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Respiratory Therapy Department Credentialing and Educational Level Impact on Patient Outcomes: A Pilot Study

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Abstract

Background: AARC "2015 and Beyond" conferences accepted 2020 as a target for RRT credential and baccalaureate degree being minimum requirements for entry into practice. The purpose of this study was to explore hiring practices related to credentialing and education level, assess progress towards goals of the AARC consensus conferences, and the relationship between patient outcomes, RRT credential, and having a baccalaureate degree. **Methods:** An exploratory survey was developed to evaluate education levels, credentialing status, and hiring practices by four clinical partners in a metropolitan medical center. Clinical partners were defined as clinical affiliates of a baccalaureate entry-level education program recruited to help with the development of a survey. The partners were respiratory therapy department managers at four different hospitals located in a large metropolitan area in Texas. After the survey was developed, the clinical partners completed it and the researchers reviewed the clinical partners' responses to the survey, demographics, and respiratory-related patient outcomes. This allowed for inferences to be made from collected survey data. The survey was then distributed to members of the AARC Management Section. **Results:** The management section was surveyed (n =1583), with 67 responses collected. Seventy-five percent of department staff held RRT credentials, forty-five percent of hospitals offer a career advancement program, and ninety-one percent of departments did not differentiate clinical tasks by educational preparation. **Conclusions:** The clinical partner data showed a trend towards better respiratory-related outcomes associated with the RRT credential and higher education. Most survey participants hire RRT's and do not offer career advancement programs. The average number of therapists with a baccalaureate degree was 27%. Most departments require a baccalaureate degree or higher for management positions. Clinical partners all had > 90% of their departments RRT credentialed, > 33% with baccalaureate degrees, and respiratory-related outcomes were at or above the national average. One clinical partner with 99% RRT and 34% of staff with baccalaureate degrees exceeded the national average on three of five respiratory-related outcomes evaluated.

Keywords: Respiratory therapy education, career advancement program, advancement ladder, advanced degrees, educational impact on patient outcomes

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Introduction

The third conference of the AARC "2015 and Beyond" task force accepted 2020 as a date for achieving goals of having the RRT credential required for entry into clinical practice and the baccalaureate degree as the minimum educational requirement. These recommendations were driven by significant changes in the US Health Care system and the technological changes that significantly increased the complexity of care provided by respiratory therapists.[1] Increased demands on respiratory care practice brought about by technological change, evidence-based clinical decision making, and the need to work collaboratively with other health care professionals have revealed the importance of enhanced levels of formal education for respiratory therapists.[2] The complexity of mechanical ventilation and critical care patients continues to increase at an astounding pace. The expectation that respiratory therapists be experts in providing mechanical ventilation requires advanced education.[3] Although nurses and physicians are intimately involved in the care of patients on mechanical ventilation, nursing and medical schools devote a small portion of their curricula to mechanical ventilation technology. In addition, the growth of practice specialties, such as respiratory care, makes it unfeasible for nursing schools to prepare graduates for this specialized practice in critical care comprehensively.[4] The COVID-19 pandemic highlighted the need for highly trained therapists, given the increase in the number of patients requiring mechanical ventilation due to the pandemic.

There was a report of training fourth-year medical students to be able to function as respiratory therapist extenders to address respiratory therapist shortage during the pandemic.[5] The rationale of this model was that medical students' educational preparation included knowledge of respiratory physiology, pathophysiology, and clinical exposure and experience that would help prepare for the additional specialty training to provide respiratory care procedures. This is a recent example of why there is a need for additional baccalaureate-prepared therapists to enter the workforce.

There are reasons that graduates of baccalaureate degree programs would have advantages in job placement. These advantages include greater competitiveness for available entry-level positions, the ability to participate in a career advancement program, and the ability to promote advanced positions within an RT department. For the purpose of this study, a career advancement program is defined as a structured system created by institutions to provide staff with career and education advancement opportunities while remaining in the clinical setting, providing direct patient care. It is used to recognize professional development and differentiates levels of expertise and contribution. Advanced positions may include managerial, clinical preceptors, or advanced practitioner roles. Some hospitals offer career advancement programs that allow therapists to be promoteed, and many use continuing education and advanced degrees as part of the promotion process. An AARC survey in 2003 reported that 34% of managers preferred baccalaureate-prepared over associate degree entry-level therapists.[6] A recent study found that 70% of managers preferred to hire new graduates with a baccalaureate degree in respiratory therapy. Over 40% of participants indicated that baccalaureate-prepared graduates communicated effectively and worked effectively as part of a health care team and provided evidence-based quality patient care.[7] The most commonly cited reasons for preferring the baccalaureate degree for new graduate respiratory therapists were related to providing value to the respiratory therapy department, teamwork, professional advancement, and effective communication skills.[7] Over the last 40 years, researchers have studied the association between nursing education levels and the quality of care provided.[8-9] Hospitals with a higher percentage of RNs with baccalaureate or higher degrees had a lower mortality rate with patients with heart failure, lower incidence of decubitus ulcers, lower thrombosis-related diseases, and shorter length of stay.[10] A related study found that with an increased percentage of baccalaureate-level nurses, there was a reduction in the number of patient falls.[11]

The American Nurses Credentialing Center awards Magnet status to hospitals where nursing care provides excellent patient outcomes. The nursing profession has published data supporting improved patient outcomes when nurses have higher educational degrees[8-11]. The American Nurses Credentialing Center awards recognition to hospitals that deliver excellent patient outcomes and meet staffing and educational requirements for nurses. Magnet status is a recognition given to hospitals that meet exemplary professional practice, structural empowerment that can affect change in practice, and empirical quality results.[12] Empirical quality results are outcomes that demonstrate continuous quality improvement. The same policies supporting career development and advancement must be used throughout the system to achieve exemplary professional practice. In the area of structural empowerment, the same educational opportunities, including career advancement programs, must exist across the entire system. Also, 100% of nurse managers and leaders must have a baccalaureate degree or higher in nursing. An example of a quality improvement assessment are the Hospital Compare datasets. The data allows for the comparison of Medicare-certified hospitals across the country. Medicare collected data are used to promote the reporting of quality of hospital care, facilitate informed health care decisions for the public, and improve the overall quality of care in US hospitals.[13] Quality outcome metrics can be filtered by geographic region, provider, and hospital size. Hospitals obtaining Magnet status for nursing quality may also apply similar standards to respiratory care departments.

There is a gap in the literature for the association between respiratory care education levels and patient outcomes. The 2017 AARC Human Resources (HR) survey revealed that 56% of practicing respiratory therapists have a bachelor's degree or higher or were working on completing a bachelor's degree.[14] The purpose of this pilot study was to determine if there were any relationships between respiratory therapists' hiring practices and educational requirements and respiratory-related patient outcomes. The study also examined patient outcomes associated with RTs having an advanced degree, along with being a registered respiratory therapist.

Methods

Survey

This study employed an online survey to explore current Respiratory Care department hiring practices regarding staff credentialing and educational preparation. The Midwestern State University (Wichita Falls, TX) Institutional Review Board approved the study (#18121701). The deployed survey was developed after a review of the literature and consultation with four clinical partners who completed the survey. Clinical partners were defined as clinical affiliates of a baccalaureate entry-level education program recruited to help with the development of a survey. The clinical partners were respiratory therapy department managers at four different hospitals located in a large metropolitan area in Texas. The researchers reviewed the clinical partners' responses to the survey, demographics, and respiratory-related patient outcomes. This allowed for inferences to be made from collected survey data. The AARC Executive Committee also reviewed and approved the survey before distribution.

The survey was distributed to the members of the AARC Management Section via an AARC Connect email with a SurveyMonkey link. The survey was open from September 27, 2019 –October 17, 2019, and three reminders were sent to the section members before the close of the survey. In October 2019, the Management Section had a membership of 1583 members. The email with a link to the survey served as informed consent of the purpose of the survey.

The survey consisted of 10 questions. The survey focused on hospital size, Magnet status, total department employees (full-time and part-time respiratory therapists), number of staff holding a baccalaureate degree, and number of staff who have the RRT credential. The survey also addressed whether or not the department employed a career advancement program. In addition, it addressed if a career advancement program existed, did having a baccalaureate degree affect advancement, are clinical tasks differentiated by degree level, did departmental management position require a baccalaureate or graduate degree, did the hospital hire BSRN nurses only, and was the hospital considered an academic teaching hospital (see Appendix A). This was relevant to the study to explore the culture of the hospitals to determine if they valued advanced academic preparation.

Clinical Partners and Pilot Analysis

The pilot survey was developed in consultation with the clinical partners of the respiratory care program with which one of the authors is affiliated. These clinical partners of a baccalaureate entry-level education program were recruited to help with the development of a survey that would not be onerous and would be more likely to be completed by members of the AARC management section. The clinical partners were the content experts and the field test related to the data being gathered. The rationale for the selection of these clinical partners to participate in the development of the survey was that the managers had insight into hiring practices and demographic data collection. The clinical partners were respiratory therapy department managers at four different hospitals located in a large metropolitan area in Texas. The managers of the four clinical partners completed the pilot survey, and the affiliate hospitals were compared for respiratory care-related outcomes in the Medicare Hospital Compare datasets.[13] Outcomes compared were COPD mortality rate, pneumonia mortality rate, postoperative respiratory failure, and pneumothorax due to medical treatment. All partner institutions were greater than 200-bed capacity, had departments with more than 50 employees, 90% of staff held the RRT credential, and more than 30% of staff held a baccalaureate degree. These characteristics of the clinical partners were the rationale used for grouping survey data.

Hospital Compare

Hospital Compare is a publicly available database that the Centers for Medicare and Medicaid Services (CMS) has developed and maintains for hospital quality improvement, public reporting, and payment purposes.[13] Data files include the type of outcome measure, specific diagnosis, and provider demographics (hospital size and geographic region). Scores for different outcome measures are provided for individual providers compared to the national benchmark. Scores were compared for the outcomes of COPD mortality rate, pneumonia mortality rate, postoperative respiratory failure, and pneumothorax due to medical treatment for the reporting period of 2014-2017. The data were also queried to group providers based on the number of licensed beds as either less than or greater than 200 beds. Scores for COPD mortality rate, pneumonia mortality rate, postoperative respiratory failure, and pneumothorax due to medical treatment for the reporting period of 2014-2017 were compared based on hospital size.

Data Analysis

Survey data were downloaded and grouped into categories for bed size as <200 or > 200 beds. From descriptive statistics of the respondents, departments on average had 75% of staff hold the RRT credential, thus in subsequent categorical analysis, RRT credential was grouped as < or > 75%. Similarly, on average, 30% of staff held a baccalaureate degree: categories of < or > 30% were established for a baccalaureate degree. Department size was categorized as <25, 25-50, and >50. The number and percent of responders were reported as a categorical variable and compared with the chi-square test or Fisher's exact test for those with an expected value of less than five. Mean (standard deviation, SD) was presented for continuous variables and compared with a t-test. Clinical partner's outcomes were assessed in the Hospital Compare Dataset. The Hospital Compare dataset was also queried to find national average rates for respiratory care patient outcomes of hospitals less than and greater than 200 beds. All analyses were performed with SAS 9.4 (SAS Inc., Cary, NC).

Results

Clinical Partner Outcomes

The respiratory-related patient outcomes for the clinical partners were analyzed in the Hospital Compare database. The authors chose to compare the relationship between the data from the clinical partners and the survey respondents since the data from the survey participants was not retrievable as the surveys were anonymous. The relationship that was explored was outcomes and hiring practices of the clinical partners for the study. They were compared to the national benchmark, as well as hospitals with less than 200 beds and those with greater than 200 beds. All four of the clinical partners were greater than 200 beds in size. The percentage of staff with the RRT credential and baccalaureate degree were, like those of the survey respondents. The respiratory care-related outcomes compared were COPD 30-day mortality rate, pneumonia mortality rate, postoperative respiratory failure, and pneumothorax due to medical treatment (Table 1). One clinical partner (Partner D) with 99% of the department holding the RRT credential and 34% of RT staff with a baccalaureate degree rated better than the national average in three outcome categories, and the other partners had outcomes no different than the national average. The respiratory-related outcomes for hospitals categorized by size (< 200 beds or >200 beds) are shown in Table 2. There was a trend to lower COPD 30-day mortality scores in larger hospitals, although not statistically significant. Pneumonia mortality score was significantly lower in larger hospitals. Postoperative respiratory failure scores were higher in larger hospitals. One possible explanation for these higher scores could be related to the case mix of larger hospitals.

Of the 1583 AARC management section members surveyed, 67 responded to all survey questions (4.2%). Descriptive statistics of the respondents for hospital size and department size are shown in Figure 1.

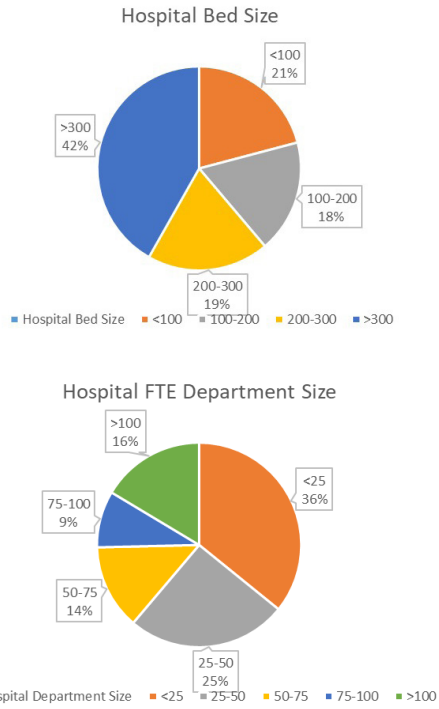
Hospital Size

Hospital bed size was placed into two categories <200 and > 200 beds. In this analysis, of the 67 respondents, 41 (61%) were greater than 200 beds, and 26 (38.8%) were less than 200 beds. As seen in Table 3, hospitals larger than 200 beds were more likely to hold Magnet status, have larger RT departments, offer clinical advancement ladders, be teaching hospitals, have a greater percentage of staff with a baccalaureate degree, and have a greater percentage of staff with the RRT credential ($p < 0.05$).

Educational Background

From the descriptive analysis of the 67 respondents, it was noted that, on average, departments had 27% of staff with a baccalaureate degree. This was like the pattern seen in our clinical partners. Therefore, the respondents were placed in categories of having <30% or >30% of their staff with a baccalaureate degree. Of the 67 respondents, 44 (65.6%) had less than 30% of the RT staff with a baccalaureate degree, and 23 (34%) had >30% staff with a baccalaureate degree. Departments with >30% of RT staff holding a baccalaureate degree were more likely to be in larger hospitals, be in hospitals with Magnet status, have larger departments, and be in academic teaching hospitals (Table 4: $p < 0.05$).

Figure 1: Respondent demographics by hospital bed size and Respiratory Care department size



RRT Credential

The descriptive analysis of respondents revealed that, on average, 75% of department staff held the RRT credential. Therefore, the respondents were placed in categories of <75% of RT staff with RRT credentials and >75% of staff with RRT credentials. Of the 67 respondents, 26 (38.8%) had less than 75% of staff holding the RRT credential, and 41 (61%) had >75% of staff holding the RRT credential. Departments with >75% of staff holding the RRT credential were more likely to be in larger hospitals, be larger RT departments, and be in teaching hospitals (Table 4: $p < 0.05$). There was a tendency for departments with >75% RRT credential to offer advancement programs, but this was not statistically significant.

Discussion

Health care continues to evolve, with the emphasis being placed on patient safety, cost-effective care, and quality health care services. This pilot study found that, on average, 27% of department staff held a baccalaureate degree or higher. In addition, it was observed that departments with >30% of RT staff holding a baccalaureate degree were more likely to be in larger hospitals, be in hospitals with Magnet status, have larger departments, and be in teaching hospitals. Departments with >75% of staff holding the RRT credential were more likely to be in larger hospitals, hospitals with Magnet status, larger RT departments, and teaching hospitals.

In this analysis, the average number of therapists with a baccalaureate degree was twenty-seven percent. Researchers have explored the desired educational levels for respiratory

Table 1. Outcome scores for Clinical Partners Compared to National Benchmarks

Measurement	National	Clinical Partner			
		A	B	C	D
% staff with RRT	NA	100	99	94	99
% staff with BS degree	NA	33	50	38	34
Certified number of beds	NA	740	1034	975	1299
COPD 30-day mortality[§]	8.5	9.4 (7.1-12.4)	7.7 (5.3-10.7)	7.8 (5.3-11.2)	6.9 (5.4-8.8)
Pneumonia mortality[§]	15.6	13.3 (10.9-16.0)	14.1 (11.5-17.3)	16.8 (12.4-22.2)	9.9 (8.6-11.4)*
Post-operative respiratory failure[§]	7.35	4.01 (0-9.15)	6.33 (2.38-10.28)	7.65 (0.56-14.74)	3.34 (1.22-5.47)*
Post-operative pneumothorax[§]	0.27	0.3 (0.1-1.49)	0.30 (0.13-0.47)	0.34 (0.12-0.57)	0.20 (0.06-0.34)

Estimated score and 95% confidence interval of estimation was presented

***** The estimated score significantly lower than national benchmark (better than national average)

Table 2. Comparison of outcomes between hospitals with ≥ 200 and < 200 certified beds

Measurement	All	Certified beds ≥ 200	Certified beds < 200	p-value
COPD 30-day mortality				
Number of hospitals	3533	1356	2177	
Mean (SD)	8.54 (1.11)	8.51 (1.28)	8.55 (0.99)	0.245
Below average	1797 (50.9%)	721 (53.2%)	1076 (49.4%)	0.056
Equal to average	127 (3.6%)	41 (3.0%)	86 (4.0%)	
Above average	1609 (45.5%)	594 (43.8%)	1015 (46.6%)	
Pneumonia mortality				
Number of hospitals	4134	1482	2652	
Mean (SD)	15.70 (2.10)	15.56 (2.24)	15.77 (2.02)	0.002*
Below average	2042 (49.4%)	749 (50.5%)	1293 (48.8%)	0.301
Equal to average	91 (2.2%)	27 (1.8%)	64 (2.4%)	
Above average	2001 (48.4%)	706 (47.6%)	1295 (48.8%)	
Postoperative respiratory failure				
Number of hospitals	2736	1351	1385	
Mean (SD)	7.52 (2.71)	7.76 (2.88)	7.28 (2.51)	<0.001*
Below average	1587 (58.0%)	699 (51.7%)	888 (64.1%)	<0.001*
Equal to average	5 (0.2%)	2 (0.1%)	3 (0.2%)	
Above average	1144 (41.8%)	650 (48.1%)	494 (35.7%)	
Postoperative pneumothorax				
Number of hospitals	3177	1395	1782	
Mean (SD)	0.27 (0.05)	0.27 (0.07)	0.27 (0.04)	0.005*
Below average	1728 (54.4%)	709 (50.8%)	1019 (57.2%)	<0.001*
Equal to average	498 (15.7%)	113 (8.1%)	385 (21.6%)	
Above average	951 (29.9%)	573 (41.1%)	378 (21.2%)	

A score of each measurement was presented with the original score (continuous) and a comparison with the national average (categorial). A continuous variable was compared with a t-test, and categorical data were compared with a chi-square test.

Table 3. Comparison of hiring and staffing patterns by hospital size.

Category	All	Hospital's Bed Capacity		p-value
		Bed Size <200	Bed Size ≥ 200	
No. of Subject	**67**	**26**	**41**	
Magnet Status				
No	44 (65.7%)	24 (92.3%)	20 (48.8%)	0.0003*
Yes	23 (34.3%)	2 (7.7%)	21 (51.2%)	
Number of respiratory therapists				
<25	24 (35.8%)	20 (76.9%)	4 (9.8%)	<0.0001*
25-50	17 (25.4%)	6 (23.1%)	11 (26.8%)	
>50	26 (38.8%)	0 (0.0%)	26 (63.4%)	
Offer advancement ladder program				
No	37 (55.2%)	19 (73.1%)	18 (43.9%)	0.0193*
Yes	30 (44.8%)	7 (26.9%)	23 (56.1%)	
Task differentiated between degree				
No	61 (91.0%)	25 (96.2%)	36 (87.8%)	0.3925
Yes	6 (9.0%)	1 (3.8%)	5 (12.2%)	
Hold BS or higher to work in management				
No	15 (22.4%)	9 (34.6%)	6 (14.6%)	0.0559
Yes	52 (77.6%)	17 (65.4%)	35 (85.4%)	
Only hire BSRN				
No	46 (68.7%)	20 (76.9%)	26 (63.4%)	0.2454
Yes	21 (31.3%)	6 (23.1%)	15 (36.6%)	
Teaching hospital				
No	33 (49.3%)	20 (76.9%)	13 (31.7%)	0.0003*
Yes	34 (50.7%)	6 (23.1%)	28 (68.3%)	
Staff member with BS degree, %	27.16 (23.72)	15.46 (13.24)	34.59 (25.95)	0.0002*
Staff member with RRT credentialed, %	74.27 (27.78)	52.92 (29.97)	87.80 (15.11)	<0.0001*

*P<0.05 "Staff member with BS degree, %" and "Staff member with RRT credential,%" were reported as a continuous variable (range 0-100). Mean (standard deviation, SD) are presented for continuous variable and compared with t-test.

