun to offer advice and counseling about quitting smoking during routine office visits (86). These activities are considered cost-effective and have influenced smoking cessation rates. Pharmacists and dentists have also been involved in advising smokers. Nurse-directed smoking cessation interventions with patients in outpatient settings need to be examined. Nurses are also ideally suited to counsel hospitalized smokers since patients are seen most frequently by nurses who are considered to be credible health professionals (87). However, no information is available regarding the effectiveness of nurse-directed interventions with hospitalized patients.

In addition to smoking cessation, research is needed to address methods of smoking prevention during childhood and adolescence. Little has been done in this area.

Prediction and Prevention of Pulmonary Complications

The majority of the work done to date in this area has been with postoperative patients. Nurses assume primary responsibility for the preoperative preparation of surgical patients, and prevention of pulmonary complications is a major emphasis of postoperative nursing care prevention of pulmonary complications. Further work needs to be done to establish the pathogenic mechanism of atelectasis, specifically the role of diaphragmatic dysfunction in patients undergoing upper abdominal surgery (88). Results of studies done on the prevention and treatment of postoperative complications have been contradictory. Further clarification of techniques for preventing and treating postoperative pulmonary complications is needed and could be provided by studies that separate prophylactic from therapeutic measures, classify patient groups on the basis of their ability to perform deep breathing maneuvers, and compare varying intensities and types of treatment across similar patient groupings (89). Also required is the investigation of teaching techniques and the role of patient learning styles in preoperative instruction for deep breathing and coughing exercises (90).

Research has not adequately addressed the issues of preventing pulmonary complications in immunocompromised patients, neurologically impaired patients, premature infants, and the elderly. Many potential complications are associated with retention of secretions, and

this was discussed earlier. But the prevention and treatment of other complications such as respiratory muscle weakness, nosocomial pulmonary infections, and atelectasis have not been addressed from a nursing perspective.

Technology Dependence

Research in this area should focus on the optimal application of pulmonary technology to improve patient outcomes while preventing iatrogenic complications. Associated with the application of technology across the life-span are the psychosocial and physiologic responses of patients and families to technology as well as the ethical-legal implications of technology. Issues related to the interaction of patient and families with technology need to be explored with particular emphasis on the following:

1. Mechanical ventilation. *Examine issues related to initiation, maintenance, and termination of artificial ventilation, prevention of iatrogenic complications of endotracheal intubation, and endotracheal suctioning such as endotracheal trauma.*

2. Ventilation during transport (emergency transport to the hospital and transport within the hospital system). *Areas of concern include methods of delivering ventilation, maintaining cardiopulmonary stability, and assessing clinical status in critically ill patients during transport.*

3. Ethical issues. *Examine the ethical issues related to initiation, maintenance, and withdrawal of life support technology.*

4. Emotional support and communication. *Study methods of emotional support and communication in technology-dependent patients, for example, communication with intubated patients and support during weaning. Areas of concern for the family of intubated patients must also be explored, particularly as technology-dependent patients are increasingly returning to their homes.*

5. Methods of assessment. *Study appropriate indications for using noninvasive and invasive technology to assess cardiopulmonary function in the critically ill patient such as pulse oximetry, transcutaneous partial pressure of oxygen, end-tidal carbon dioxide, inductive plethysmography, mixed venous oxygen saturation, arterial blood gases, and pulmonary arterial pressures.*

6. Oxygen delivery. *Examine optimal methods of delivering oxygen therapy.*

7. Home mechanical ventilation. *Areas of concern include methods of optimally managing airway care, impact of care on family dynamics, and decision-making regarding initiation and withdrawal of ventilatory support.*

Mechanical Ventilation

Techniques of weaning from mechanical ventilation. The decision as to when a patient is able to sustain the work of spontaneous ventilation after a period of assisted ventilation is critical and should be based on objective criteria. The identification of predictive criteria would promote attainment of a num-

ber of positive patient outcomes including: (1) a reduced risk of premature termination of ventilatory support and recurrent episodes of respiratory failure, (2) a decrease in the number of ventilator-dependent days and the risks associated with prolonged intubation and mechanical ventilation, and, subsequently, (3) a reduction in the costs associated with this form of treatment. The conventionally applied standard weaning parameters have not demonstrated predictive validity. Further investigation of the usefulness of respiratory rate, indicators of respiratory work load and muscle fatigue, and combinations of such indices are required in order to develop clinically useful predictive weaning criteria (91). The effects of different weaning techniques (t-tube, synchronized intermittent mandatory ventilation, and pressure support) on respiratory work load and the patient's subsequent ability to wean need to be compared (92).

Endotracheal intubation. Prolonged endotracheal intubation and tracheostomy results in tracheal tissue trauma caused by the presence of the tube, which is a foreign object, and the pressure generated by the tube cuff, which is required to maintain mechanical ventilation (93-102). Further research is required on methods of monitoring tracheal cuff pressure, techniques to reduce cuff pressure and prevent aspiration, and methods of securing endotracheal and tracheostomy tubes in neonate, pediatric, and adult populations to reduce tracheal tissue damage. In pediatric populations, noninvasive assessment measures of proper tube placement other than X-ray such as ultrasound are needed (103-106).