Table 4. Comparing the facility status by educational degree and RRT credential.

Category	All	Staff with BS degree			Staff with RRT credential		
		<30%	≥30%	p-value	<75%	≥75%	p-value
No. of Subject	**67**	**44**	**23**		**26**	**41**	
Hospital's Bed Capacity							
<200	26 (38.8%)	23 (52.3%)	3 (13.0%)	0.0018*	18 (69.2%)	8 (19.5%)	<0.0001*
≥200	41 (61.2%)	21 (47.7%)	20 (87.0%)		8 (30.8%)	33 (80.5%)	
Magnet Status							
No	44 (65.7%)	34 (77.3%)	10 (43.5%)	0.0057*	22 (84.6%)	22 (53.7%)	0.0093*
Yes	23 (34.3%)	10 (22.7%)	13 (56.5%)		4 (15.4%)	19 (46.3%)	
Number of respiratory therapists							
<25	24 (35.8%)	21 (47.7%)	3 (13.0%)	0.0007*	14 (53.8%)	10 (24.4%)	0.0175*
25-50	17 (25.4%)	13 (29.5%)	4 (17.4%)		7 (26.9%)	10 (24.4%)	
>50	26 (38.8%)	10 (22.7%)	16 (69.6%)		5 (19.2%)	21 (51.2%)	
Offer advancement ladder program							
No	37 (55.2%)	25 (56.8%)	12 (52.2%)	0.7166	18 (69.2%)	19 (46.3%)	0.0663
Yes	30 (44.8%)	19 (43.2%)	11 (47.8%)		8 (30.8%)	22 (53.7%)	
Task differentiated between degree							
No	61 (91.0%)	41 (93.2%)	20 (87.0%)	0.4056	25 (96.2%)	36 (87.8%)	0.3925
Yes	6 (9.0%)	3 (6.8%)	3 (13.0%)		1 (3.8%)	5 (12.2%)	
Hold BS or higher to work in management							
No	15 (22.4%)	12 (27.3%)	3 (13.0%)	0.1846	7 (26.9%)	8 (19.5%)	0.4782
Yes	52 (77.6%)	32 (72.7%)	20 (87.0%)		19 (73.1%)	33 (80.5%)	
Only hire BSRN							
No	46 (68.7%)	33 (75.0%)	13 (56.5%)	0.1216	21 (80.8%)	25 (61.0%)	0.0888
Yes	21 (31.3%)	11 (25.0%)	10 (43.5%)		5 (19.2%)	16 (39.0%)	
Teaching hospital							
No	33 (49.3%)	28 (63.6%)	5 (21.7%)	0.0011*	17 (65.4%)	16 (39.0%)	0.0355*
Yes	34 (50.7%)	16 (36.4%)	18 (78.3%)		9 (34.6%)	25 (61.0%)	

*P<0.05

therapists.[6-7] No one, to our knowledge, has reported outcomes associated with advanced educational degree respiratory therapists. It is difficult to obtain this type of data since the majority of practicing respiratory therapists are at the associate degree level, and although at initial hire, the baccalaureate degree can offer a competitive advantage after hire, there are few incentives for respiratory therapists to advance their degrees. Findings from this study revealed that ninety-one percent of respiratory therapy departments do not differentiate clinical tasks between degrees. This is likely due to the low number of therapists with either a baccalaureate or master's degree, given that most educational programs are at the associate degree level.[15] When evaluating the respiratory-related patient outcomes of our clinical partners, all except one had outcomes equal to the national benchmark, and one had better outcomes than the national benchmark. Although multiple variables can account for differences in patient outcomes (including case mix, patient volume, and patient comorbidities), staffing patterns and hiring practices can also contribute to outcomes. When the Hospital Compare dataset was queried for outcomes based on hospital size (less than or greater than 200 beds), scores for two of the respiratory outcomes worsened when hospital size decreased (COPD 30-day mortality and pneumonia mortality). One possible interpretation of that observation could be the educational preparation and credentialing trend described by our survey data for hospitals with less than 200 beds contribute to the score. This finding would support expanding the number of baccalaureate degree programs in the US. This interpretation would also support the AARC position statement on education recommending that respiratory therapists entering practice in 2030 and after obtaining a minimum of a baccalaureate degree in respiratory therapy or health sciences with a concentration in respiratory therapy and earn the RRT credential.[16]

The COVID-19 pandemic has also highlighted the importance of appropriately trained therapists to provide for patient safety and improved outcomes. As a result of ventilator shortage, one idea that was offered as a possible solution in case of a surge was to ventilate as many as four patients with a single ventilator. It took the input from clinical experts, many of whom were respiratory therapists with graduate degrees, to point out the danger and impracticality of the idea.[17] Another example of the need for increased training for the entry-level therapist was a training model that took fourth-year medical students and trained them to be respiratory therapist extenders during the COVID-19 surge.[5] The authors of the study reasoned that the didactic and clinical training of the medical students better prepared them for intensive training in basic respiratory care modalities. However, advanced respiratory therapy education is needed in these situations. Respiratory therapists' management of chronic and acute respiratory failure is proving to be a fundamental asset for managing patients during the COVID-19 epidemic, and this will likely not be a short-term matter.[18] High mortality rates reported related to mechanical ventilation in hospitals with increased caseloads of mechanical ventilation could be related to the availability of respiratory therapists. The need for the advanced education of respiratory therapists around the world will continue to rise.

Limitations

This study was subject to several limitations. The clinical outcomes data is subject to individual variables and institutional variables. The individual case mix at some hospitals may have multiple comorbidities and could have been a higher risk regardless of the care they received. On the other hand, some institutions could be limited by resources other than staff training and educational level. There can also be geographic differences in outcomes, and all our clinical partners came from the same geographic region. The geographic region of survey participants was not collected. The sample of respiratory therapy managers and directors was one of convenience, using AARC Management Section Connect email. Also, the results and conclusions are subject to non-response bias since respondents may differ significantly from non-respondents and are limited by a low response rate. The clinical partners self-reported the facility demographics at their hospitals: this could be subject to inaccuracies due to a lack of direct knowledge. It is also important to note that it is difficult to obtain data when such a small number of managers and directors participate in surveys. As a profession, we need to encourage respiratory department leaders to participate in data collection. There is a need for more studies on patient outcomes and the relationship to respiratory therapy education levels.

Conclusions

Many participants in this pilot study hire therapists who have or will obtain the RRT credential to work in their departments. Most departments surveyed do not offer career advancement programs. The average number of therapists with a baccalaureate degree was 27%. The majority of departments require a baccalaureate degree or higher for management positions. Definite conclusions cannot be made about the effect of educational background on outcomes due to the study sample size: however, there was a statistically significant difference in therapists' credentialing and educational level between hospitals greater than 200 beds and those less than 200 beds.

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Appendix A

Survey

1. What is your hospital's bed capacity?
    a. <100
    b. 100-200
    c. 200-300
    d. >300
2. Is your hospital a Magnet status hospital?

    Y/N
3. How many of your FT and PT respiratory therapists do you have on staff?
    a. <25
    b. 25-50
    c. 50-75
    d. 75-100
    e. >100
4. How many of your staff members hold a bachelor's degree?

(FILL IN THE BLANK)

5. How many of your staff members are RRT credentialed? (FILL IN THE BLANK)
6. Do you offer an advancement ladder program for your staff? Y/N
    a. If you answered yes; does having a BS degree affect your advancement? Y/N
7. Are tasks differentiated between degree levels? Y/N
8. Do you have to hold a BS or higher to work in management within your department? Y/N
9. Does your hospital hire **BSRN** nurses only? Y/N
10. Is your hospital considered a teaching hospital? Y/N

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Perspectives of Graduates from an Online Respiratory Care Degree Advancement Program

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Abstract

Background: The number of online degree advancement programs (DAPs) in respiratory care that facilitate Registered Respiratory Therapist (RRT) from an associate degree to a bachelor's degree is increasing. The perceived value of the transition to a bachelor's degree for RRTs has not been extensively studied. This study examines perceptions of the added value of a bachelor's degree to both personal and professional development as held by students who graduated from an online baccalaureate DAP between 2015-2018. **Methods:** A mixed-methods approach included a web-based survey and virtual interviews were used to collect data from the graduates and both descriptive information and perceptions were evaluated and compared. A 39-item survey was emailed to graduates (n=391). Ten survey respondents were randomly selected from among those who volunteered to participate in open-ended interviews. Descriptive statistics and thematic analysis were conducted on the graduates' responses. **Results:** The survey completion rate was 26.7%. Graduates reported perceptions that the completion of a baccalaureate degree in Respiratory Care contributed to an increased understanding of medical research, which enhanced their ability to understand and apply the information. Additionally, graduates reported an improved ability to communicate to patients' family members and other healthcare providers. Finally, participants reported an increase in confidence and an overall sense of pride. **Conclusion:** Graduates who completed a baccalaureate degree in Respiratory Care through an online DAP reported perceptions of a positive impact on several clinical skill sets: the improvement in competencies also increased their perceived value as an essential healthcare worker.

Keywords: online degree advancement, respiratory care education, bachelor's degree outcome, clinical competencies, respiratory therapists, graduate perspect

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Introduction

Respiratory Care degree advancement programs (DAPs) are designed for working therapists who have earned an associate degree and the Registered Respiratory Therapist (RRT) national credential. These programs are designed to add both breadth and depth through a bachelor degree with expanded learning outcomes often underscored with emphases on clinical knowledge: critical thinking skill: interpersonal and interprofessional communication: evidence-based medicine: research methods and analysis, and professional leadership.[1] The push towards degree advancement is a combination of increasing complexity and capability of respiratory care technology, the need for Respiratory Therapists (RTs) to think critically and consult on appropriate application of respiratory care devices, as well as to communicate effectively as professionals.[2] "Too few associate-degree RC programs teach their students how to read and critique research, understand the statistical data, and search for evidence to support respiratory care practice", as shown by a report indicating that 80% of baccalaureate RC programs teach these skills compared to just 41% of associate programs.[3] There is little argument that the growing level of content, competencies, and decision making skills for an RT are difficult to fit into the curriculum limitations of an associate degree.[3] However, moving most of the profession to the baccalaureate entry-level poses several challenges. Despite a call by the American Association of Respiratory Care (AARC) to do so, and a large percentage of employers indicating a preference for baccalaureate RTs, progress over the last 6 years to increase the number of entry-to-practice bachelor's degree programs has been slow.[4,5] Additionally, despite the development of DAP-specific accreditation standards by the Commission on Accreditation for Respiratory Care (CoARC) in 2015, only 19 of the approximately 60 existing DAPs across the country offered at either a 4-year college or university had achieved accreditation as of July 2019.[6] Underscoring these challenges, and perhaps the largest hindrance to the transition of many academic programs from an associate level to a baccalaureate level degree, may be the lack of differentiation in credentialing requirements set forth by the National Board for Respiratory Care (NBRC). Graduates of associate-level degree programs remain eligible to take the national credentialing exam as well as achieve licensure to practice in most states. The lack of delineation between the associate level respiratory therapist (ASRT) and baccalaureate level respiratory therapist (BSRT) in terms of either skillset or licensing has therefore been difficult to quantify: likely slowing momentum of any definitive shift in entry-level requirements for the profession. The increase in the number of online DAPs across the United States seems to be a direct response to the most recent promotion of degree advancement within the profession by the AARC.[2] Although the overarching goal of these programs is to increase the number of working respiratory therapists (RTs) holding a baccalaureate degree, the rise of these self-supported programming models should also be considered a barometer of the financial instability of publicly funded higher education. The financial instability of appropriated money is likely another issue contributing to the dwindling numbers of entry-level, face-to-face programs offering a baccalaureate degree in RC. As of 2019, there were 448 RT degree programs under accreditation review by CoARC: the majority of which (54%) were Associate of Applied Science (AAS) degrees.6 AAS programs began to outnumber Associate of Science (AS) programs in 2015 and as of 2019, AS programs accounted for 27% of all degree types offered.[6] This means that 81% of the RT-specific, CoARC accredited, educational options to potential RTs are at the Associate level. Therefore, in order to obtain a BS degree in RC, a majority of students must look to DAPs for an accessible way to advance their RC education.

Although there has been a proliferation of online undergraduate DAPs in recent years, there is little known concerning graduates' perceptions about the added value of a bachelor's degree acquired through a DAP. With the growing number of RTs choosing the DAP path to advance their education, having outcome data from these graduates would benefit the profession's understanding of both the quality and efficacy of DA programs in meeting students' professional expectations. The purpose of this study was to understand how students who earn a baccalaureate degree through an online DAP perceived the benefit of the advanced degree while working in the field.

Methods

This mixed-methods study used a phenomenological research design to explore how people who graduated from a DA program perceived the value of the degree in relation to career trajectory. This study was conducted at a mid-sized, four-year, public metropolitan university located in the northwest United States. Participants were identified as those students who graduated from an online ASRC-BSRC DAP between the years of 2015 and 2018 (N=382). All participants who entered the DAP earned an associate-level degree and RRT credential.

Participants were contacted via email to participate in a web based Qualtrics™ survey about the experiences and perceptions of completing an online DAP. Those participants who opted to complete the survey (N=102: 26.7%) were also asked to indicate interest in participating in a semi-structured, qualitative interview process as an extension of the survey. From this pool, ten respondents were randomly selected to participate in a virtual interview to expound upon their experiences. Survey data gathered descriptive data of the graduates whereas the semi-structured qualitative interviews were conducted via telephone and recorded and transcribed using an online software recording and transcription program (Rev.com, 2019). This project received institutional review board (IRB) approval.

The survey instrument was developed with the aim of objectively describing the changes graduates experienced in skills and knowledge, as well as career impact following the achievement of a bachelor's degree. Descriptive data included information related to career pathways within RC including work history, educational history, perceptions of career advancement, and perceived opportunities within the field. The general premise of the interview questions was to create open-ended conversations and dialogues around the following

questions: "What are the lived experiences of achieving a bachelor's degree through the degree advancement route?", "What situations influenced this experience?", and "What is the essence of the experience for you?"

Data Analysis

Descriptive analyses including frequency distribution was performed to gather general trends and synthesize a demographic profile. The interview data were analyzed using qualitative methods. After transcriptions were reviewed in depth, initial broad contexts were generated to see if themes emerge which could then be coded. As themes emerged, they were organized to describe the phenomenon. Bracketing was done to help decrease researcher bias that arose during the process. The final step in the data analysis was to bring the survey and interview data together which is shared in the following sections.

Results

A total of 102 (26.7%) survey responses were included in analyses. All respondents graduated from a single educational program over the course of three years and were predominantly white, female, and between the ages of 25 and 54 years of age. The majority of respondents were located in urban areas. Additionally, most respondents were located in the Northwest region. Thirty-eight percent of the respondents worked 1-3 years before seeking a bachelor's degree, 31% worked 4-8 years, 12%, worked 9-12 years, 11% worked 13-20 years, and 8% worked more than 20 years. Table 1 illustrates respondent demographics.

Table 1. Survey Respondents' Population Information Summary

	%
Age	
20-24	17%
25-34	24%
35-44	48%
45-54	19%
55+	7%
No answer	1%
Gender	
Male	37%
Female	63%
Ethnicity	
Hispanic or Latino	17%
Black or African American	6%
Native American or American Indian	2%
Asian or Pacific Islander	11%
White	56%
Prefer not to answer	4%
Not listed	4%
Geographic location	
Northeast US	8%
Southeast US	20%
Midwest US	14%
Northwest US	28%
Southwest US	25%
Other	5%
Outside US	1%
Location of Employment	
Urban	85%
Rural	15%

Outcomes of the Baccalaureate Degree

The purpose of this investigation was to investigate graduates' perceptions of pursuing a baccalaureate degree through a DAP. As such, the majority of the survey questions centered on identifying the perceived outcomes of obtaining a baccalaureate education. The majority of responses identified four major outcomes, including: increased understanding of medical research, an improved ability to communicate with other healthcare professionals and patients, an increase in confidence as an RT, and an overall sense of pride. These topics were predominately expanded upon during the interviews and therefore, both quantitative and qualitative findings related to these themes will be presented together.

Medical Research Comprehension

The quantitative and qualitative responses were similar regarding an increased ability to comprehend medical research. For graduates from four-year programs, the ability to read evidence-based medical research more effectively was often discussed; 94% of survey respondents indicated agreement that this skill was a direct benefit of a DAP. Additionally, most of the interviewees expanded on the impact that the ability to read evidence-based healthcare research with an improved understanding has had on their work. Interview responses associated with the themes outlined in Table 2.

Improved Ability to Communicate

Eighty-four percent of respondents reported that they strongly agreed, or somewhat agreed, to the statement, "My communication skills (oral and written) have improved." (see Table 2). The interviewees tended to blend this concept with the content about communicating healthcare research topics to colleagues or patients. The interviewees spoke primarily of improved oral communication, with themes ranging from specific abilities related to articulating rationale, to an increase in confidence regarding the ability to participate effectively in professional discussions related to patient care. Table 4 outlines the thematic constructs related to communication as an outcome of a DAP.

In addition to the general consensus among respondents regarding a positive change in their ability to communicate following the completion of their baccalaureate degree, survey respondents reported an increased ability to take on new or expanded roles (see Table 3).

Table 2. Thematic categorization of interviewee responses regarding increased comprehension of medical research

Theme	Direct Quote of Interviewee
Increased ability to articulate study rationale	*"I would say I had a surface level understanding when I started pursuing my respiratory degree versus after my bachelor's where I felt like I was actually able to understand what the study was saying as opposed to regurgitating what the result or conclusion portion of the study would say."*
Increased ability to both understand and critique study design	*"The study says this or that and now I am able to actually articulate what the study is saying and know if it's valid and if it's powered properly. With my associate, I had a surface understanding"*
Increased ability to extrapolate or generalize findings appropriately	*"Being able to digest the RC journals, be able to break those down and tell my staff that, Hey, you know what, if and about whenever you're lost, you can always go back to your RC journals. That's your Bible. Knowing that and problem solving from the research."*
Increased perception of purpose for practice-related application	*"I understand how I'm doing something, but I really don't know that I can articulate or defend my position or share a plan of care in a meaningful manner. I really only knew how I was doing something, not why I was doing it before my bachelor's."*

Table 3. Graduates perspective on skills developed after completion of Bachelor's degree

Question	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
My ability to effectively access, interpret, and critically appraise relevant medical literature has improved.	2%	32%	5%	1%	0%
My communication skills (oral and written) have improved.	5%	39%	10%	5%	1%
My ability to assume new or expanded roles in my professional career has improved.	5%	27%	14%	9%	5%
My critical thinking skills have improved.	4%	34%	19%	2%	1%
My ability to interpret pertinent clinical information has improved.	7%	36%	24%	2%	1%
My ability to make recommendations for appropriate therapeutic interventions have improved.	31%	39%	24%	2%	4%

Table 4. Thematic categorization of interviewee responses regarding increased ability to communicate

Theme	
Increased ability to communicate effectively as a whole	*"I think you can be more articulate at the bedside as an educator, as a professional, someone even in the way of compassion, just exposure to even your other classes. But other people experienced that. I mean, there's the opportunity to do really great things on a larger scale. So, I feel I gained that through the program."*
Increased confidence to take part in interprofessional conversations	*"With an associate degree, it was a bit more of a fake it 'till you make it kind of attitude. Because of my bachelor's, I was able to learn skills that allowed me to talk to individuals. It was the ultimate test of [like] interpersonal communication skills from classes regardless of what the subject matter was and turning that into real meaningful conversations."*

Increase in Professional Confidence

An increase in professional confidence following graduation with a bachelor's degree in RC was reported in both survey responses and the interviews. The survey asked graduates to indicate their level of agreement with how much the completion of their bachelor's degree had contributed to job performance. Table 5 outlines a summary of survey responses.

The survey respondents reported an increased ability to think critically, interpret pertinent clinical information, and make recommendations on patient care. Improvement in these areas may be attributed to an increase in confidence in the study participant's abilities. Most respondents agreed that there was an increase in confidence in communicating with other healthcare providers (78% strongly agree and moderately agree), confidence in mentoring new employees (73% strongly and moderately agree), and confidence in taking the lead on new initiatives (72% either strongly agree and moderately agree). Qualitative data from the interviews echoed these findings. Interviewees spoke to these new or expanded roles with comments like, "the bachelor's gives you a priority for the positions". Themes described by interviewees related to an increase in professional confidence are outlined in Table 6.

Overall Sense of Pride

Together, the survey and interview results indicated that participants perceived both personal and professional growth in several areas: which they attributed to earning a bachelor's degree. Although there were no survey questions directly related to the sense of pride: interviewees spoke freely about the sense of pride in the accomplishment of earning a baccalaureate degree. Several of the interviewees spoke of maturing professionally from a place of '*how*' to do something to an understanding of '*why*' to do something as a result of the bachelor's degree. Pride in personal accomplishment was described by most participants following graduation. Table 7 illustrates the thematic categorization of the qualitative assessment of pride.

Table 5. Contribution of completion of Bachelor's to job performance

Question	Strongly Agree	Moderately Agree	Neutral	Moderately Disagree	Strongly disagree
Confidence in mentoring new employees	49%	24%	24%	0%	3%
Confidence in communication with other healthcare providers	45%	33%	20%	0%	2%
Confidence in job tasks	37%	31%	28%	2%	2%
More effective as an RT consultant at the bedside	35%	29%	31%	2%	3%
Overall job satisfaction	32%	32%	30%	4%	2%

Table 6. Thematic categorization of interviewee responses regarding increased professional confidence

Theme	Direct Quote of Interviewee
Confidence related to the perceived meaning of the degree (Degree as a symbol)	*"We had it [the diploma] professionally framed just because it was such a big deal."*
Confidence in the significance of clinical contribution	*"I felt like I had a better grasp of the base knowledge than I did before. I could articulate why I did what I did as opposed to just say oh you know that's what I was taught in school. I feel like I had a more scientific basis for what I did."*
Confidence related to empowerment attributed to the degree (intrinsic pride)	*"I think it's a little boost because you have that degree, it's like my wife says, "You're a little [more] braver now that you got a bachelor's degree." I go, No, it's not that. It's just, I always feel confident in just knowing that you have a bachelor's degree, you kind of stand higher than everybody else." In all, it's how you gained experience and how you add value. I feel it's boosted my confidence."*

Table 7. Thematic categorization of interviewee responses related to pride

Theme	Direct Quote of Interviewee
Extrinsic validation manifested as pride (e.g. professional acknowledgement or benefit related to earning the degree)	*I think going back to school gave me the confidence to have ... I don't walk around with a name tag on that says bachelor's degree. I don't walk around with a BSRT: it still says RRT. I don't walk around with a white coat even though I have one, I don't like it. I don't walk around with that. I don't go, 'Oh, I have a bachelor's.' I feel that, because I have it, I feel a little more empowered to talk about it. I think it's all personal. Again, more confidence in myself to talk about the stuff that I do know."*
Intrinsic validation manifested as pride (e.g. sense of personal accomplishment and reflection of academic achievement)	*"I was so proud when I finished and what I had accomplished."* *"It was a moment of pure joy and satisfaction of accomplishing something that I had wanted for so long."*
Increase in confidence attributable to pride in the degree, achievement, or both	*"Everybody looked at me different[ly] with a bachelor's at work. Family wise, everybody looked at me differently because now I had a bachelor's there was a big change between an associate and bachelor's. It's actually a self-accomplishment. The level of pride from the personal achievement of achieving a bachelor's degree was clearly expressed by the graduates."*

Discussion

The mixed methods approach provided a unique overview of the graduates and demonstrated perceptions that exist related to earning a bachelor's degree as well as perspectives on the value added by the outcome. The main outcomes graduates reported as directly related to having earned a bachelor's degree were: 1) having an increased understanding of healthcare research (which provided a deeper understanding of RC therapies): 2) improved communication ability: 3) increase in confidence: and, 4) an overall sense of pride in their accomplishment. These findings provide insight into the perspectives and outcomes of furthering an RC education from those who have experienced it.

The findings can be summarized into two categories in response to the research question. One category was the performance development gained from the bachelor's program and a second was the effect the degree has had on respondents' career pathways.

Performance Development Following Bachelor's Degree

There were consistent reports of development of skills from the degree completion program in the ability to understand medical research and improved communication skills. The ability to effectively access, interpret, and critically appraise relevant medical literature was the most frequently cited skill resulting from completing the bachelor's degree program. The next highest reported positive responses were for improved communication skills. Additionally, participants reported an increase in confidence following graduation.

Interviewees highlighted that after earning a bachelor's degree, they had a deeper understanding of their practice. Translated from a qualitative analysis of interviewee responses, there was a progression from their associate degree program outcomes wherein graduates understood better *how* to perform therapies and toward a better understanding of *why* therapy was performed. These findings are consistent with the results of a 2012 survey of RC directors by Kacmarek, Barnes and Durbin (2012) which identified a need for RTs to be able to critique medical literature so they can grasp the evidence supporting the decisions made with patient care. The authors argued that this outcome was essential for RTs as they are challenged in future roles.[7] Barnes, Gale, Kacmarek, and Kageler (2010) listed the ability to apply evidence-based medicine, protocols, and clinical practice guidelines as necessary RT skills to be competent in chronic disease management. RTs working within an environment utilizing such protocols require an understanding of evidence-based medicine to help facilitate and improve quality and to help control cost in healthcare delivery.[3] A reported 34% of associate degree programs taught this content, compared to 78% of traditional, face-to-face bachelor's programs.[3]

This mixed-methods study is among the first to demonstrate that online DAP graduates have obtained the skill of analyzing evidence-based medical literature.

This study revealed that participants had improved communication skills following the bachelor's degree program. Interviewees often spoke to this point as well. Smith, Endee, Scott, and Linden (2017) reported that encouraging RTs to obtain a baccalaureate degree or higher can strengthen adaptability and improve their ability to communicate effectively.[9]

Barnes et al. (2010) emphasized communication as an important competency for RTs: explaining that RTs must have the ability to "communicate and educate to empower and engage patients" (p. 604).[3] The ability to explain an RT procedure to a patient, family member, or healthcare provider is often listed as an RT skills competency.[7] Mishoe (2003) proposed that communications skills are necessary to discuss or share an RT's position on the care of patients and to advocate for the best approach to short- and long-term care.[10] Additionally, effective communication skills are cited as a preference for hiring bachelor's prepared RTs.[4] In this study, 84% of survey respondents reported that they either strongly agreed or somewhat agreed that their communication skills were improved by earning a bachelor's degree, indicating that graduates from an online DAP perceive improved communication skills, which is a documented, desired trait of an RT.

Impact on Career Pathways

Survey and interviewee participants reported an increase in confidence following bachelor's degree attainment. It was suggested by Barnes et al. (2011) that RTs should possess the ability to discuss and recommend care for patients presenting with respiratory disease.[8] Additionally, the same study argued RTs need to be able to consult on the delivery of respiratory care in the work environment. The underlying principle of self-efficacy, translated in this investigation as 'confidence', is that professionals are more likely to engage in activities for which they have high self-efficacy and less likely to engage in those they do not.[11] Survey respondents reported an increase in confidence in several areas and both confidence and self-efficacy were expressed by interviewees.

Seventy-three percent of survey participants strongly agreed that confidence in mentoring new employees had improved and 78% indicated that confidence in communication with other healthcare providers had increased. This is essential for both personal and professional growth. The belief one has in one's self to be successful will likely influence many of the aspects of growth reported in Table 2, such as the ability to assume new or expanded roles, interpret pertinent clinical information, or make recommendations. The reported increase in confidence from study participants can potentially enhance job performance as an RT.

Limitations

The study presented has the potential to have several limitations. A known limitation was that the survey results were obtained from students who had graduated from one specific program. Although the students represented many geographical locations throughout the United States, the generalizability of the results could be questioned due to the specific learning objectives and outcomes of one program of study. Another limitation could be in the lack of statistical analysis performed, whereas this study is descriptive only in nature leaving concepts of "significance" up to the reader. Lastly, another potential

limitation is whether this sample of degree advancement students truly represent the population or are representative of early adopters, motivated by both personal and professional advancement.

Conclusion

The purpose of this research was to describe the perceptions of graduates of an online Respiratory Care DAP of the value of obtaining a baccalaureate degree. The Respiratory Therapist is a key member of the healthcare team, specializing in the ability to assess and treat patients with cardiopulmonary disorders. This critical role is enhanced with expanded knowledge obtained with a bachelor's degree. This study demonstrated an increase in abilities and skills that RTs achieve with a bachelor's degree. As the profession strives to move towards a bachelor degree entry-level, the online degree advancement option needs to continue to be part of the conversation. DA programs demonstrate desirable outcomes from graduates such as the ability to understand evidence-based medical research and more effective communication. The positive outcomes participants gained from advancing their degrees as working professionals are evident. These data assists leaders in higher education, national organizations, and the Respiratory Care community to better understand the impact of online degree advancement.

As the Respiratory Care workforce prepares for the future, additional competencies are needed such as a deeper level of independent decision making that includes: critical thinking, improved communication skills, patient and family education, leadership content, as well as several others. Participants in this study consistently reported that earning a bachelors' degree supported these competencies and contributed value to their practice as essential members of an interdisciplinary healthcare team.

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Understanding Barriers Identified by Practitioners in Central Illinois in Pursing Advanced Degrees in Respiratory Care

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Abstract

Background: The respiratory care (RC) profession has recommended a minimum of a baccalaureate degree for entry into the profession. A lack of a baccalaureate program in Illinois demonstrates a discrepancy between the profession and the practicing therapist in Central Illinois. The purpose of this research is to identify barriers perceived by Central Illinois respiratory therapists (RTs) to degree advancement. **Methods:** This study employed a descriptive, cross-sectional non-experimental design. Between September and October 2019, a 16-question survey with branching logic closed-ended questions was distributed via e-mail to 178 practicing RTs who serve as preceptors for the Lincoln Land Community College (LLCC) Respiratory Care Program. Descriptive statistics were used to summarize responses, and Chi-square and cross-tabulation analysis were assessed using Microsoft Excel™ software. **Results:** The response rate was 38.8% and resulted in 69 valid surveys returned. Sixty-two percent of the 69 respondents identified they have earned the registered respiratory therapist (RRT) credential and would be eligible to enroll in a baccalaureate degree completion program. Forty-seven percent of the 38-therapist identified they would be unwilling to pursue an advanced degree with full tuition reimbursement options. The most cited barriers preventing these RTs from obtaining a baccalaureate degree is lack of financial benefit (54%) and lack of advancement opportunities (51%). **Conclusions:** The data emphasizes a lack of growth opportunities and pay differentials are contributors to Central Illinois respiratory care therapists not pursuing advanced degrees in RC, which may extend to other regions as well. This may need to be addressed by the profession prior to requiring a baccalaureate degree for entry-level.

Keywords: baccalaureate degrees, respiratory care practitioners, registered respiratory therapist, barriers to advancement, scope of practice, clinical ladder, healthcare environment

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Introduction

Respiratory Therapists (RTs) emerged over sixty years ago, beginning as oxygen technicians, and often trained on the job.[1] As the scope of care provided by RTs evolved to include competencies beyond the administration of oxygen devices so did the academic expectations for future clinicians and a minimum of an associate-level education became the entry-level standard for RTs.[2]. A formal curriculum leads to the development of nationally accredited programs as well as credentialing exams. The first registry exam was offered in 1961 and aimed to validate RTs' comprehension through both a written and verbal exam.[3] In some areas, the length of these formal RT educational programs contributed to a shortage of available working therapist. To meet the growing demand for therapists, some programs created an abridged curriculum to confer a certificate: resulting in eligibility to sit for an entry-level credential (now known as certified respiratory therapists or CRTs).[3] However, by 2002, programs issuing only professional certification were either closed, or had transitioned to programs designed to lead to successful completion of the national registry exams. This shift, underscored the consensus among the profession that the minimum of an associate degree for an entry-level respiratory care practitioner should be required.[2] As the needs of the patients with cardiopulmonary disease processes continue to grow along with advancements in both care and disease management, a new debate has emerged: Is there a need for the profession to increase minimum entry level requirements of RTs to the baccalaureate level?

In 2007, the American Association of Respiratory Care (AARC) formed a committee to both evaluate the status of the Respiratory Care profession and to provide guidance for how to best align with the rapidly evolving healthcare environment. The committee released an evaluation of the profession and suggestions for alignment in a series of articles published between 2009-2011: one of the most controversial recommendations made by the committee was for a Baccalaureate of Respiratory Care degree to become a minimum requirement for entry into the profession.[1] Although there seems to be support to move the profession to better align with the trajectories modeled by other allied health professions (e.g., physical therapy), this goals have been difficult to fulfill for several reasons: one of the primary barriers is that very few associate-level programs have access to the resources required to transition to offer an entry-level baccalaureate degree. As such, there remain several states which do not offer potential RTs access to an entry-level baccalaureate program: perpetuating the issue of graduating associate-level clinicians. Although there are several quality programs offering an associate-level degree in Respiratory Care, the failure of the profession to require a baccalaureate degree as a minimum for entry shifts the burden, typically financial, of degree advancement entirely to the student.

Illinois is among several of those states where there are no accredited entry-level programs offering a baccalaureate option or degree-advancement programs in Respiratory Care. The purpose of this study was to identify potential barriers which may exist for Respiratory Care Practitioners in Illinois in the pursuit of an advanced degree within the field. Additionally, this investigation sought to understand whether therapists would pursue an advanced degree if potential barriers were removed.

Methods

Although the barriers described here are hypothesized as deterrents to obtaining an advanced degree in respiratory care in Central Illinois, the purpose of this study was to identify what barriers existed in this sample. A convenience sample of participants were selected as practicing RTs in Central Illinois who also have an existing relationship with the associate-level Respiratory Care program at Lincoln Land Community College (LLCC). A total of 178 participants were sent a link to a web-based survey (Appendix A). Participants were informed of the purpose of the study and the anonymity of their responses. Consent to participate was outlined via the survey instructions. This study was approved for distribution by the research oversight offices at both Boise State University and LLCC.

The survey was designed specifically for this investigation and focused on identifying potential barriers which have been discussed throughout the literature: most notably financial incentive and lack of professional advancement opportunities.[10] The survey was made available for approximately four weeks during the months of September and October, 2019 and included 16 close-ended questions with branching logic based on the credentialing and current degree held by the respondents. The survey was organized to investigate three major contents areas: participant characteristics, type of degree held, and credentials held. Participants were not limited regarding the time spent on the survey. Of the 178 respondents invited to participate in this study, 69 provided complete answers to each of the questions: a response rate of 38.8%. Incomplete survey attempts were excluded from analysis.

Data analysis

Respiratory therapists who serve as clinical preceptors at 7 LLCC clinical sites were surveyed using Qualtrics™, a web-based survey software. The anonymous responses were downloaded into Microsoft Excel™ for analysis. A total of 178 respondents were identified and asked to complete the web-based survey. Sixty-nine (38.8%) surveys were completed, with respondents representing 6 of the 7 facilities surveyed. Five surveys were excluded because they were incomplete. Survey questions centered on which credentials respondents held as well as both the reality and perception of how tuition reimbursement affected the likelihood of pursuing an advanced education. Data were described using descriptive analyses and relationships between variables were explored using both Chi square and crosstabulation analyses.

Results

Descriptive analyses of the data revealed a majority of female respondents (72%). Although the age of respondents from 24-64 years of age, the mean age of respondents was 44.8 years (SD 12.1 years). Table 1 illustrates a descriptive breakdown of respondent demographics.

Table 1. Demographics of Survey Participants

Characteristic	*n (%)
Gender	
Male	20 (29)
Female	49 (71)
Age	
Average	44.8
20-25 yrs. old	5 (7)
26-30 yrs. old	7 (10)
31-35 yrs. old	6 (8.6)
36-40 yrs. old	8 (11.5)
41-45 yrs. old	8 (11.5)
46-50 yrs. old	13 (19)
51-55 yrs. old	7 (10)
56-60 yrs. old	5 (7)
61-65 yrs. old	10 (14)
>65 yrs. old	0 (0)
*n = 69	

The characteristics of this populations were also assessed. Nineteen percent of these respondents indicated that they will be retiring within the next five years. Although, sixty-two percent have obtained the RRT credential, only 20% hold a baccalaureate degrees. It is important to note, however, that the majority of baccalaureate degrees held by respondents in this sample were obtained prior to entering the health care field, indicating that the baccalaureate degree was not related to Respiratory Care. Table 2 illustrates the characteristics of the respondents.

Relationships between CRT and CRT with RRT eligibility without plans to obtain the RRT credential were explored. Major barriers to these respondents not obtaining the RRT credential include: financial burden of testing (80%), no financial gain in doing so (60%), the credential is not being required by the current employer (60%), and the estimated time to retirement (i.e., respondent is planning on retiring in less than 5 years) (60%). These results are illustrated in Table 3.

Relationships between the types of baccalaureate degrees currently held by respondents were explored. As mentioned, 64% of respondents held a baccalaureate degree in a nonhealthcare field, indicating Respiratory Care as a second career pursuit. Further relationships were explored between those respondents with a baccalaureate degree in respiratory care and the advantages of this degree. Seventy-five percent of respondents with a baccalaureate degree in RT indicated that the degree has elevated their bedside assessment and management skills. However, 75% of respondents indicated that there was no increase in hourly wage associated with the accomplishment of a baccalaureate degree.

Relationships between degree of tuition reimbursement currently offered and tuition reimbursement desired to encourage advanced degrees were explored to determine if eligible RTs would obtain a baccalaureate degree if the facilities offered more tuition reimbursement. There was no significant relationship between respondents working at facilities that

Table 2. Characteristics of survey participants

Characteristic	n (%)
Years till Retirement	
< - 5 yrs. ±	13* (19)
-10 yrs. ±	8* (12)
11-15 yrs. ±	10* (14)
16-20 yrs. ±	8* (12)
21-25 yrs. ±	8* (12)
26-30 yrs. ±	11* (16)
31-35 yrs. ±	4* (10)
36-40 yrs. ±	7* (10)
Credentials	
CRT$	2* (3)
CRT$-RRT‖ eligible, but not taking RRT‖	3* (4)
CRT$-RRT‖ eligible, taking RRT‖	7* (10)
RRT	43* (62)
N/A -respondents with baccalaureate degree	14* (20)
Baccalaureate Degree	
Respiratory Care	4+ (29)
Other health care field	1+ (7)
Non health care field, held prior to profession	9+ (64)

*n = 69: Baccalaureate Degree +n = 14: ±yrs. = Years

$CRT = Certified Respiratory Therapist: ‖RRT = Registered Respiratory Therapist

Table 3. Identified reason CRT respondents are not willing to obtain the RRT credential

	*n (%)		
Reason for not obtaining RRT Credential	Disagree	Agree	Neutral
Financial burden of testing	0 (0)	4 (80)	1 (20)
Lack of advancement	3 (60)	1 (20)	1 (20)
No financial gain	2 (40)	3 (60)	0 (0)
Not required by employer	1 (20)	3 (60)	1 (20)
Retiring in 5 or less years	2 (40)	3 (60)	0 (0)
*n = 5			

Table 4. Comparing tuition reimbursement offered to desire for Baccalaureate degree

Current level of tuition reimbursement	Not willing, Tuition Reimbursement Not a Factor	Desire Partial Tuition Reimbursement	Desire Full Tuition Reimbursement	p Value
Currently no tuition reimbursement	0	0	2*	0.09
Currently partial tuition reimbursement	19*	5*	14*	0.36

*n = 40 respondents: 2 no current reimbursement options: 38 currently partial reimbursement options

did not offer any degree of tuition reimbursement benefit, and their willingness to obtain a baccalaureate degree. This finding was the same when institutions offering partial tuition reimbursement were considered: there was no significant relationship between those who have partial reimbursement available and their willingness to pursue a baccalaureate degree if more reimbursement was offered. The most unnerving finding: however, is that there was a significant relationship among those institutions which did offer full tuition assistance and respondent's willingness to pursue an advance degree. Unfortunately, even full tuition assistance did not increase respondent's willingness to pursue an advanced degree.

Therapists who identified their place of employment as already offering full tuition reimbursement for advanced degrees were then asked to state if they planned on utilizing tuition reimbursement to obtain a baccalaureate degree in the next 2 years. Nine (64%) of 14 survey respondents indicated they would neither utilize tuition reimbursement nor obtain a baccalaureate degree, while 5 (36%) were neutral. To explore the relationship between therapists with full tuition reimbursement available, their willingness to obtain a baccalaureate degree within the next 2 years, and years until retirement, a cross-tabulation was performed. The average age of years until retirement for those who strongly disagreed with obtaining a baccalaureate degree was 15 years, while those who were neutral in response have an average projected time-to-retirement of 19.6 years.

Relationships between RRT credentialed therapists who would be eligible for a baccalaureate degree completion program were asked to identify barriers for not completing an advanced degree. Table 5 illustrates the results of these barriers.

Discussion

This study explored the accuracy of hypothesized barriers preventing Respiratory Therapists in Central Illinois to pursuing an advanced degree within the field. Most of the responding RTs work in an acute-care-hospital setting and the results indicated that a lack of financial gain was among the primary barriers to degree advancement. This result is consistent with a secondary survey conducted by Barnes et al., (2011).[4] The results of this survey confirm the hypotheses that a lack of both financial incentive and professional opportunities in response to an advanced degree continues to be among those factors holding the respiratory care professionals located in Central Illinois back from pursing an advanced degree in the field of Respiratory Care. The number of associate-level practitioners entering the workforce may also influence the perception of the profession held by the organization which hire these individuals, and the incentives made available to them. The hard line of recognition of a profession by an organization is at the baccalaureate level.[7] The continued reliance on associate-level programs to graduate clinicians to meet workforce demand may actually provide rationale for institutions to pay RTs less, or provide fewer incentives, when compared to other allied professions who have a minimum entry-to practice at the baccalaureate level. [5,6,7,8] The lack of professional incentive and trajectory may also be adding to the apathy highlighted by respondents.