Endotracheal suctioning. Research findings indicate that patients who receive no form of pre- or posthyperoxygenation (increased concentration of oxygen in the inspired air) with ETS show a significant decline in the partial pressure of arterial oxygen (107-111) or oxygen saturation (112-114). As much as 40% of hypoxemic episodes in critically ill newborns have been associated with endotracheal suctioning (115). Further research is needed to determine the optimal level of hyperoxygenation to be delivered to adults, children, and newborns based on the patient's underlying disease process, level of acuity, and baseline oxygenation status.

Well-controlled studies in the adult examining the optimal number and volume of hyperoxygenation hyperinflation breaths and the hemodynamic consequences of the procedure are needed. Studies in the adult and newborn populations to determine the optimal method of delivery (manual resuscitation bag versus ventilator) of oxygen-enriched breaths while simultaneously monitoring cardiopulmonary hemodynamics alterations are needed to provide empirical data to guide clinical practice.

Studies comparing disconnection from the ventilator for the introduction of the suction catheter (open system) to the modified endotracheal tube adapter (closed system), which permits ventilation and the maintenance of positive end-expiratory pressure

and peak inspiratory pressure during ETS, indicate that the adapter shows great promise as a technique to minimize suction-induced hypoxemia (108, 113, 114, 116-122). However, there are potential risks in closed-system ETS. If the suction flow rate through the catheter exceeds the volume of gas supplied by the ventilator, negative pressure can cause a decrease in functional residual capacity and a tendency toward alveolar collapse (113, 116, 119, 123, 124). Further study is needed in humans to determine the degree of negative pressure developed during closed-system ETS. Research to describe the effect of suction flow rate on negative airway pressure and blood oxygen levels in humans is also necessary since preliminary work has been done only in animal models.

Although the ultimate aim of ETS is the retrieval of secretions to maintain airway patency and adequate oxygenation, few investigators have examined the efficacy of ETS (125, 126) and saline instillation (127) on secretion recovery in adults and in newborns. It is critical that the effect of ETS techniques on oxygenation, hemodynamics, and secretion recovery be examined simultaneously.

Although ETS techniques have been examined extensively over the past 50 yr, little attention has been directed toward determining the constellation of clinical cues indicative of the need for ETS in adults (128, 129). This issue has not been addressed at all in the newborn population, and it requires further investigation across all patient populations.

Methods to prevent trauma and promote repair of the trachea after cessation of endotracheal suctioning and endotracheal extubation requires further investigation in light of the high incidence of tracheal trauma with ETS (125, 126, 130-138) and tracheal anomalies with intubation (96, 97, 99, 102, 139-141).

Lastly, endotracheal suctioning is not a benign procedure, and, consequently, research efforts should be directed toward finding alternatives to endotracheal suctioning such as ultrasonic nebulization, positioning, irrigation, drug therapy, etc., which would reduce the need for frequent ETS.

Ventilation during Transport

There is a paucity of research on ventilatory support during transport; the most critical issue is determining effective modes of ventilation and oxygenation during ground and air transport in critically ill adults and neonates (142-144).

Ethical Issues

Ethical issues associated with the initiation, maintenance, and withdrawal of mechanical ventilation include prognostic indicators of survival (145), long-term survival of patients with acute and chronic lung disease across the life-span (146, 147), cost (148), and quality of life (149, 150). Research is needed that simultaneously examines the parameters in relation to initiation, maintenance, and withdrawal of mechanical ventilation.

Emotional Support and Communication

Artificially ventilated patients are unable to speak, and caregivers frequently are unable to understand needs and concerns, creating major anxiety for critically ill patients. Only four data-based studies have examined communication techniques: an electrolarynx (151), a communication board (152), a computer (153), and a speaking-cuffed tracheostomy tube (154). The need for emotional support to families of children who are or have been artificially ventilated is documented (155), but knowledge of successful interventions is limited. Further research is needed regarding emotional support and communication in the artificially ventilated patient.

Methods of Assessment

Currently, a number of invasive and noninvasive technologies exist to assess pulmonary function: arterial blood gases, mixed venous oxygen saturation, pulmonary artery pressures, transcutaneous arterial oxygen, pulse oximetry, end-tidal carbon dioxide, and inductive plethysmography. The major focus in this area should be on the reliability and validity of noninvasive assessment techniques in comparison with invasive measures of the variable under investigation, iatrogenic complications of these techniques, and the appropriateness of use during the transport of critically ill patients.

Oxygen Delivery

Transtacheal oxygen delivery is a newer method of delivering oxygen, and it requires further comparison with traditional delivery methods. Preliminary data suggest that oxygenation can be maintained with lower flow rates and that psychosocial problems associated with traditional methods of delivery are minimized (156, 157). Further research is needed on oxygen delivery methods that are unobtrusive, easily concealed, and require less oxygen. Issues such as patient mobility, acceptance, compliance, and cost need to be explored in relation to newer oxygen delivery methods (158).

Home Mechanical Ventilation

With increasing frequency, chronically ill children and adults are being maintained on home ventilators. This has created problems with caregiving resources, family functioning, and quality of life, but these issues have not been studied adequately.

This Statement was prepared by an Ad Hoc Committee of the Scientific Assembly on Clinical Problems, Section on Nursing. Members of the Committee were:

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