Table 5. Barriers to RTs obtaining baccalaureate degrees

	*n (%)			
Barrier	Disagree	Agree	Neutral	No Answer
No options in IL	9 (21)	7 (16)	22 (51)	5 (12)
Lack of time	10 (23)	17 (40)	13 (30)	3 (7)
No financial advantage	8 (19)	24 (56)	6 (14)	5 (12)
No advancement opportunities	6 (14)	22 (51)	11 (26)	4 (9)
Retiring within 5 years	20 (47)	9 (21)	9 (21)	5 (12)

*n = 43

Current Baccalaureate Degrees

Despite disagreements about the entry-to-practice requirements, respiratory care is a growing profession. According to the Bureau of Labor Statistics, the respiratory profession is expected to grow 21% between 2018-2028, which is, much faster than average.[9] The increase in demand for respiratory therapists, and relatively stable job environment may explain why the majority of our respondents entered the profession secondary to obtaining a baccalaureate degree in another field: the associate-level pathway allows prospective students to obtain a degree relatively quickly and subsequently begin working in a stable field.

Those respondents who held a baccalaureate degree in Respiratory Care indicated that the degree improved their bedside practice. Improved assessment and management skills will continue to impact patient outcomes as RTs emerge into new roles such as care coordinators and pulmonary consultants. Respiratory therapists are no longer strictly utilized only in the acute-care setting, but have moved into alternative settings and are becoming member of specialized teams at clinics and in home care.[6] In such settings, the RT must be able to rely on skills included in many baccalaureate curriculums to provide the best care to patients in dynamic settings.

Fifty percent of respondents who indicated they had earned their baccalaureate degree in Respiratory Care indicated that their baccalaureate degree offered them greater opportunities for advancement. Advancement opportunities may include positions of management or education. As key program personnel from accredited schools retire, the need for RTs with a baccalaureate degree (and ideally, master's degree) will rise.[1] A lack of baccalaureate-level RTs will cause shortages in key personnel for respiratory care programs. If staff cannot be replaced, education programs could be forced to close, thus increasing the shortage of clinical RTs: which may impact patient outcomes.

Barriers to Baccalaureate Degrees

The lack of financial gain was highlighted as a major barrier to advancing toward a baccalaureate degree. These data corresponds with a previous survey completed by Becker and Nguyen.[10] In this study, a secondary survey from a 2009 AARC Respiratory Therapist Human Resource Survey was conducted and determined that entry-level baccalaureate degree therapists did not earn increased wages when compared to an entry-level RT prepared with an associate-level degree.[10] However, those with baccalaureate degrees were able to advance to higher-paid positions which yielded increases in wages compared to those with associate degrees.[10]

Lack of advancement opportunities for RTs was another major barrier identified by respondents. Many advancement opportunities and clinical autonomy are often linked to educational experience.[5] It is likely that many associate-level RTs are not considered for advanced roles simply because they lack the appropriate educational requirements. This makes it very difficult to build career pathways in the respiratory care profession and may contribute to apathy.

The barriers identified by these respondents explain the lack of enthusiasm for degree advancement: as it is apparent the in Central Illinois, there is very little reward for advancement when compared to the degree of effort required. Unfortunately, this lack of enthusiasm may be passed from the preceptor to new RT students further impairing the advancement of the profession.[5] Although other health professions have evolved and increased their entry-level educational requirements, respiratory care has remained consistent.[5] This has stunted the growth of the profession, caused discrepancies among wages, and stifled the opportunity for growth.

Limitations

The purpose of this study was to evaluate the barriers towards respiratory care degree advancement in a specific sample in a specific region. This survey was distributed to 178 respiratory care practitioners throughout Central Illinois. This sample represents a small percentage of the total population of respiratory care practitioners in the state of Illinois and therefore the results of this study may not be generalizable beyond the Central Illinois area. Additionally, the sample identified for this study was one of convenience: meaning all respondents are or have been previously affiliated with LLCC. As such, this sample may not be representative of therapists who are not affiliated with LLCC. Additional research pertaining to respiratory care degree advancement is recommended with larger more diverse samples to better address factors which may be regionally specific.

Conclusion

There are no accredited entry-level baccalaureate programs in the state of Illinois.[10] At this time, a baccalaureate degree program is unlikely to survive due to a generalized perception that there lack significant financial and professional benefit. Although the specific boundaries and scope of this investigation limit the findings, the discovery that stifled professional growth and stagnant wages may contribute to professional apathy. Additionally, the barriers identified here, lack of financial incentive and minimal opportunities to advance one's career, are likely major contributors to a lack of degree advancement within the field, and should be explored more broadly.[5] At minimum, facilities in this area employing RTs should consider differentiating opportunities based on educational level: highlighting the incentives of advancing the degree. Doing so may provide tangible evidence of the value of a baccalaureate degree to address apathy and stagnation within the field.

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Appendix A

Barriers to Degree Advancement Survey Flow

Block: Informed Consent (1 Question)

Standard: Demographic (5 Questions)

Standard: Bachelor's Degree (5 Questions)

Standard: No Bach. Degree (5 Questions)

Standard: Tuition available (0 Questions)

Q1 You are invited to participate in a web-based online survey regarding identified barriers to advanced degrees in respiratory care. This is a research project being conducted by Lori Badgley, a graduate student at Boise State University. It should take approximately 10 minutes to complete this survey.

PARTICIPATION
Your participation in this survey is voluntary. You may refuse to take part in the research or exit the survey at any time without penalty.

BENEFITS
You will receive no direct benefits from participating in this research study. However, your responses may help us learn more about barriers that exist for respiratory care practitioners in Central Illinois in pursuing advanced degrees in respiratory care.

RISKS
There are no foreseeable risks involved in participating in this study other than those encountered in day-to-day life.

CONFIDENTIALITY
Your survey answers will be sent to a link at Qualtrics where data will be stored in a password protected electronic format. You will not be asked for your name at any point during this survey, therefore, your responses will remain anonymous. No one will be able to identify you or your answers, and no one will know whether or not you participated in the study.

Questions
If you have any questions or concerns, please feel free to contact Lori or her faculty advisor:

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If you have questions about your rights as a research participant, you may contact the Boise State University Institutional Review Board (IRB), which is concerned with the protection of volunteers in research projects. You may reach the board office between 8: 00 AM and 5: 00 PM (MTN Time), Monday through Friday, by calling (208) 426-5401 or by writing: Institutional Review Board, Office of Research Compliance, Boise State University, 1910 University Dr., Boise, ID 83725-1138

ELECTRONIC CONSENT: Please select your choice below. Clicking on the "Agree" button indicates that you have read the above information, you voluntarily agree to participate, and you are 18 years of age or older.

- ○ I agree
- ○ I do not agree

Q2 Please select the facility you are currently employed at (if you are employed at more than one of the list, please select the facility that is considered your primary employer)

- ○ Carlinville
- ○ Taylorville
- ○ Jacksonville
- ○ St. John's Hospital
- ○ Memorial Medical Center
- ○ Springfield Clinic
- ○ Decatur Memorial Hospital

Q3 Please select your gender

- ○ Male
- ○ Female

Q4 Current Age

▼ 19 (1) ... >70 (53)

Q5 Year of graduation from the respiratory care program?

▼ 1949 (1) ... 2019 (71)

Q6 In years, how many years until you would consider retirement?

▼ (1) ... >60 (62)

Q7 Do you currently hold a Baccalaureate degree?

- ○ Yes
- ○ No

Skip To: Q23 If Do you currently hold a Baccalaureate degree? = Yes

Skip To: End of Block If Do you currently hold a Baccalaureate degree? = No

Q23 Which of the following best describes your Baccalaureate degree?

- ○ My bachelor's degree is in respiratory care.
- ○ My bachelor's degree is in a different healthcare related field.
- ○ My bachelor's degree is not in a health care related field.

Skip To: Q24 If Which of the following best describes your Baccalaureate degree? = My bachelor's degree is in respiratory care.

Skip To: Q25 If Which of the following best describes your Baccalaureate degree? = My bachelor's degree is in a different healthcare related field.

Skip To: Q27 If Which of the following best describes your Baccalaureate degree? = My bachelor's degree is not in a health care related field.

Q24 The following question is designed to understand how you feel earning your Baccalaureate in respiratory care has impacted your career. using the Likert Scale below, select the choice indicating how much you either agree or disagree with the statement.

The following Likert Scale was utilized in the answering of the following questions

1-Strongly Disagree: 2-Somewhat Disagree: 3-Neutral: 4-Somewhat Agree: 5-Strongly Agree

a. My bachelor's degree in respiratory care has given me advancement opportunities.

b. My bachelor's degree has increased my knowledge base increasing my abilities in bedside assessment

c. My bachelor's degree has increased my overall hourly pay.

Skip To: End of Survey If The following question is designed to understand how you feel earning your Baccalaureate in respi... = My bachelor's degree has increased my overall hourly pay. [Strongly disagree]

Skip To: End of Survey If The following question is designed to understand how you feel earning your Baccalaureate in respi... = My bachelor's degree has increased my overall hourly pay. [Somewhat disagree]

Skip To: End of Survey If The following question is designed to understand how you feel earning your Baccalaureate in respi... = My bachelor's degree has increased my overall hourly pay. [Neither agree nor disagree]

Skip To: End of Survey If The following question is designed to understand how you feel earning your Baccalaureate in respi... = My bachelor's degree has increased my overall hourly pay. [Somewhat agree]

Skip To: End of Survey If The following question is designed to understand how you feel earning your Baccalaureate in respi... = My bachelor's degree has increased my overall hourly pay. [Strongly agree]

Q25 The following question is designed to understand how you feel earning a Baccalaureate in a non-respiratory, but healthcare related field has impacted your career in the field of respiratory care. Using the Likert Scale below, select the choice indicating how much you either agree or disagree with the statement.

The following Likert Scale was utilized in the answering of the following questions

1-Strongly Disagree: 2-Somewhat Disagree: 3-Neutral: 4-Somewhat Agree: 5-Strongly Agree

a. There are no advancement opportunities in respiratory therapy.

b. I obtained my bachelor's degree prior to entering the respiratory profession.

c. There are no available bachelor's degree respiratory care programs in Illinois.

Skip To: End of Survey If The following question is designed to understand how you feel earning a Baccalaureate in a non-re... = There are no available bachelor's degree respiratory care programs in Illinois. [Strongly disagree]

Skip To: End of Survey If The following question is designed to understand how you feel earning a Baccalaureate in a non-re... = There are no available bachelor's degree respiratory care programs in Illinois. [Somewhat disagree]

Skip To: End of Survey If The following question is designed to understand how you feel earning a Baccalaureate in a non-re... = There are no available bachelor's degree respiratory care programs in Illinois. [Neither agree nor disagree]

Skip To: End of Survey If The following question is designed to understand how you feel earning a Baccalaureate in a non-re... = There are no available bachelor's degree respiratory care programs in Illinois. [Somewhat agree]

Skip To: End of Survey If The following question is designed to understand how you feel earning a Baccalaureate in a non-re... = There are no available bachelor's degree respiratory care programs in Illinois. [Strongly agree]

Q27 The following question is designed to understand how you feel earning your Baccalaureate in a non-respiratory, non-healthcare related field has impacted your career in the field of respiratory care. Using the Likert Scale below, select the choice indicating how much you either agree or disagree with the statement.

The following Likert Scale was utilized in the answering of the following questions

1-Strongly Disagree: 2-Somewhat Disagree: 3-Neutral: 4-Somewhat Agree: 5-Strongly Agree

a. I obtained my bachelor's degree in a field other than health care in preparation for leaving the respiratory care profession.

b. I obtained my bachelor's degree in a field other than health care because I had obtained the degree before entering the respiratory care profession.

c. I obtained my bachelor's degree in a field other than health care because there are no available programs in Illinois.

Skip To: End of Survey If The following question is designed to understand how you feel earning your Baccalaureate in a non... = I obtained my bachelor's degree in a field other than health care because there are no available programs in Illinois. [Strongly disagree]

Skip To: End of Survey If The following question is designed to understand how you feel earning your Baccalaureate in a non... = I obtained my bachelor's degree in a field other than health care because there are no available programs in Illinois. [Somewhat disagree]

Skip To: End of Survey If The following question is designed to understand how you feel earning your Baccalaureate in a non... = I obtained my bachelor's degree in a field other than health care because there are no available programs in Illinois. [Neither agree nor disagree]

Skip To: End of Survey If The following question is designed to understand how you feel earning your Baccalaureate in a non... = I obtained my bachelor's degree in a field other than health care because there are no available programs in Illinois. [Somewhat agree]

Skip To: End of Survey If The following question is designed to understand how you feel earning your Baccalaureate in a non... = I obtained my bachelor's degree in a field other than health care because there are no available programs in Illinois. [Strongly agree]

Q18 Does your current employer offer tuition reimbursement? Select the option that best describes the reimbursement option available to you, given your current position.

- ○ Yes, Full Reimbursement available
- ○ Yes, Partial Reimbursement Available
- ○ No Reimbursement Available

Skip To: Q19 If Does your current employer offer tuition reimbursement? Select the option that best describes the... = Yes, Full Reimbursement available

Skip To: Q22 If Does your current employer offer tuition reimbursement? Select the option that best describes the... = Yes, Partial Reimbursement Available

Skip To: Q22 If Does your current employer offer tuition reimbursement? Select the option that best describes the... = No Reimbursement Available

Q22 Select the statement that best describes your willingness to pursue a Baccalaureate degree in respiratory care.

- ○ I am not willing to obtain a bachelor's degree in respiratory care no matter the amount of tuition reimbursement available.
- ○ I would be willing to obtain my bachelor's degree in respiratory care if my employer offered full tuition reimbursement.
- ○ I would be willing to obtain my bachelor's degree in respiratory care if my employer offered partial tuition reimbursement

Q19 Please select the highest credential you have obtained

- ○ CRT Only
- ○ CRT, RRT eligible, do not plan on obtaining RRT credential
- ○ CRT, RRT eligible, plan on obtaining RRT credential
- ○ RRT

Skip To: Q28 If Please select the highest credential you have obtained = RRT

Skip To: Q28 If Please select the highest credential you have obtained = CRT, RRT eligible, plan on obtaining RRT credential

Q20 Using the Likert Scale provided, please indicate how strongly you either agree or disagree with the following statements regarding why you do not plan to obtain/pursue the RRT credential.

The following Likert Scale was utilized in the answering of the following questions

1-Strongly Disagree: 2-Somewhat Disagree: 3-Neutral: 4-Somewhat Agree: 5-Strongly Agree

a. I am utilizing a tuition reimbursement program and I plan to complete my bachelor's degree in respiratory care within the next two years.

b. I do not plan on obtaining my RRT because there is no financial advantage to do so.

c. I do not plan on obtaining my RRT because I plan on retiring within the next 5 years.

d. I do not plan on obtaining my RRT because of the financial burden of testing.

e. I do not plan on obtaining my RRT because my current employer does not require I do so.

Q28 Using the Likert scale provided, please indicate how much you either agree or disagree with the following statements regarding your plans to obtain a Baccalaureate degree in respiratory care using some type of tuition reimbursement through your current employer.

The following Likert Scale was utilized in the answering of the following questions

1-Strongly Disagree: 2-Somewhat Disagree: 3-Neutral: 4-Somewhat Agree: 5-Strongly Agree

a. I am utilizing a tuition reimbursement program and I plan to complete my bachelor's degree in respiratory care within the next two years

b. I do not plan on taking advantage of tuition reimbursement and completing my bachelor's degree in respiratory care due to lack of advancement opportunities in this field.

c. I do not plan on taking advantage of tuition reimbursement and completing my bachelor's degree in respiratory care because there is no financial advantage in doing so.

d. I do not plan on taking advantage of tuition reimbursement and completing my bachelor's degree in respiratory care, I plan on retiring in the next five years.

e. I do not plan on taking advantage of tuition reimbursement and completing my bachelor's degree in respiratory care, I do not have time to put forth into advanced education

f. I do not plan on taking advantage of tuition reimbursement and completing my bachelor's degree in respiratory care, there are no in-state options available to me.

g. I am utilizing a tuition reimbursement program and I plan to complete my bachelor's degree in respiratory care within the next two years.

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A Pilot Study Of Respiratory Therapy Faculty Involvement At Student Health Centers On College Campuses In The United States

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Abstract

Background: Student health centers on college campuses represent one resource for providing health education to students. Respiratory Therapy (RT) faculty represent a potential resource to provide health-related services such as, asthma education, lung function testing, and smoking cessation education at the student health center. The primary purpose of this study was to gain insight into the perceptions of RT directors regarding RT faculty involvement at the student health center. **Methods:** Fifty directors of RT educational programs were contacted via email and invited to complete an online, 10-item, RT faculty questionnaire. Descriptive statistics and qualitative content analysis were performed on the collected data. **Results:** Thirty-four of fifty surveyed RT directors completed the online questionnaire. Seventy-six percent of the directors surveyed indicated a student health center was present on their campus. Most directors highly favored RT faculty involvement at the student health center in providing respiratory therapy health-related services. **Conclusions:** The involvement of RT faculty at student health centers is scarce. There is opportunity for RT Faculty to increase involvement in student health center operations and positively contribute to the health of college students.

Keywords: asthma, college students, faculty, health, lung function testing, respiratory therapy, smoking cessation, student health center

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Introduction

According to the U.S. Department of Education, there are over 20 million students attending more than 6700 degree granting colleges and universities in the nation.[1] The American College Health Association-National College Health Assessment II reports that 85.9% of college students described their health as good, very good or excellent.[2] However, approximately 9% of college students indicate they have an asthma diagnosis.[2] Furthermore, an article published by Sutfin et al. examined the cigarette smoking status of 4100 college students (62.4% female) with an average age 20.5 years.[3] The authors' findings revealed the smoking status of the students to be 2911 non-smokers (71%), 832 non-daily smokers (20%) (refers to those who have smoked in the past month, but less than every day) and 357 daily smokers (9%).[3] These facts have important implications for health care providers employed at student health centers (SHC) on college campuses in the United States. In addition, institutions of higher education in the U.S. face increasing public pressure to provide students with quality health care services.[4]

Student health centers (SHC) are primary care facilities whose mission is to improve the health and well-being of college students enrolled at their institutions. These facilities are typically staffed by licensed health care providers (i.e., physicians, physician assistants, nurses, and nurse practitioners) who provide similar levels of care that are provided at off campus clinics. The employment of these health care providers in the SHC is well documented.[5] However, according to a report by the American College Health Association[5] respiratory therapists are not staffed at any SHC in the United States. In addition, the 2017 executive summary of the Commission on Accreditation for Respiratory Care revealed there were a total of 443 entry into Respiratory Care Professional Practice programs in the United States.[6] The respiratory therapy (RT) faculty employed at these educational programs on college campuses represent a potential resource for providing respiratory therapy health-related services, such as asthma education, lung function testing, and smoking cessation education to students seeking health care at the student health center.

The RT provides a unique and necessary set of knowledge, skills, and abilities to the health care environment.[7] What is not known is the extent to which RT faculty participate in providing respiratory therapy health-related services in a SHC outside their academic responsibilities. The following research questions guided this study: 1) Are RT faculty involved in providing respiratory therapy health-related services in student health centers, and 2) what are the perceived barriers for RT faculty providing respiratory therapy health-related services for students seeking health care services at the student health center? The purpose of the study was to determine the involvement of RT faculty in the SHC and to gain insight into the perceptions of RT directors regarding their RT faculty providing respiratory therapy health-related services in student health centers.

Methods

This cross-sectional descriptive study selected 50 RT education programs in the U.S. from the institutional members of the Coalition for Baccalaureate and Graduate Respiratory Therapy Education. The 50 RT education programs selected met the inclusion criteria at the time of data collection phase of this study. The inclusion criteria consisted of RT directors employed at colleges/universities in the U.S. that offered a baccalaureate degree in respiratory therapy. The directors of each institution were contacted via email and invited to complete the online Respiratory Therapy Faculty questionnaire (figure 1) via Survey Monkey® (www.surveymonkey.com). Due to the lack of an existing instrument to fit the needs of data collection, the authors created the Respiratory Therapy Faculty questionnaire for this study. This questionnaire served as the principal survey instrument used to collect data for this study and consisted of a 10-item questionnaire containing closed and open-ended questions. The first eight items on the questionnaire focused on descriptive data of the directors (Table 1), college/university information, the characteristics of the RT faculty, teaching experience of the RT faculty, the presence of a SHC on campus, and the RT faculty's involvement in providing respiratory therapy health-related services. The ninth and tenth items were qualitative in nature and focused on the perceptions of the directors. The university's IRB granted approval to conduct this study and declared it exempt (#4395).

Table 1. Description of the Directors (N=34)

Years as Director	Frequency
0-5	12(35.3%)
6-10	6(17.6%)
11-15	7(20.6%)
16-20	2(5.9%)
21-25	1(2.9%)
Over 25 years	6(17.6%)
Credentials Earned	
RRT	32(94.2%)
MD	1(.2.9%)
Undetermined	1(.2.9%)
RT-NPS	5(14.7%)
RRT-ACCS	1(2.9%)
RPFT	3(8.8%)
CPFT	2(5.9%)
RPSGT	1(2.9%)
RST	1(2.9%)
Years teaching in the BSRT program	
0-5	6(17.6%)
6-10	8(23.5%)
11-15	5(14.7%)
16-20	3(8.8%)
21-25	5(14.7%)
Over 25	7(20.6%)

Figure 1. The Respiratory Therapy Faculty Questionnaire

1. RT Chair/Director Information: Title, highest degree earned and credentials, gender, years as Chair/Director, and years teaching in a BSRT program

2. College/University Information: College name, City, State, and Zip Code

3. Please provide the following information about the respiratory therapy faculty that teach on campus:

   - Number of full-time, tenured faculty
   - Number of full-time, tenure-track faculty
   - Number of full-time, non-tenure-track faculty

   Of the entire faculty on staff . . .

   - How many hold the RRT credential?
   - How many hold the certified asthma educator (AE-C) credential?
   - How many have a Doctorate degree as their highest level of education?
   - How many have a master's degree as their highest level of education?
   - How many have a bachelor's degree as their highest level of education?

4. In regard to years of teaching experience in a BSRT program, how many faculty have:

   - 0-5 years
   - 6-10 years
   - 11-15 years
   - 16-20 years
   - 21-25 years
   - Over 25 years

5. Does the college/university have a Student Health Center on campus? Yes or No

If the answer is NO, please proceed to question 9.

6. If YES to question 5, has the RC faculty ever been involved with providing any respiratory therapy related health services to the SHC? Please check all that apply asthma education, lung function testing, or smoking cessation education, not applicable, other (please describe)

7. If YES to question 5, at which frequency does the RT faculty provide respiratory related health services to the SHC? Annually, quarterly, monthly, not applicable: other (please describe)

8. What are your perceived barriers for the RT faculty providing Respiratory Therapy related health services to the SHC? Check all that apply.

   - Lack of faculty availability/time:
   - Lack of faculty interest:
   - SHC medical Director/staff not open to the idea:
   - Legal issues:
   - funding issues:
   - Lack of RT Chair/Director interest:
   - Lack of RT chair/director availability/time:
   - The need for RT services at the SHC has not been assessed:
   - Not applicable:
   - Other (please describe)

9. As RT chair/director, what is your perception of having RT faculty involved with providing respiratory therapy related health services at the SHC on campus?

10. Is there anything else related to this survey you would like to add?

Data Analysis

The quantitative data were organized into a Microsoft Excel spreadsheet and subsequently exported to SPSS statistical software (IBM Corp. Released 2017.Version 25.0. Armonk, NY) to produce the descriptive statistics (i.e., percentages) for the first eight survey questions. The last two survey questions underwent qualitative content analysis.[8] The goal of the qualitative approach for the last two questions was to identify important themes that represented the directors' perceptions.

Quantitative Results

A total of 50 directors were emailed the Respiratory Therapy Faculty questionnaire, with 34 directors completing the questionnaire yielding a response rate of 68% (34/50). Male respondents represented 67.6% (23/34) of the sample. Most of the respondents held the director position for 5 years or less: half of the directors held a doctoral degree and 47.1% reported having earned a master's degree with 2.9% indicating "other degree". The directors reported their number of years teaching in a Baccalaureate respiratory therapy program, which ranged from less than 5 years to more than 25 years. This study included institutions spanning all regions of the U.S. (i.e., east, west, north, and south). The 50 institutions of higher education selected for this study included thirteen private institutions and thirty-seven public institutions. The results revealed 76% (26/34) of the directors reported the presence of a SHC on campus and 24% (8/34) reported not having a SHC on campus. Three institutions reported providing respiratory therapy health-related services at the SHC, which included asthma education and lung function testing on an annual basis. Regarding smoking cessation education, none of the directors reported RT faculty were currently providing this service to the SHC: however, one director stated this service was offered to the SHC in the past. Under the "other" category, five directors reported providing a variety of respiratory therapy health-related services such as educating SHC pharmacists about proper metered dose inhaler device use and lung screenings (i.e., lung function testing) for employee health services.

The directors were asked to identify perceived barriers to providing respiratory therapy health-related services to the SHC from a list of barriers on the questionnaire (Table 2). Most responses (15/26) indicated the main barrier was that the need for respiratory therapy health-related services at the SHC had not been assessed. Furthermore, four directors stated that they had never considered or thought of providing respiratory therapy health-related services to the SHC on campus.

Table 2. Directors' perceived barriers to providing respiratory therapy related services at the student health center.

Barrier	Number of Responses
Lack of faculty availability/time	13
Lack of faculty interest	2
SHC Medical Director/staff not open to the idea	6
Legal Issues	4
Funding Issues	10
Lack of RT Chair/Director Interest	3
Lack of RT Chair/Director availability/time	3
The need for RT services has not been assessed	15
Other	7

Qualitative Results

The qualitative items on the survey allowed the directors to express their perceptions and comments in a "free text" narrative format. The directors' responses regarding RT faculty involvement in providing respiratory therapy health-related services at the SHC were provided in the last question of the survey, which was for additional comments. In this last question, there were 29 written comments, with 82% of the directors (24/29) responding positively. The qualitative content analysis of the directors' responses revealed three themes: a) significance of well-being, b) collaboration and community, and 3) resource awareness.

The first theme, "Significance of Well-Being" is evidenced by the directors' perceptions. One director commented, "I feel this is an important part of the future of our student health center." Another director indicated, "I think it is important". Lastly, a director stated, "It could be very beneficial to both patients and RT students and faculty". It is our interpretation the health and well-being of students visiting the SHC for health care services may benefit from respiratory therapy health-related services delivered by RT faculty and the directors surveyed seem to agree that it is an important endeavor.

The second theme uncovered is, "Collaboration and Community". A director commented, "Participating in the SHC provides teaching faculty with the opportunity to maintain clinical skills while providing a valuable service to the community and supporting research." In addition, another director adds, "I believe an on-campus lab that offers respiratory care services and diagnostics to the community of students and/or community would help develop learning outcomes broader than in a clinical setting." This theme reveals a combination of benefits for the RT faculty including support of research and service to the community.

The third theme is, "Resource Awareness". Some directors' perceptions focused on the availability of human resources. For example, one director stated, "I'm not sure if this would be my first priority, but if the university was to express a desire or recommended it, we would work up the staffing needs." While another director shared, "this is a great idea, if resources were available and faculty workload adjustments were made." This theme reveals the reality of the demands for resources, including faculty employed at the institution. In addition to staffing needs, there are equipment needs that would have to be realized.

Discussion

Our findings indicate RT faculty involvement providing respiratory therapy health-related services in SHC are scarce among the institutions surveyed. There is a paucity of literature on the subject that is likely due to the absence of RT faculty providing health care services on college campuses as revealed by the American College Health Association report.[2] However, the literature reveals parallel studies of nursing and dental hygiene faculty who engage in providing health care services at private or community clinics.[9-11] These studies revealed faculty benefitted from working in a clinic by maintaining their clinical skills, enrichment of the classroom experience, and the prospect of research opportunities.[9-11]

The directors in this study identified the biggest barrier to providing respiratory therapy health-related services was the lack of an assessment of the needs at the SHC and therefore some directors had not considered RT faculty involvement at the student health center. In a study by Aquadro et al[11], the authors examined the barriers of nursing faculty engaging in professional practice and found they were multifactorial. For example, the nursing faculty's complex workload (i.e., teaching workload and academic responsibilities), dependence on full administrative support from the university, and the need for clear goals and objectives to guarantee success.[11] This study reveals the potential opportunity for RT faculty to design strategies and implement respiratory therapy health-related services in a formal arrangement with the SHC. The nursing literature suggests faculty who partake in clinical practice are more relatable to students, are able to refine clinical skills, and share knowledge.[11] In addition, respiratory therapy health-related services at the SHC could potentially evolve into a model that integrates RT faculty practice and clinical training for respiratory therapy students, a model that has been successful for nursing.[12]

Limitations

The participants completed the Respiratory Therapy Faculty questionnaire via e-mail, which did not allow the researchers the opportunity to ask the participants to expand or clarify their responses for the researchers. In addition, this study utilized a convenience sample of the Coalition for Baccalaureate and Graduate Respiratory Therapy Education institutional members in the U.S., which did not allow for participation from other directors of respiratory therapy educational programs not affiliated with the Coalition for Baccalaureate and Graduate Respiratory Therapy Education, thereby limiting the sample size. A future study with a larger sample size is warranted.

Conclusions

This research reports on a survey of directors of Baccalaureate Degree level respiratory therapy programs assessing their perceptions of providing respiratory therapy health-related services in SHC on college campuses. Respiratory therapy faculty represent an untapped resource in providing services in SHC on college campuses. Directors surveyed were overwhelmingly in favor of supporting RT faculty's involvement in this setting if resources were available and faculty workloads were balanced. In addition, the qualitative themes reveal evidence of support by the directors regarding RT faculty involvement at the SHC providing respiratory therapy health-related services. There are implications of this study that are important to respiratory therapy faculty and the student body. This study suggests there are opportunities for respiratory therapy faculty to increase their involvement in student health center operations and positively contribute to the lung health of college students.

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Undergraduate Health Science Education during a Pandemic: Perceptions and Experiences of Respiratory Care Students

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Abstract

Background: College students are recognized as having high levels of stress, anxiety and worry. Students preparing for health science careers have been identified as being subject to more stress and anxiety than other groups studying at colleges and universities. Curriculum modifications imposed during the COVID-19 pandemic have altered traditional forms of course delivery potentially affecting this vulnerable group. **Objective:** (1) To determine the effects of a modified respiratory care curriculum on the perceptions and experiences of respiratory care students. (2) To explore the career expectations and future plans of respiratory care students in the context of pandemic-related occupational stress. **Methods:** Ten senior-level respiratory care students enrolled in a Commission on Accreditation for Respiratory Care (CoARC) accredited bachelor degree entry-level were recruited for the qualitative study. Descriptive phenomenology was chosen as a framework for the research because of its emphasis on the lived experience. Data were generated using an interview technique guided by unstructured and semi-structured questions. Interviews were transcribed and coded. During the transcript review process, meanings were formulated for each statement and then organized into theme clusters. **Results:** Three themes were extracted from the data: (1) Facing up to challenges and loss: (2) Learning to adjust: and (3) Career affirmation. **Conclusions:** Participants described challenges related to understanding and accessing modified course content, a sense of isolation and disconnect, lack of motivation, and fears surrounding the pandemic. Students expressed satisfaction with some elements of the modified curriculum but still preferred the traditional model. Discussions with participants revealed that the clinical experience during the COVID-19 pandemic helped to confirm their career choice and served as a motivator to enter into clinical practice.

Keywords: Respiratory care students, RCPs, phenomenology, curriculum modification, career intention

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Introduction

The Covid-19 pandemic has affected almost all aspects of life in the United States. Institutions of higher learning have not been immune from the effects as universities face declining enrollments, displaced students, and questions relating to appropriate platforms for delivering course content.[1,2] During Spring 2020, as a cautionary measure, many educational institutions moved students into alternative forms of content delivery. In the state of Texas, per mandate, K-12 public schools were closed to in-person instruction in March.[3] Colleges and universities were granted leeway in how they responded to the pandemic. At Midwestern State, the Incident Management Team (IMT) was activated, and acting on input from state and local health officials, the university elected to move all courses to online or hybrid instruction during the Spring semester. (https://msutexas.edu/coronavirus/index.php, *Accessed July 27, 2021*) Typical modifications included total or partial online instruction, the use of digital platforms such as Zoom, altered in-person class times, and reduced clinical time.

Colleges and universities were uniquely affected by the pandemic as they are often composed of large numbers of residential students: when pandemic restrictions were instituted, students were required to either return home, or stay in their dormitories or residence halls. Like their K-12 counterparts, the majority of educators in universities and colleges were required to modify the delivery of course content in order to help minimize the spread of the virus. Online delivery methods, or some type of hybrid instruction (i.e., the majority online, limited on-campus) remain common alternatives for institutions seeking to control viral outbreaks on campuses and in college communities.[2]

Although the migration of course materials from traditional to non-traditional platforms addressed the immediate threat of close-contact spread of the virus, the uprooting of students created additional challenges.[4] The use of digital delivery methods resulted in students without easy access to personal computers, reliable internet connections, or competence in navigating digital platforms experiencing difficulty completing required course assignments and mastering course content: the problem is particularly acute among low-income students and students of color.[4] In addition to concerns about course material access, students on campuses with pandemic mandated social distancing have reported feelings of isolation, loss of motivation, and increased stress and anxiety.[5]

The traditional instructional model for health science students involves didactic, laboratory, and clinical components. Pandemic-related modifications to traditional forms of instruction have resulted in the creation of hybrid models that may be unfamiliar to students and faculty. Such forms of curricula may provide additional challenges for health science students.[1,5] Students studying for professions in the health sciences have previously been shown to experience higher levels of stress, anxiety, and depression than students in other programs: [6,7] prolonged stress can lead to emotional suffering, mental anguish, and burnout: [8,9] students experiencing burnout during training report increased feelings of career dissatisfaction and contemplation of early- career exit.[10]

It is against this challenging backdrop the current study is centered. Given the elevated physical and mental stresses already experienced by health sciences students, the purpose of this study was to explore the following: How did COVID-19 related modifications in course delivery methods affect the perceptions and experiences of students in a respiratory care training program? What are students' current perceptions of a respiratory care career after witnessing the occupational demands brought about by the COVID-19 pandemic?

Methods

The study design was in the form of descriptive phenomenology. This approach was chosen because the methodology is focused on how a participant makes sense of their lived experience, and it allows the unique perspective of the individual to predominate.[11] Phenomenology is a research method that attempts to identify the basic structure of a particular experience. This approach allows for the exploration of intense human emotions or may be applied to the study of a singular event experienced by a group of participants. Moreover, as a form of qualitative research, the goal of phenomenology is to gain an in-depth understanding of a specific experience and, from the data, learn more about issues central to an inquiry.[12] Since qualitative research is not focused on statistical analysis, large sample sizes are typically unnecessary as the research is oriented towards an in-depth understanding of cases: thus, the criterion sampling approach is encouraged for phenomenological studies.[11,12] In this research, potential participants were selected based on experience with a respiratory care curriculum pre/post COVID-19 modifications.

Study participants

The study group was comprised of ten participants from a purposively selected cohort of 17 senior respiratory care students (seven self-described female and three self-described male) enrolled in a CoARC accredited entry-level on-campus bachelor degree respiratory care program. A researcher visited a course and invited students to participate in the research study. Participation in the study was voluntary. All participants signed a consent form containing information pertaining to the goals of the study, research design, obligations of the researcher, and participant rights. In consideration of the time required for interviews and follow-up, a gift card was awarded to participants at the conclusion of the study. All participants in the study group had completed at least two full semesters in a traditional curriculum before the program was forced to modify content delivery as a result of COVID-19 protocols. At the time of the study, participants had been receiving instruction via a modified platform since March 2020, a time period of approximately 10-months.

Ethical consideration

The research was conducted at Midwestern State University (Wichita Falls, TX), and the authors received intuitional review approval (#21011402) for the study. Informed consent was obtained from all participants prior to initiation of the interview

process. Participants were given the opportunity to decline or leave the research process at any time. All audio files, transcripts, and thematic analysis materials were kept in a secure location. Participant numbers were used to protect confidentiality. Dual role conflict was prevented as all interviews were conducted by a researcher who has teaching responsibilities outside the traditional respiratory care program and who had no prior or anticipated future teaching role with the participants.

Data collection

Data were collected through a mix of unstructured and semi-structured questions. An interview guide was developed by a research team with extensive experience in designing qualitative studies. The initial interview was conducted in-person and viewed as a pilot test for the question matrix. Valuable feedback on additional areas for investigation was obtained and the overall approach to data collection was validated. The remaining interviews were conducted via telephone per participant request.

Data collection in basic qualitative research is conducted until data saturation is observed.[11,12] In this study, theme redundancy (data saturation) was noted after eight participants were interviewed, two additional interviews were conducted to confirm previously identified themes. Interviews were conducted over a two-week period, and averaged approximately 30 minutes in length. Each encounter began with a collection of basic demographic information and then a general question such as: "How have things have been for you over the last year in the respiratory care program?" Follow-up questions were focused on life experiences outside the program and future goals. Interviews were digitally recorded, transcribed verbatim, reviewed for accuracy, and approved by each participant.

Data analysis

The methodology proposed by Colaizzi was used to guide the process of data analysis.[13,14] Transcripts were read in their entirety to acquire a feel for the data before the researcher extracted key words, phrases, and relevant statements relating to the investigated phenomena. Two researchers participated in this process, and three discussions were held to discuss significant findings and to confirm emergent themes. During the transcript review process, meanings were formulated for each statement and then organized into theme clusters. A total of 375 significant statements were identified, and nine theme clusters and three themes were extracted from the data. A final meeting of the researchers was conducted to review themes and subthemes, and the completed theme map was presented to participants for confirmation of validity. All participants were provided the opportunity to comment on the validity of the findings: nine participants replied to the request and reported that the dominant themes accurately represented what they experienced during the period under investigation.

Verification

Phenomenological research is somewhat subjective in interpretation. The primary strategy used in the study to ensure validity, was the provision of thick, rich, detailed descriptions so that anyone interested in transferability will have a framework for comparison.[10] Member checks were performed after the data had been transcribed to confirm the accuracy of the transcription. As a final member check, participants reviewed and verified the extracted themes which enhanced trustworthiness. These data were further compared and contrasted with existing research literature and independently reviewed by each researcher.

Results

The participants were all willing to be interviewed and seemed excited to tell their stories and have someone listen. They generously gave their time and seemed eager to participate in the study. The participants seemed interested in the researchers' goals and the purpose of the study. All of the participants appeared to be open and honest in their responses. During the interviews, participants expressed their feelings and offered constructive feedback on positive and negative experiences. Interpretation of the emerging themes enabled the investigators to draw the data, leading to an understanding of the participant's experiences. A compilation of the experiences that led to the development of themes and theme clusters are presented in Table 1 and discussed below:

Facing up to challenges and fears

Unfamiliar learning platforms

Participants described problems with navigating unfamiliar learning platforms, issues with faculty access and a loss of lab time. Although improvement occurred during the semester, participants still expressed feelings they had to work harder to master course content: scheduled make-up times with course professors were appreciated, but participants felt the lack of daily personal contact with faculty created challenges.

> *"So, doing it from an online platform, I felt personally disadvantaged, because I just wasn't grasping the material, and so I had to spend extra time with my professor … I had to work things up on my own."* Participant 7

They described obstacles to hands-on learning which resulted in feelings of falling behind in course work. Because of COVID-19 protocols, lab times were strictly controlled and students were not allowed into labs without the presence of an instructor. Initially, labs were curtailed completely which increased anxiety for participants.

> *"It's been rough, for me. I'm a very visual and hands-on learner, and shutting down the school and not being able to come up here and moving everything to strictly online has been very difficult for me."* Participant 1

Learning from home

As a result of modifications forced on schools due to the pandemic, students were displaced from classrooms and required to learn from home or in residential halls. Issues related to internet connectivity or access, and a lack of motivation for learning were reported by participants.

Table 1

Emergent themes	Theme cluster	Formulated meanings
Facing up to challenges and fears	Unfamiliar learning platform	Difficulty with online learning: difficulty with faculty access: loss of hands-on learning: hard to keep up
	Learning from home	Unreliable internet connectivity: lack of internet access: distracted by children at home: distracted by cell phone: lack of focus: lack of motivation
	Living with loss	Loss of job: loss of income: loss of collaborative learning: loss of personal relationships: living in isolation: feeling lonely and disconnected: strained relationships with family
	Coping with fears and uncertainty	Fear of getting sick: fears concerning friends and family: fear of poor grades: concern for impending workplace pressure: concern for effects on overall health: distrust of the 'other'
Learning to adjust	Changed approach to learning new material	More focused on assignments: becoming more organized: less procrastination: spending more time studying: finding new ways to study: repeated listening to taped lectures: learning to be more flexible
	Taking advantage of outside resources	Watching online videos (e.g., YouTube): one-on-one Zoom meetings with professors: additional assignments to help make-up: shared links to additional content
	Finding the positives in change	Improved clinical experience: spending more time with patients: gaining a better feel for the career: learning at the bedside: getting into a better routine: improved continuity of care
Career affirmation	Acknowledging workplace realities	Overworked staff: staffing shortages: burnt-out staff: long hours on the job: potential strain on families: high-stress environment: mental strain: too many patients
	A sense of recognition and reward	Enhanced visibility: increased employment opportunities, potential for increased income: sense of feeling needed: ability to contribute: recognition and gratitude from patients and families: potential for increased learning: fulfilling a calling: supporting peers and colleagues

"My internet would always go in and out and then I would fall behind and have to catch up. … it was just my internet that wouldn't always let me see what I needed." Participant 1

"I would have to say there were internet issues, because there were so many people online and doing classes that sometimes things failed to upload…" Participant 3

"I was really unmotivated, because I was like, what in the world are we doing?" Participant 8

Students also reported the presence of distractions which interfered with learning focus. Activities related to housekeeping such as cooking, cleaning, and helping children with homework tended to act as barriers to academic progress.

"I'm sitting there trying to do my class and trying to help them [children] do their class, there's so many distractions going on and I didn't feel like I could really focus …" Participant 4

"…it was more of a temptation to be on your phone because they couldn't see us, or being distracted by things that were going on at home." Participant 8

Living with loss

Study participants also noted the presence of loss in their personal and academic lives as a result of the COVID-19 pandemic. Losses were described in regards to jobs, income, personal relationships with friends and family, and reduced opportunities for collaborative learning.

"When the pandemic hit, my job shut down. I was a manager at a retail store…" Participant 1

"…before COVID hit, I was able to study with my friends, we could go out and bring our textbooks and eat dinner together.… but after COVID, it's really, everything is so different, and you are just so isolated: and trying to be collaborative …you can't collaborate unless it's over FaceTime or Skype or something like that." Participant 7

Coping with fears and uncertainty

Participants recounted feeling afraid during the early months of the pandemic. Fear and worry about family members and fears concerning personal health were frequently discussed. Concerns about whether other people were taking appropriate preventive measures created stress in face-to-face interactions with social groups.

"…the biggest thing right now is just worrying about their health [family members]: Worried if they get COVID, worried if I get COVID, I mean I have asthma, and if I bring it home and they get it, they are not healthy enough to fight it." Participant 7

"I mean, I'm taking it seriously and I have to trust that the people I hang out with are taking it [COVID precautions] seriously. So, it kept, I guess, my physical social circle very, very small." Participant 10

Learning to adjust

Changed approaches to learning new material

Study participants discussed the outcomes of changes to the instructional design, some of which were determined to be beneficial to learning on a number of levels: students commented on modified approaches to course content and how they adjusted their approaches to learning. During the period of COVID-19 lockdown, all courses were switched to an online delivery platform (e.g., D2L). Courses were modified for online delivery and synchronous Zoom lectures - presented during scheduled class time - were provided in most courses. The lectures were recorded for the benefit of students who might be experiencing connectivity issues and instructors provided on-line tutorials and extra assistance as needed. Participants reported they felt that online instruction required more individual effort than traditional in-class models. In spite of the changes, many participants found the modified curriculum beneficial.

"It turned me into, like, less of a procrastinator, and more focused, more organized." Participant 3

"… it's really different with an online model. I think, as a student, you have to do more outside work, you can't just go sit in a class and absorb the instruction." Participant 4

"I personally enjoyed the online more, just because I was able to listen to the content as much as I needed…" Participant 5

Taking advantage of outside resources

Additional resources such as links to other materials, YouTube videos, and Zoom time with professors were seen as valuable for mastering course content. On-line chats with professors were deemed helpful for clarifying concepts and maintaining contact.

"I think one good thing is they were able to give us all the outside assignments that helped us and the Zoom calls were good for helping with one-on-one." Participant 2

Finding the positives in change

Modifications to course design also included changes to the clinical experience. In an effort to ensure students received adequate clinical time, and prevent students from potentially exposing others on campus, clinical rotations were changed to a six-week continuous block instead of a two-week clinical, two-week classroom model the students had experienced during their initial two semesters in the program. Study participants found the change afforded greater opportunity for integrating clinical concepts, allowed for improved continuity of care, and provided more insight into the daily activities of a practicing therapist.

"I like doing the whole six weeks clinic and then coming back to learn. I feel like I learn a lot more…" Participant 1

"Normally, when we were doing the two weeks on model, I would come back to clinic and almost feel like I had to refresh and start back up again." Participant 5

"… I really know more about what is going on with my patients." Participant 6

"…I kind of like getting the feel of what I'm going to be doing all the time." Participant 8

Career affirmation

Acknowledging workplace realities

Participants were asked if their desire to enter the profession had changed after their experiences in clinic. The subject was a topic of concern for participants was they commented on the daily stresses of respiratory therapists and other health care personnel. Students noted the obvious exhaustion and burnout of clinicians and preceptors and recognized the prospect of working in similar conditions post-graduation: however, the participants felt that what they saw made them more motivated to enter practice.

"I mean, they're getting tired, they are on the front lines with this, and they are getting burned out ... So, I'm just ready to jump in there and help." Participant 4

"…you got to see the people that were from the COVID places [units] when they got done, and they were just worn out. It's definitely rough seeing that, when members of your profession are just done with it. … I definitely felt more motivated." Participant 5

"Personally, I think that the pandemic confirmed my career choice. Seeing how over worked my preceptors are showed me how important it is for Respiratory Therapy to expand and grow." Participant 9

"I'm definitely much more aware and prepared for what I'm going to probably experience once I graduate and start working." Participant 10

Overwhelmingly, participants expressed determination to continue their academic preparation undeterred and the dominant view was the pandemic helped to confirm their career choice.

"…as far as my calling to be a respiratory therapist, it has only strengthened it." Participant 7

"…it is very sad, a lot of these patients aren't doing their best and it's sad, but at the same time … it's my calling." Participant 8

A sense of recognition and reward

In regards to the career, participants expressed their perceptions concerning positives that may accrue for themselves and the profession as a result of the pandemic. They believed their career prospects would be enhanced as a result of increased visibility for the profession brought about by COVID – 19. Staffing shortages in the profession due to increased demand for respiratory therapists were believed to present avenues for greater compensation and perceived value.

"… now people know who we are, because I think a lot of people just don't know anything about respiratory therapy." Participant 2

"I think it has brought a lot of attention to the field – a field not a lot of people knew about." Participant 5

"It gives you a good opportunity, good pay…. It has really affected our job: everyone is in demand right now …" Participant 6

Discussion

All participants expressed a belief that the effects of curriculum delivery modification and pandemic-related lifestyle changes created hardship in the continuation of undergraduate study. Study participants reported that the change resulted in increased frustration and produced barriers to learning due to unfamiliarity with the platforms and reduced access to departmental faculty. In addition, the movement to home-based instruction caused participants to feel their need for hands-on experience with mechanical ventilators and other types of respiratory care equipment was compromised due to reductions in lab time: thus, creating sense of falling behind in their coursework. Such feelings have been recalled by medical students who expressed the belief that on-line learning had negatively affected the quality of their educational instruction.[15] Other studies have shown when students have had previous experience with online learning, overall satisfaction tends to improve: the use of multimedia may also improve overall satisfaction with online learning platforms.[16,17]

The delivery of educational content for students who are learning from home produced additional challenges for participants. A majority in the study group reported issues with internet connectivity or access that caused frustration and interruption of the learning process. Such problems resulted in delays completing course work and a sense of being disconnected from classmates. Home-bound learners also reported problems with maintaining focus on academic work due to distractions produced by children, pets, and competing electronic media (e.g., cellphones). Such learners also remarked that maintaining motivation to "go to class" digitally was often a problem. Students forced into learning situations that require them to self-isolate or learn from home have been shown to experience increased difficulty with concentration, motivation, and keeping up with coursework due to the forgoing factors. [18]

Study participants indicated that pandemic-related events had created a series of losses in connection with personal and academic life. A majority of students who were working either full or part-time had absorbed job or financial losses due to the COVID-19 pandemic. Participants also reported the loss of personal relationships, feelings of isolation and loneliness, and strained family relations due to the politicization of the pandemic. Such findings concerning actual financial loss or the potential for loss in terms of internships or future opportunities have been reported among university students nationally: feelings of isolation/loneliness and loss of motivation were among the most frequently identified conditions in this group.[18,19]

Feelings of fear were common topics discussed by the study group. Participants expressed concerns about becoming ill, or having family members who might become ill with the virus. Personal health concerns were also expressed as a number of students described weight gain, altered exercise regimens, and changes in diet. Other issues related to fear included concerns about academic performance and a fear/distrust of other people. Large national studies have found students who have had the virus, or have close personal friends or family members who have become infected, are more likely to have increased fear in regards to illness.[19] Concerns related to personal health have been shown to be more pronounced among students who have existing conditions or illnesses, and alterations in diet and exercise tend to accompany forced social isolation.[18]

In spite of initial difficulties in managing online/hybrid delivery systems, the majority of participants felt that they had adapted to some degree to the new methods as increased focus, improved organization, more study time, and less procrastination were noted. These findings align with previous research which indicated that while negative aspects of COVID-related change were dominant features (e.g., stress, worry, isolation), students were still able to make positive life-style modifications.[19] Other changes that were popular with the study group included access to recorded lectures, outside assignments, and one-on-one Zoom time with professors. These modifications to course delivery have also been shown to be favored by other groups of health science students.[15]

Participants expressed recognition of the challenges they were likely to face in clinical practice during the COVID-19 pandemic. They discussed the effects of a high-stress environment on their preceptors and other staff working in hospitals. Students also expressed concern about how respiratory care practitioners, physicians and nurses were coping with overloaded schedules and long hours on the job: the potential for family stress was also identified as a possible issue for participants raising children. The effects of the pandemic on health care workers have been widely reported, such studies have indicated the presence of conditions that predispose workers to burnout such as high workloads, time pressures, and job stress.[20,21] Research concerning the effects of the COVID-19 pandemic on career intention among health science students is scant. Results from a study of student nurses in Korea revealed that the pandemic had a negative effect on their desire to pursue a clinical nursing career due to mismatches between financial considerations and personal sacrifice.[22] Conversely, members of this study group were unanimous in their views that workplace factors were something they could overcome, and most participants indicated they were eager for the challenge.

In regards to the continued pursuit of a health care career, decisions regarding the desirability of careers and career development are posited to rest upon three variables: (1) self-efficacy: (2) outcome expectations: and (3) personal goals: the theoretical constructs of social cognitive career theory (SCCT).[23] The behavior of individuals in regards to career selection and development is believed to be influenced by the inter-play of these factors. Participants in this study, described a sense that a variety of outcome expectations have been enhanced as a result of the increased visibility and perceived value of respiratory care practitioners due to the COVID-19 pandemic. Perceptions of greater employment opportunity, income potential, and learning experiences were highlighted by the study group. In addition, participants expressed a belief that they received positive recognition from patients and families and felt a sense of being needed. No participants in the study expressed an interest in changing their career path due to the realities of the pandemic: in most instances, students reported that they had an increased desire to enter practice as a result of their clinical experiences. Such findings are supported by job satisfaction/career intent research focused on internal and external motivators that show recognition and opportunity are important factors in job satisfaction.[24] Additionally, the support of basic human needs such as belonging and feeling needed relate strongly to satisfaction with a career choice.[25]

Limitations

This small-scale qualitative study represents the experiences and perceptions of students in one university located in the South-Central United States. Other programs may have adjusted the delivery of course materials differently, and as the state-by-state responses and experiences with the COVID-19 pandemic have been far from universal, students in disparate respiratory care programs may hold alternative perspectives concerning this unique period.

Conclusions

The findings of this study indicated the educational experiences of respiratory care students are similar to other groups in regards to managing modified curricula brought about by concerns related to the COVID-19 pandemic. A majority of participants felt frustrated and challenged by unfamiliar digital platforms and the technology necessary to access educational content: self-described "hands-on" learners felt particularly disadvantaged. Enforced social distancing created a sense of disconnect and isolation for participants that was only partly resolved by on-line interactions with professors and colleagues. Over time, participants indicated on-line coursework became more comfortable, and some of the course modifications were regarded favorably: however, a majority of students indicated they were ready for a return to traditional forms of instruction.

A major finding of this research was the continued enthusiasm expressed by participants for a respiratory care career. All study participants had witnessed the physical and psychological toll experienced by preceptors and other RCPs during the pandemic. In spite of some concern for their own welfare, the participants were universal in describing a sense of eagerness and increased motivation to help unburden their fellow RCPs and to provide care to those in need. Such findings should be encouraging for department managers and hiring directors who are struggling to make up for staffing shortages brought about by the increased demand for respiratory care services. However, the research literature indicates that new graduates may be less resilient than veteran staff members and are known to be more susceptible to the effects of stress, anxiety, and burn out.[26-28] It is recommended that departments follow retention models promoted in the nursing literature. Methods that include thorough orientations, mentorships, residencies, and regular de-briefing sessions for new graduates have been shown to increase retention, and reduce employment costs.[29-31] Such approaches can help foster a sense of belonging and support, and help leverage enthusiasm brought to the profession by graduates who have already fully evaluated their career choice.

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Appendix A

Interview Protocol

General Introduction: Thank you for your participation in this research study. The interview should take approximately thirty minutes. There are several questions we have prepared for this study. I may ask additional questions for clarifications such as, “Can you expand on that issue?” or “How did that make you feel?” If you are uncomfortable with any of the questions I ask, please let me know immediately and I will move to the next question. Results of this research study may be published but your name or identity will not be revealed and all data collected in connection with the study will remain confidential. Your participation in this research study is voluntary and refusal to participate will involve no penalty to you or loss of benefits to which you are otherwise entitled. You understand that you may withdraw from this study at any time without penalty or prejudice.

I would like to ask a few questions about your experiences during the COVID Pandemic.

A. Demographics
    1. Age
    2. Children
    3. Working full or part-time
B. Program experience
    1. Describe your experiences over the past year in the respiratory care program
    2. How has the past year been different compared to your early experiences in the program?
C. Life experience
    1. What has life been like outside of school for you?
    2. Possible probes include effects on family, health and well-being, other challenges.
D. Future plans
    1. Tell me what effect the pandemic has had on your outlook in regards to a health care career.
E. Summing up and final thoughts

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Responding to Challenges Posed by COVID-19: A Mechanical Ventilation One-Pager

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Abstract

Background: The COVID-19 pandemic presented an array of challenges across healthcare, notably critical care staffing models. The potential for mechanical ventilation (MV) to be managed in part by practitioners unaccustomed to doing so revealed the need for basic and applicable education. Detailed online modules and quick-reference document formats emerged to bridge knowledge gaps. To aid clinicians who assisted in the management of mechanical ventilators during the COVID-19 pandemic, a one-page tool was developed and widely disseminated. **Methods:** A panel of experts composed of respiratory care clinicians, educators, and managers developed the tool. Mean respiratory care experience among the panel was 22 years (11-31). The tool contained information derived from evidence-based practices, consensus guidelines, and ventilator platform configurations. Summarized within the document were initial ventilator settings, assessment-based adjustments, and recommended ARDSnet guidelines. A glossary of commonly used terms and modes of ventilation was also included. **Results:** The one-page reference tool was distributed via social media. Available analytics showed social media posts were viewed 46,745 times and the MV reference attachment was opened 2,815 times. It is unclear from available analytics how many times it was downloaded. The MV reference was also posted to the AARC's "Mechanical Ventilation for COVID-19 Video Series" webpage and AARC Connect. The AARC clinical reference site showed 34,501 site visits, though data specific to downloads of the MV reference was not available. Data relevant to views associated with AARC Connect and institutional utilization were unavailable. Data are limited since we could not analyze specific information accessed. **Conclusions:** Quick reference educational tools and just-in-time learning can be developed and disseminated rapidly in times of crisis.

Key Words: COVID-19, Education, Mechanical Ventilation, Pandemics, Respiratory Therapy, Training

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Introduction

The COVID-19 pandemic presented numerous challenges regarding caring for patients in the intensive care unit (ICU) capacity and staffing models throughout the world.[1] There was an overwhelming increase in ICU patient volume and a need to rapidly increase the availability of staff able to assist in the management of mechanical ventilation (MV).[2]

Respiratory care managers and educators were faced with the possibility of a surge in patients requiring mechanical ventilation. In many locations there was a high number of patients requiring mechanical ventilation.[1] Many managers of respiratory care departments recognized the possibility for the utilization of non-ICU clinicians as respiratory therapy extenders as well as the possibility of repurposing anesthesia machines for use as critical care ventilators.[3–6] These challenges required quick and efficient training for clinical personnel.[7,8]

Due to the demand for urgent dissemination of usable information to individuals with a wide-ranging clinical knowledge base, a number of educational strategies, both procedural and technological, were utilized.[2] Such strategies included just-in-time training (JITT), as defined by information provided to clinicians in the right place at the right time, simulation, and continuing education training modules.[2,9,10,11] The American Association of Respiratory Care (AARC) developed the *Mechanical Ventilation for COVID-19 Series* (https://www.aarc.org/resources/clinical-resources/pandemic-ventilation-video-series-covid-19) to provide "foundational knowledge" for caregivers collaborating with RTs during the COVID-19 pandemic. Other efforts documented during the pandemic included rapid deployment of in situ simulations focused on pandemic preparedness.[12,13] Online modules and training videos were utilized at the University of Michigan to train medical students as RT extenders (RTE).[4]

With the goal of supplementing education and training non-ICU clinicians involved in managing mechanical ventilation throughout the COVID-19 pandemic: we developed a one-page tool that could be utilized as a bedside reference for those clinicians assisting with the management of patients on mechanical ventilation.

Figure 1

Ventilator Tip Sheet for non-Critical Care Respiratory Therapists and RT Extenders version 2.4

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This tip sheet assists non-Critical Care Respiratory Therapists and Respiratory Therapy extenders (RNs and APPs) who may be called upon to assist in a pandemic.

Disclaimer: This document is provided for informational purposes only and it does not replace formalized training or knowledge.

Presentation

Patients with COVID-19 appear to have similar lung physiology to ARDS.

Acronyms

VT - Tidal Volume, amount of air inhaled with each breath
RR - Respiratory Rate
PEEP - Positive End Exp. Pressure
P_{PLAT} - Plateau Pressure
Driving Pressure (DP) = P_{PLAT} - PEEP
Trigger - what is needed to start breath delivery to the patient
PIFR - Peak Inspiratory Flow Rate
PIP - Peak Inspiratory Pressure
MAP - Mean Airway Pressure
T_I - Inspiratory time
V_E - Minute Ventilation
PBW - Predicted body weight
F_{IO2} - Fraction of inspired oxygen (0.21-1.0 or 21%-100%)

Other important considerations

- For guidance on the use of other modalities such as prone positioning, epoprostenol, ECMO, or other therapies for severe hypoxemic respiratory failure, please consult your local protocols or guidelines.
- For more information on the biology, epidemiology, diagnostics, treatment and lab values related to COVID-19 refer to: https://onepagericu.com

MODES OF MECHANICAL VENTILATION

Volume Control (VC)
- Settings: VT 4 - 6 mL/kg of PBW, RR 14 - 18 bpm, PEEP (see Table), T_I to achieve PIFR 40 - 60 L/min
- Trigger: 2 - 5 L/min for Flow trigger, -2 cmH2O for Pressure trigger
- Alarms: High Pressure 5-10 above PIP, V_E 50% above and below actual V_E

Pressure Control (PC)
- Settings: Start at PIP 10-15 (adjust for VT goal), RR 14-18, PEEP (see Table), set T_I to ensure complete exhalation 1st, 2nd to make sure inspiratory flow waveform reaches baseline
- Trigger: 2 - 5 L/min for Flow trigger, -2 cmH2O for Pressure trigger
- Alarms: High Pressure 5 - 10 above PIP, V_E 50% above and below actual V_E

RULES OF PROTECTIVE LUNG VENTILATION
- Tidal volume setting: 4 - 6 mL/kg PBW (max 8 mL/kg)
  - PBW in kg = 50 + 2.3 (height in inches - 60)
  - PBW in kg = 45.5 + 2.3 (height in inches - 60)
- Keep plateau pressure ≤ 30 cmH2O
  - Decrease VT by 1 mL/kg PBW if P_{PLAT} > 30 cmH2O
  - Measure P_{PLAT} after any changes
- Titrate FiO2 to maintain SpO2 92-96%
- Maintain driving pressure <15 cmH2O (Driving pressure = P_{PLAT} - PEEP)

Consider low PEEP table for normal compliance/ low driving pressure

Lower PEEP/higher FiO2

FiO_2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

FiO_2	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

Consider high PEEP table for low compliance/ high driving pressure

Higher PEEP/lower FiO2

FiO_2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5
PEEP	5	8	10	12	14	14	16	16

FiO_2	0.5	0.5-0.8	0.8	0.9	1.0	1.0
PEEP	18	20	22	22	22	24

Mode Names on Different Vents

Drager E4 and XL
- VC = CMV, PC = PCV+Assist

Drager V500
- VC = VC-AC, PC = PC-AC

Serov-I and Servo-U
- VC = VC, PC = PC

PB 840 or 980
- VC = A/C VC , PC = A/C PC

Viasys Avea
- VC = Volume AC
- PC = Pressure AC

Hamilton (G5, C3)
- VC=(S)CMV, PC=PCV+, P-CMV

LTV 1200
- VC= Volume AC, PC=Pressure AC

Management Based on ABG
- Normal ABG ranges
  - pH: 7.35 - 7.45
  - P_{aCO2}: 35 - 45 mmHg
  - P_{aO2}: 60 - 100 mmHg
- To decrease P_{aCO2}: ↑V_E
  - Increase rate or VT
- To increase P_{aCO2}: ↓V_E
  - Decrease RR or VT
- To change respiratory rate: (Current P_{aCO2} × Current RR) ÷ Desired P_{aCO2} = new RR
- To increase P_{aO2}: ↑PEEP by 2, and or ↑F_{IO2} by 10%
- Consider permissive hypercapnea to prevent ventilator induced injury, pH as low as 7.25

Methods

A panel of respiratory care practitioners, including bedside clinicians, educators, and managers from various healthcare organizations from around the United States, developed the tool's content. These individuals were members of the AARC Adult Acute Care Specialty Section and have extensive clinical experience. The mean respiratory care experience among the panel was 22 years (11-31). Several panel members have made significant contributions to respiratory medicine through scholarly activities. This collaborative effort was made to develop a tool to aide non-ICU clinicians in MV management of COVID-19 patients as part of the response to the pandemic. Targeted professionals thought to benefit from this reference included, but were not limited to, non-ICU respiratory therapists, RTEs that includes physicians, medical residents, advanced practice providers, paramedics, and other ancillary professionals. Institutional review board approval was not sought because this document was considered a necessary and urgent educational need specific to the COVID-19 pandemic.

The bedside tool developed included the definitions related to MV, positive end-expiratory pressure (PEEP) table, two initial ventilator modes with basic settings, and guides for MV adjustments. We summarized concepts that related to lung-protective ventilation (LPV) and listed variations of MV mode names based on multiple ventilator platforms. The information included on the tool was based on evidence-based practices, consensus guidelines, and ventilator platform configurations.

The tool was written and organized in a way to be comprehensive, but simple to use. A glossary section was included to list acronyms frequently used in MV. Mechanical ventilation terms and acronyms were listed in an attempt to avoid confusion associated with the MV nomenclature. Modes of ventilation were limited to volume control (VC) and pressure control (PC) to provide consistency in education and practice. We provided initial setting guidelines and alarm limits to promote lung-protective ventilation (LPV). PEEP/F_IO_2 tables were adapted from the ARDSnet protocol and LPV guidelines were also included to provide the clinician with guidance on those settings.[14–17] Mechanical ventilation management considerations based on arterial blood gas analysis (ABG) were included to guide clinical decision making based on results. Recommendations included were based on widely accepted ventilator management strategies.[16,17]

Results

A one-page reference guide was created that represented expert consensus. (See Appendix) After development, the document was shared on social media outlets, including Twitter, Facebook, and LinkedIn. The document was also shared via AARConnect and the *AARC's Mechanical Ventilation for COVID-19 Series* webpage. Social media posts of the tool yielded 46,745 views, with the MV attachment being opened 2,815 times. The AARC clinical reference site also showed 34,501 site visits. We were not able to verify through the shared posts how many times the document was downloaded. It is not possible to know how the document may have been utilized during the pandemic. Data are limited with respect to institutional utilization and downloads of the MV reference. The MV reference download data from the AARC clinical reference page was not available. However, it was not our goal to analyze data, and the intent of this project was to share expert opinions in an effort to share knowledge in a timely manner.

Discussion

Our project demonstrates that an expert panel written one-page reference can be quickly disseminated through social media. Although it is difficult to ascertain the internet reach of our reference tool, it was clearly viewed numerous times. This demonstrates the utility of using social media to quickly distribute reference information.

Despite the challenges posed by the COVID-19 pandemic, the need to prepare came as no surprise. In 2007, a CHEST taskforce related to disaster preparedness recommended measures needed to educate staff for increased patient volume.[7] The task force recommended staffing strategies to support the management of mechanically ventilated patients including, but not limited to, the deployment of the staff of the surgery department to the ICUs. Similarly, Project XTREME delineated plans for RTE education, for responding to disaster preparedness/mass casualty events that would increase the volume of patients requiring MV.[8] The AARC had also substantially contributed to disaster preparedness in hosting live, in-person, hands-on training programs for ventilators in the Strategic National Stockpile at conferences for the last several years. (https://www.aarc.org/resources/clinical-resources/strategic-national-stockpile-ventilator-training-program) In conjunction with the Department of Health and Human Service (HHS) & the Center for Disease Control and Prevention (CDC), training was focused on the use of the ventilators that were in the repository to bring awareness and a fundamental knowledge to the use of these specific ventilators. Instructional videos have been available as a self-paced resource.

Education models for continuing healthcare education have evolved, and include flipped classrooms, clinical simulation, and virtual reality. However, these models may be inefficient when healthcare systems are overwhelmed an acute crisis such as a pandemic. With the high volume of patients during the surge of the COVID-19 pandemic, clinical educators and department managers had to address educational gaps quickly due to the increase of non-critical care clinicians stepping in to assist.[1–4,10] Preparation for patient care prior to catastrophic events is desirable, but not all events involving high patient volume can be predicted.[13] Inevitably, unplanned events and process changes will occur, creating the need of pathways to rapidly develop and disseminate information. Real-time training and re-training during unprecedented events have shown to be effective.[3,4,8] Cathcart et al.,[18] described the development of JITT templates that can be quickly modified during public health emergencies to address diverse learning needs among clinicians. Easy to use training modules free-up time and resources to enhance a department's ability to address crises.[18]

The AARC rapidly developed the *Mechanical Ventilation for COVID-19 Series* to support education for non-ICU clinicians that were being deployed as support staff during the pandemic. Similarly, the American Thoracic Society (ATS) developed web-based instructional video series and instructional guides for non-critical care providers.[2,9,10] The European Society for Intensive Care Medicine (ESICM) developed a multi-modeled educational series designed to train or retrain healthcare professionals not regularly working in ICUs on fundamental critical care concepts. (https://c19-space.academy.esicm.org) The American College of Chest Physicians (https://www.chestnet.org/Guidelines-and-Resources/COVID-19/Resource-Center) and the Society of Critical Care Medicine (https://www.sccm.org/COVID19RapidResources/Home) also developed consensus guidelines and resource centers for clinicians, critical care experienced and otherwise. The development of our document was predicated upon bringing foundational concepts to the bedside in a one-page reference tool.

Providing a JITT educational model in times of crisis and frequently changing information is supported by the literature. The model is adapted from the manufacturing industry to manage clinical inventories of information and has been utilized in healthcare prior to the COVID-19 pandemic.[11] A comparison of traditional educational models versus JITT with pharmacists, to administer emergency pediatric influenza vaccines demonstrated similar mean competency scores between both groups.[19] The JITT model has also been used for training nurses in emergency preparedness during disasters.[20] Jacobs-Wingo et al developed six modules, utilizing surveys and focus groups, demonstrating a significant improvement in knowledge before and after training began.[20] Similarly, medical students in a Level 1 Trauma center demonstrated effective competency and confidence with tourniquet application, with training provided by a JITT model.[21] Brickman et al,[21] describe retraining a large number of CRNAs as bedside nurses via 3-hour critical care class. The narrative did not however provide qualitative analysis of outcomes or adverse events.

The most relevant aspect of our effort to help provide a bedside educational resource was the dissemination via the internet. Similar efforts were widely described during the COVID-19 pandemic. Mark[22] developed several one-page educational documents. These were distributed using a blog format and via social media, primarily Twitter. Siuba et al described the utilization of social media as a means to disseminate medical education.[23] The authors write that sharing knowledge via social media facilitates a more informal learning model with elements of mentorship and allows for new ways of thinking about old problems.[23] Similarly, Acquaviva et al,[24] described the easily disseminated nature of social media for building scholarship. These concepts were central to the utilization of social media disseminate the resource we developed.

Regardless of the educational model, the dissemination and delivery of the resources to a large number of clinicians in an efficient way was perceived to be important early in the COVID-19 pandemic. Social media platforms have increasingly become a forum for scholarship and education and rapid dissemination of information, and this was on display during the pandemic.

Limitations

A major limitation to our project is that the tool was not validated. Thorough validation of the tool prior to distribution would have allowed for feedback to drive improvements to content and usability. Also, we were unable to track tool use or downloads, which limits our understanding of how clinicians perceived its clinical value. The use of social media to disseminate the tool, in theory, made it widely available, but this cannot be verified. We were able to quantify the views of the tool, but were not able to assess downloads or use. We are also unaware of the tool was altered in any way, invalidating our expert consensus.

Furthermore, the management of MV on non-ARDS patients may be different from those with ARDS.[17] While some have argued that COVID-19 can be treated as ARDS, others have, perhaps correctly, pointed out significant differences in the etiologies.[25,26] We therefore acknowledge that a limitation of this project is the inclusion of a MV management strategy similar to one that would be used to treat ARDS.

We suggest refinement and validation of one-page ICU tools in anticipation of future outbreaks, epidemics, and pandemics. Future research should focus on comparison of JITT and one-page modules to test differences in educational outcomes.

Conclusions

Using expert consensus, quick reference educational tools and just-in-time learning can be developed and disseminated rapidly in times of crisis.

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Teaching Evidence-Based Practice in Respiratory Therapy Education: A Pilot Study

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Abstract

Background: The use of evidence-based practice (EBP) in clinical decision-making is considered a major respiratory therapy competency established by the profession. Currently, there is a limited understanding of what factors influence the use of EBP among respiratory therapists. The purpose of this pilot study was to describe currently used educational strategies and resources for teaching EBP in associate degree respiratory therapy programs in a large community college system. **Methods:** An online self-administered questionnaire was developed and distributed to 35 faculty using a web-based survey platform. Survey responses were analyzed using descriptive statistics. **Results:** The survey return rate was 65.7%. Case studies (87%) were the most common teaching strategy and AARC clinical practice guidelines (87%) were the most common resource used by faculty. All of the steps of EBP were reported as being taught to students, with searching efficiently for the best available evidence used most often (65.2%) and formulating a clinical question was used least often (21.7%). Faculty expressed concern regarding time limitations and lack of experience in teaching EBP concepts in the curriculum. **Conclusions:** Faculty in this study used some teaching strategies and resources to teach EBP concepts. Potential opportunities exist to increase awareness and use of strategies and resources available to develop meaningful EBP learning experiences without creating additional time constraints in the curriculum.

Keywords: evidence-based, evidence-based practice, research, respiratory therapy, associate degree programs, curriculum, learning experiences, competencies, teaching strategies

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Introduction

In 2007, the American Association for Respiratory Care (AARC) established a task force and commissioned a series of conferences to look at health care trends, changes in the healthcare workforce, and expected changes in respiratory therapy to meet future healthcare needs. As a result, EBP emerged as one of the major core competencies needed by respiratory therapists to provide quality patient care.[1] Evidence-based practice involves using the best available research evidence, clinician expertise and experience, and patient values and preferences to make informed clinical decisions.[2] While the definition seems fairly straight forward, understanding what is involved in EBP remains unclear among many respiratory therapists.[3] The lack of self-efficacy, knowledge, and skills documented in studies highlight an important gap regarding the incorporation of the principles of EBP into the education and training of health care professionals.[4-10] Asokan[11] suggested that a research-practice gaps exists resulting from a lack of training in developing interprofessional collaborative and research competent health professionals to use EBP in day-to-day clinical practice. As a result, Asokan recommended that a well-structured curriculum that includes the principles of EBP is needed to prepare graduates to apply practice-related research findings to clinical decisions. However, the extent to which EBP has been incorporated into the respiratory therapy education has not been well established.

The majority of the research conducted on assessing EBP curriculum has been with clinicians, students, and faculty in baccalaureate and graduate education programs. In contrast, respiratory therapy associate degree programs provide the primary means of entry-level preparation but have been the subject of less research in regard to EBP. Respiratory therapy students must learn to apply the principles of EBP in the didactic and clinical setting by demonstrating their ability to effectively ask, acquire, appraise, and apply evidence to practice as well as assessing patient outcomes.[1,12-16] Welch et al.[9] suggested that creating a culture of EBP must start with didactic education. The incorporation of the EBP principles in the curriculum should not be limited to one course but span the entire curriculum in didactic and clinical student learning experiences.[17] Higher levels of education, research activities, and engaging in EBP training opportunities are positively associated with increased knowledge and confidence in understanding and using EBP.[8,9] According to the Commission on Accreditation for Respiratory Care (CoARC), there are over 400 entry-level respiratory therapy programs in the United States with only 17% at the baccalaureate and graduate degree level (https://coarc.com/, Accessed February 19, 2021). Less than half of respiratory therapists hold a baccalaureate degree or higher.[18] Currently, only 17% of graduates are earning entry-level respiratory therapy baccalaureate or graduate degrees.

Barnes, Kaczmarek, and Durbin[19] surveyed respiratory therapy education program directors to assess the current state of readiness to address the required competencies expected of new graduates and found that three of five EBP competencies were taught significantly less in associate degree programs compared to baccalaureate programs. The competencies included: (a) the ability to critique published research, (b) the ability to explain the meaning of general statistical tests, and (c) the ability to apply EBP to clinical practice. The results of the survey indicated that EBP is being taught at both educational levels but to a much lesser extent in associate degree programs. With a general agreement that EBP is essential to the profession, there are concerns that the majority of respiratory therapists entering the profession and currently practicing respiratory therapists are not prepared to effectively use EBP as a tool to inform clinical decisions.

The AARC contends that a minimum of a baccalaureate degree is needed to meet the competency requirements to enter practice, with a goal to reach the minimum requirement by 2030.[20] Teaching EBP concepts is important in preparing new respiratory therapy graduates to enter clinical practice with the skills necessary to identify, critically appraise, and apply scientifically supported respiratory care throughout their careers.[11,21] Incorporating EBP concepts consistently in the respiratory therapy associate degree curricula will facilitate new graduate transition to clinical practice and serve to strengthen the overall future transition of the profession. However, respiratory therapy faculty may not be prepared to teach EBP to students due to their own lack of EBP knowledge and experience. A prerequisite for teaching in respiratory therapy education programs requires experience as a clinician. Clinicians who transition to teaching without sufficient knowledge and experience in using EBP in clinical practice may not be aware of teaching strategies and resources and be less likely to teach EBP concepts to their students. Therefore, the specific aim of this pilot study was to determine what teaching strategies and resources faculty use to teach EBP concepts in entry-level respiratory therapy associate degree programs from one community college system.

Methods

This pilot study used a non-probability, descriptive survey research design to collect data. Prior to data collection, study approval was obtained through the sponsoring institutional review boards. Faculty were notified by an email invitation requesting their participation. Informed consent was included at the beginning of the questionnaire prior to accessing the items.

Study Participants

Faculty currently teaching in associate degree respiratory therapy programs in a large community college system were invited to participate in the study. To facilitate recruitment of study participants, permissions were obtained from the respiratory therapy educators' association to use their email distribution list for soliciting participation. A total of 35 faculty were invited to participate, with 25 faculty responding to the survey. Data were missing for two faculty leaving 23 total participants. Average years of age for faculty participating in the study was 45.4 (SD = 8.14). The majority of faculty were female (71.4%), held a baccalaureate degree (62%), had 11 or more

years of clinical work experience (81%), less than 11 years of teaching experience, and worked in an urban-suburban location (66.7%).

Instrumentation

Strategies and resources for teaching EBP used by respiratory therapy faculty were assessed using 10 items adapted from previous research conducted among faculty in an entry-level master's degree occupational therapy program.[22] The instrument was selected based on its ease of use, length, and the ability to revise the survey content for use with respiratory therapy faculty. Permission was obtained from the authors to use and modify the survey instrument. Check-all-that-apply items were used to assess 1) types of courses in curriculum that included EBP concepts, 2) types of strategies used to teach EBP concepts, 3) types of resources used for developing and teaching EBP concepts, 4) objectives for teaching EBP concepts, 5) steps of the EBP process, and 6) approaches used to support teaching EBP in the curriculum based on the AARC 2015 and Beyond Initiative. One yes/no item was used to assess if the curriculum included courses that focus exclusively on EBP and one multiple choice item to estimate how many courses in the curriculum incorporate EBP concepts. Two open-ended items were included for faculty to add any additional experiences with incorporating EBP into the curriculum that was not covered by the check-all-that-apply items and any other additional comments. The survey is included in the supplemental materials.

Comments were reviewed to assess other potential areas related to challenges or insights in teaching EBP concepts for possible common themes and future research considerations. Face validity of the survey instrument was assessed by 10 experts with respiratory therapy related experience, at least 10 years of clinical practice, and familiar with EBP concepts.[23] All respondents indicated that the instructions were clear with only minor suggestions for revisions. All respondents agreed that the survey instrument appeared to be relevant and effective in obtaining the requested information.

A modified Dillman approach was used to increase response rates.[24] Two personalized email correspondences were sent to 35 faculty members over a 3-week period, with the reminder email occurring in the second week. The response rate improved slightly following the reminder email with 65.7% of faculty completing the survey. The online questionnaire was distributed using Qualtrics and data analysis procedures were conducted using SPSS 25.0 statistical software. Descriptive statistics were used to calculate the frequency of responses for each item. Percentages for each answer choice were reviewed and presented to compare responses.

Results

Of the 23 faculty who completed the survey, 10 (43.5%) reported that they did not incorporate EBP concepts into any courses, 4 (21.7%) reported including EBP in up to 3 courses, 2 (8.7% reported including EBP concepts in up to 6 courses, and 4 (21.7%) reported including EBP concepts in up to 9 courses. Having a course that focused exclusively on EBP was reported by only 17.1% of faculty, with the remaining 82.6% of faculty reporting no courses. All of the steps of EBP were reported as being taught to students with searching for the best available evidence used most often (65.2%) while formulating a clinical question was used least often (21.7%) (Table 1). The majority of faculty reported incorporating EBP concepts in foundational knowledge (56.5%), assessment and evaluation (73.9%), therapeutics and diagnostics (56.5%), clinical skills and clinical intervention labs (60.9%), and clinical practice (65.2%) courses. Case studies (87%), literature reviews (60.9%), and database searches (43.5%) were used most often by faculty as strategies to teach EBP concepts. Teaching strategies aimed at developing critical appraisal skills and clinical questions were used much less often, 13% and 8.7% respectively (Figure 1).

Figure 1. List of EBP strategies and percentage of usage by faculty for each strategy (n = 23)

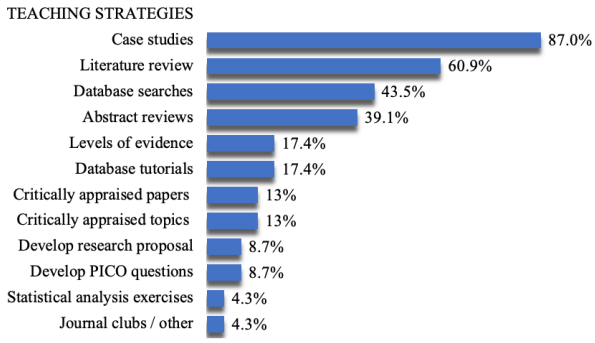

Table 1. Percentage of Faculty Teaching the EBP Steps (n = 23).

Steps of EBP	% of Faculty
Formulate a clinical question	21.7%
Search for the best available evidence	65.2%
Critically appraise the evidence	26.1%
Integrate best evidence with clinical expertise and patient preferences	52.2%
Evaluate one's performance or outcomes	26.1%
Communicate knowledge to other health professionals	52.2%

Resources most commonly used by faculty included AARC Clinical Practice Guidelines (87%), NBRC Exam Matrices (78%), and *Respiratory Care* (65%) (Figure 2). The primary objective for teaching EBP was choosing effective assessment and intervention strategies (82.6%) (Table 2). The majority of faculty reported using different approaches to support the core competency of EBP outlined by the AARC 2015 and Beyond Initiative ranging from having EBP as a core thread in the curriculum (17.4%) to recognizing both quantitative and qualitative research as contributing to EBP (56.5%) (Table 3).

Faculty had the option to provide additional comments regarding suggestions and experiences about incorporating EBP into the curriculum and other comments in general. There

Figure 2. List of EBP resources and percentage of usage by faculty for each resource (n = 23)

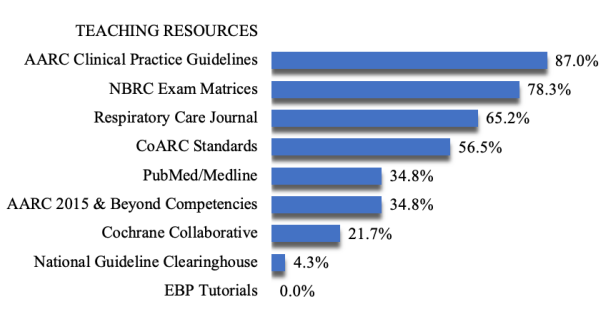

Table 2. Primary Objectives for Teaching EBP Concepts (n = 23).

Primary Objective	% of Faculty
Choose effective assessment and intervention strategies	82.6%
Develop systematic clinical reasoning processes	69.6%
Improve credibility of the respiratory care profession	69.6%
Communicate effectiveness of respiratory care to other healthcare professionals	69.6%
Communicate effectiveness of respiratory care to consumers	56.5%
Expedite knowledge translation from research to practice	65.2%

Table 3. Percentage of Faculty Using EBP Approaches to Support the AARC 2015 & Beyond Initiative (n = 23).

Steps of EBP	% of Faculty
Mission and vision of program includes focus on EBP	43.5%
EBP is a core thread in the curriculum	17.4%
Sufficient library resources to support EBP	43.5%
Students learn to apply interventions from an EBP perspective	52.2%
Quantitative and qualitative research are recognized as contributing to EBP	56.5%

were only two comments regarding suggestions and experiences about incorporating EBP and included 1) incorporating EBP into the curriculum is the best strategy moving forward but it is challenging to cover all of the major content areas within the associate degree time frame and still achieve high pass rates for CoARC accreditation and 2) a desire to include EBP as a teaching strategy more often with more teaching experience. One comment was made regarding limited time in the program to formally teach all of the EBP concepts but an attempt was made to teach some of the basic concepts.

Discussion

Of the faculty who incorporated EBP concepts into the curriculum, they did so mostly in courses covering assessment and evaluation, clinical intervention labs, and clinical practice. These findings are similar to research conducted in an entry-level occupational therapy master's program.[22] Strategies such as using literature reviews and database searches to teach EBP concepts were ranked similar but were reported much less frequently by respiratory therapy faculty. Case studies were used more often by respiratory therapy faculty compared to occupational therapy faculty.[22] The use of case studies can be an effective tool to introduce students to EBP concepts. Students can learn how to develop a clinical question using the PICO method (P = patient, problem, population, I = intervention, C = comparison, and O = outcome). The clinical question can then be used to guide the subsequent literature search to inform the discussion on the case study.

Faculty participating in this study reported using AARC Clinical Practice Guidelines as the predominant EBP resource. The use of clinical practice guidelines, systematic reviews, and critically appraised topics (CATs) may initially reduce the need for the complex search-appraise-implement process.[16,25] While using processed information does not replace the need to learn the EBP process, faculty can use this approach as building blocks for teaching the fundamental concepts. Respiratory therapists should be able to search for and apply clinical practice guidelines and systematic reviews. The use of processed information may be an effective way to translate research into daily clinical practice and reduce the research-practice gap. However, processed information may not always be available to address a defined clinical question, which would then require following the EBP process.

Regarding teaching specific EBP concepts, faculty taught searching for the best available evidence more often compared to how to formulate a clinical question, critically appraise literature, and evaluate outcomes. Developing a relevant and searchable clinical question is a critical first step in the literature search and using the PICO format is an effective strategy.[26] However, faculty reported using the PICO format as one of the least common strategies, thus raising concerns over the effectiveness of the literature search methodology that is being taught. Slightly over 50% of faculty in this study reported teaching applying EBP in clinical decisions compared to 81% of program directors in the study conducted by Barnes and colleagues.[19] The AARC determined that critical appraisal and application of EBP in clinical practice could be acquired following graduation from an entry-level respiratory therapy program.[27] Research suggests that even though respiratory therapists are aware of EBP, they are less likely to engage in available professional development to learn about EBP implementation, which raises concerns that they will not acquire the necessary skills after graduation.[28]

Faculty provided comments regarding suggestions and experiences about incorporating EBP into the curriculum and other comments in general. The common theme that emerged was related to limited time in the associate degree curriculum to teach additional concepts in an already full curriculum.

To potentially reduce the barriers, models exist on how to incorporate EBP concepts. Larmon and Varner[29] integrated EBP and research utilization over several courses throughout the nursing curriculum using various learning activities. They suggested having students conduct article critiques of peer-review journal articles on specific patient conditions, brief literature reviews on specific topics, and present their literature review findings to peers and faculty to help students make the connection between EBP and its value in clinical practice.

Dotson et al.[17] established EBP competencies and course outcomes that spanned across a 4-semester nursing associate degree curriculum. A small proof of concept study demonstrated feasibility of using a clinical research practicum to apply principles of evidence-based protocol-guided respiratory care clinical practice in an associate degree respiratory therapy program.[30] Students received clinical research training from the clinical affiliate and participated in clinical research activities such as collecting data, performing data analyses, presenting findings, and recommending modifications to clinical protocols based on the data and best available evidence. The goal is to use existing didactic and clinical student learning experiences and enhance them by incorporating EBP concepts to apply in clinical decision making without causing additional burden of trying to create another course or displacing existing content of importance to the programs.[17]

Limitations

This pilot study used a small convenience sample (n=23) from associate degree programs in one state, which limits the generalizability of the results to respiratory therapy faculty teaching in all associate degree programs. While the response rate among invited faculty was 65.7%, there were faculty who were not invited due to limited contact information. The survey instrument used in this pilot study was adapted from a previous study for occupational therapy faculty. The authors indicated the occupational therapy survey instrument was reviewed by peers and edited based on feedback. The content was modified to reflect respiratory therapy education resources and competencies. While face validity was assessed by experts in respiratory care, the survey instrument was not tested for further evidence of reliability and validity. Future studies with a larger sample size from multiple academic institutions are needed to provide evidence of reliability and validity of the results.

Conclusions

This descriptive pilot study provides baseline information regarding practices of associate degree respiratory therapy faculty in teaching EBP concepts in a large community college system. While faculty in this study used some teaching strategies and resources to teach EBP concepts, there are opportunities to increase awareness and use of strategies and resources available to develop meaningful learning experiences without creating additional time constraints in the curriculum. Previous educational and clinical experiences may influence the ability of faculty to be effective in teaching EBP concepts. The results of this pilot study may be used to inform a larger study of associate, baccalaureate, and graduate degree respiratory therapy faculty. In addition, the study may help bring awareness of the need to incorporate EBP concepts into the respiratory therapy associate degree curriculum to improve education and promote the use of EBP among respiratory therapists. Targeted professional development opportunities for respiratory therapy faculty are needed to develop ways to enhance teaching EBP concepts across the respiratory therapy curricula.

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Appendix A

Survey Instrument

Respiratory Therapy Faculty Teaching Strategies for Evidence-Based Practice: Please complete the following items in relation to strategies and resources used to teach evidence-based practice in the respiratory therapy program curriculum.

1. Please provide an estimate of how many courses in your respiratory therapy program curriculum incorporate evidence-based practice concepts.

   ❑ 0 ❑ 1-3 ❑ 4-6 ❑ 7-9 ❑ 10+

2. Are there any courses in your curriculum that focus exclusively on EBP?

   ❑ Yes
   ❑ No
   ❑ Other (please specify):

3. What types of courses within your curriculum include evidence-based practice concepts? (click on all that apply)

   ❑ Foundational knowledge (e.g., cardiopulmonary anatomy and physiology, pathophysiology, pharmacology)
   ❑ Assessment/evaluation
   ❑ Therapeutics and diagnostics
   ❑ Clinical skills/clinical intervention labs
   ❑ Clinical practice
   ❑ Other (please specify):

4. What evidence-based practice strategies do you use to teach respiratory therapy students in your curriculum? (click on all that apply)

   ❑ Development of PICO questions
   ❑ Critically appraised topics (CAT)
   ❑ Critically appraised papers (CAP)
   ❑ Abstract reviews
   ❑ Journal clubs
   ❑ Database tutorials
   ❑ Case studies
   ❑ Literature review
   ❑ Statistical analysis exercises
   ❑ Database searches
   ❑ Levels of evidence hierarchies
   ❑ Development of a research proposal (research question, relevant literature, sample, design, measurement and data analysis)
   ❑ Other (please specify):

5. What resources do you use for developing and teaching evidence-based practice concepts in your curriculum? (click on all that apply)

   - ❑ AARC 2015 and Beyond initiative major competency areas
   - ❑ AARC Clinical Practice Guidelines
   - ❑ National Guideline Clearinghouse sponsored by the Agency for Healthcare Research and Quality (https://www.guideline.gov/)
   - ❑ CoARC Standards for Entry-Level Education
   - ❑ NBRC Exam Matrices
   - ❑ PubMed/Medline
   - ❑ Respiratory Care
   - ❑ The Cochrane Collaboration (Website, Library, Resources)
   - ❑ EBP Education Center of Excellence (http://guides.lib.unc.edu/EBP_Education_COE)
   - ❑ Introduction to Evidence-Based Practice (http://guides.mclibrary.duke.edu/ebmtutorial)
   - ❑ Other (please specify):

6. In your opinion, the primary objectives for teaching evidence-based practice concepts in the respiratory therapy curricula are to enable students to:(click on all that apply)

   - ❑ Choose effective assessment and intervention strategies
   - ❑ Develop systematic clinical reasoning processes
   - ❑ Improve credibility of the respiratory care profession
   - ❑ Communicate effectiveness of respiratory care to other healthcare professionals
   - ❑ Communicate effectiveness of respiratory care to consumers
   - ❑ Expedite knowledge translation from research to practice
   - ❑ Other (please specify):

7. Which of the following steps of evidence-based practice are taught in your curriculum? (click on all that apply)

   - ❑ Formulate a clinical question
   - ❑ Search efficiently for the best available evidence
   - ❑ Critically analyze evidence for validity and usefulness
   - ❑ Integrate best evidence with clinical expertise and patient preferences
   - ❑ Evaluate one's performance or outcomes
   - ❑ Communicate knowledge to other healthcare professionals
   - ❑ Other (please specify):

8. The AARC's 2015 and Beyond initiative identified evidence-based practice as a major competency area needed by all respiratory therapists 2015 and beyond. How does your curriculum support this aspect of the 2015 and Beyond initiative? (click on all that apply)

   - ❑ The mission and vision of the program includes a focus on evidence-based practice
   - ❑ Evidence-based practice is a core thread in the curriculum
   - ❑ Library resources are sufficient to provide support for students to develop skills in evidence-based practice
   - ❑ Students learn to apply interventions from an evidence-based perspective
   - ❑ Both quantitative and qualitative research are recognized as contributing to evidence-based practice
   - ❑ Other (please specify):

9. Please include any additional suggestions and/or experiences you would like to share about incorporating EBP into the curriculum:

10. Please include any additional comments here:

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Recognition of Patient-Ventilator Asynchrony in the ICU

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Abstract

Background: Patient-ventilator asynchrony (PVA) is present in approximately 25% of the mechanically ventilated patients and is associated with increased mortality. Recognition of PVA is a skill that requires training and experience in the analysis of ventilator waveforms. The goals of this study were to determine the ability of health care providers (HCPs) to recognize PVA and its correlation with profession and official training in mechanical ventilation. **Methods:** Observational study conducted at a university–affiliated hospital. HCPs in the ICU (physicians, residents, fellows, respiratory therapists, nurses, and physician assistants) were asked to recognize 4 common types of PVA after screen shots of PVA were shown. **Results:** A total of 47 HCPs participated. Only 19.1% of HCPs recognized the 4 types of PVA correctly, whereas 27.7% did not identify any PVA correctly. Autotrigger and missed trigger were the most identified PVAs (42.5%). The percentage of trained HCPs who identified at least 2 PVAs (77.7%) was significantly higher than non-trained HCPs (22.3%; $P = 0.023$). Lack of recognition of any PVA was significantly higher in the non-trained group (76.9%) than in the trained group (21.3%; $P = 0.005$). **Conclusion:** A limited number of HCPs recognized PVA. While profession and years of experience were not relevant factors to identify the PVA using waveform analysis, those HCPs with previous training in mechanical ventilation had the ability to recognize PVA more frequently. Continuing education on waveform analysis, not ICU experience, can increase recognition of PVA in the ICU and improve safety of patients undergoing mechanical ventilation.

Keywords: patient ventilator dyssynchrony, mechanical ventilation, critical care, ventilator waveforms

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Introduction

Patient-ventilator interaction is the synchrony between patient and the ventilator and can be affected by the ventilator mode, level of support, and patient characteristics.[1-3] Patient-ventilator asynchrony (PVA) has been defined as the inappropriate timing and delivery of a ventilator breath in response to a patient's effort to breathe.[2,4-6] Although modern ventilators have been designed to improve patient-ventilator synchrony, PVAs often go unrecognized. The incidence of PVA in the ICU has been reported to be anywhere from 25% to 100%.[3,7-10] These rates reflect the fact that recognition of PVA is challenging as it requires knowledge about respiratory physiology and ventilator waveform interpretation during the breath cycle (inspiration, transition from inspiration to expiration, and expiration).[2,4,5,11,12] PVA have been classified depending on the phase of the respiratory cycle where they occur and include trigger asynchrony (i.e., ineffective effort [IE], auto trigger [AT]), flow asynchrony (i.e., double-trigger [DT]), and cycling asynchrony.[1,9,12,13] While some diagnostic methods to assess PVA are invasive and expensive (i.e., electromyography and esophageal pressure monitoring), ventilator waveforms may allow recognition of PVA in real time, noninvasively, and at no additional expense.[10,14,15]

Optimal patient-ventilator interaction avoids excessive or continuous sedation because sedation may influence the prevalence of PVA and prolong the ICU stay. Assessment of patient sedation level while being mechanically ventilated include the use of sedation protocols, sedation scales such as the Richmond Agitation Sedation Scale (RASS), daily awakening trials "sedation vacation" or alternate dosing between opioid and sedation may reduce excessive sedation.[7,16,17] Ideal patient-ventilator synchrony avoids excess sedation, patient anxiety or discomfort, episodes of fighting with the ventilator or diaphragmatic dysfunction.[17,18]

Health care providers (HCP), and especially respiratory care practitioners should be able to identify PVA due to well-recognized detrimental effects on the patient such as increased work of breathing, patient discomfort, increased need for sedation, prolonged mechanical ventilation, and increased mortality.[1,4,13,14] There is limited research regarding the ability of HCPs such as respiratory therapists, nurses, advanced practice providers or physicians in training to identify PVA in the ICU.[17,19-21] Ramirez et al.,[19] recently reported a direct correlation between training in mechanical ventilation and ability of physicians, nurses and physiotherapists in Chile to identify PVA while Colombo et al.,[17] found that ICU physicians were able to detect less than one-third of the PVAs and ICU residents only 16%. Chacon et al.,[20] found that well-trained ICU nurses were able to recognize ineffective efforts (IE) with similar accuracy as highly trained critical care physicians. Alqahtani et al.,[21] recently reported a statistically significant difference between trained and untrained critical care practitioners' ability to recognize double triggering, auto-trigger, and ineffective trigger in Saudi Arabia and the Middle East countries.

Despite the obvious and growing perception that PVA recognition and management are important to improve clinical outcomes in the ICU,[18,21-24] as the prevalence of PVA increases, it appears that the rate of correct identification of PVA by HCPs decreases.[17,21,25] Respiratory therapy programs probably provide the most intensive formal training on patient-ventilator interactions compared to other disciplines. Reinforcement of waveform interpretation in the respiratory care curriculum can improve the level of competence of PVA recognition upon graduation. This skill can result in a higher level of confidence to train other healthcare providers in clinical settings where PVA recognition can impact patient's outcomes. The goal of this study was to assess the ability of HCP that includes respiratory therapist, advanced practice providers and physicians in training to recognize PVA at a university – affiliated hospital according to their years of experience, profession or credential and official training in mechanical ventilation.

Methods

An observational study was conducted at a university-affiliated, 496-bed hospital. Health care providers who routinely care for mechanically ventilated patients in the intensive care unit were invited to participate in this study during the month of March of 2018. The Institutional Review Board approved the study.

Demographic information collected from participants prior to displaying waveforms for interpretation included gender, age, profession (MD, RN, RT, PA), numbers of years working in the ICU, type of ICU (specialties such as medical, surgical, neurological, cardiac), and level of education (AS, BS, MS, PhD, EdD, MD, OD). The level of experience with mechanical ventilation in the ICU was defined in a similar fashion to Ramirez et al.,[19] (experienced: >/= 5 years vs. limited experience: < 5 years). Training participants were asked if they had any prior education on mechanical ventilation, waveform interpretation, and PVA recognition, defined as successful completion of mechanical ventilation course(s) offered by a formal academic curriculum. They were also asked if they discussed ventilator graphics in daily patient rounds.

Four screenshots displaying pressure-time, flow-time, and volume-time waveforms with evidence of PVA (ineffective effort [IE], auto-trigger [AT], flow asynchrony [FA], and double-trigger [DT]) were presented to each HCP in the same order as shown in Figure 1.

The screenshots with PVA waveforms displayed to study participants were obtained from recorded videos using a test lung connected to a Dräger V500 (Dräger, Lübeck, Germany) in a similar fashion reported by Ramirez et al[18] in their study. After each screenshot, the HCPs were asked to select the best answer from a multiple-choice item questionnaire that included all the PVAs (IE, AT, FA, or DT). See the Appendix 1 to view the evaluation tool.

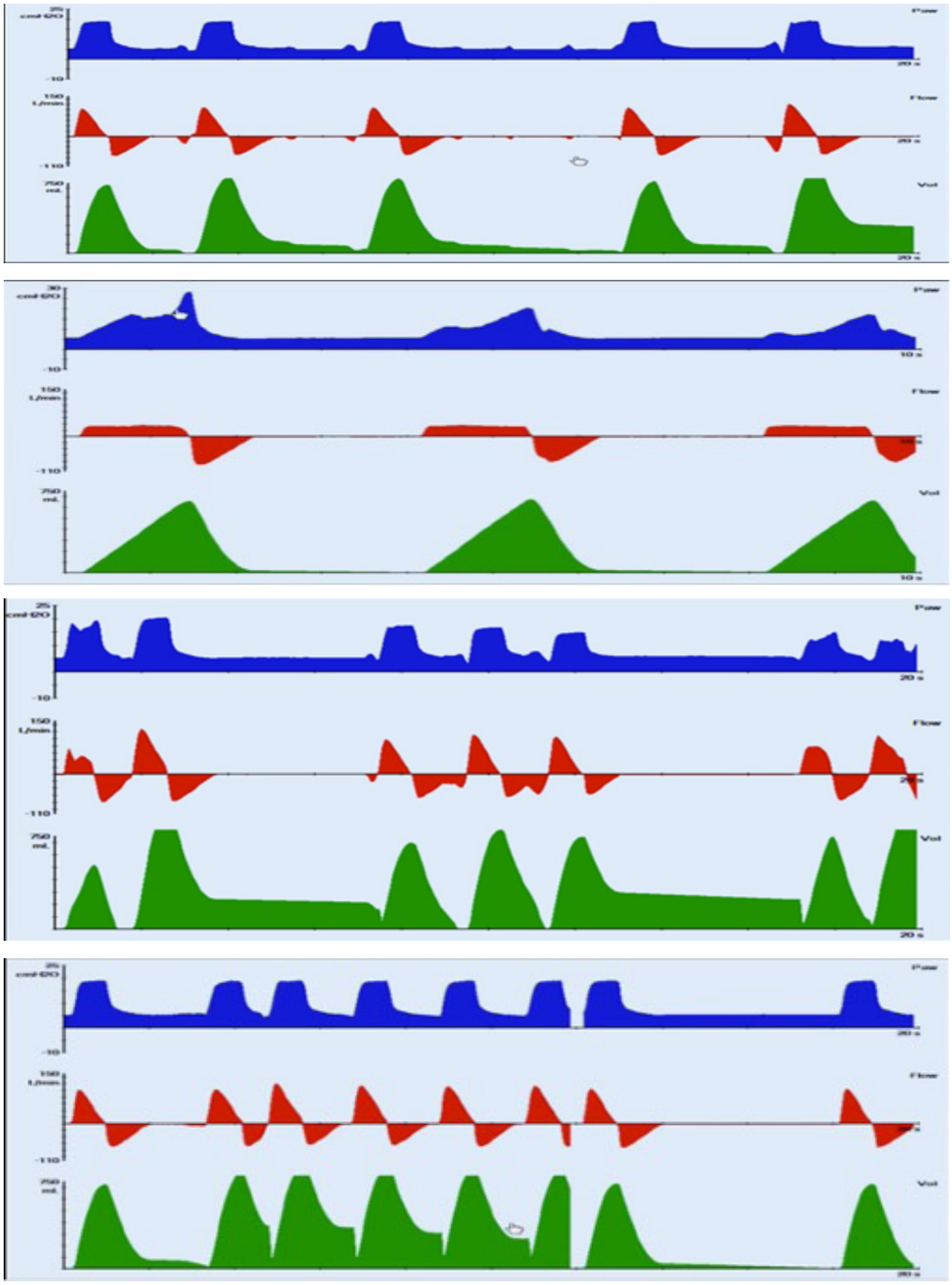
Figure 1. Screenshots obtained from simulated PVAs using a test lung connected to a Dräger V500 ventilator (Lübeck, Germany).
Note: IE = ineffective effort; AT = auto-trigger; FA = flow asynchrony; DT= double-trigger.

Knowledge Assessment

Please use the corresponding image to identify the type of patient-ventilator asynchrony.

Please write the number (on right margin) that matches the following asynchronies.

1. missed-trigger 2. flow asynchrony 3. auto-trigger 4. double trigger



Statistical Analysis

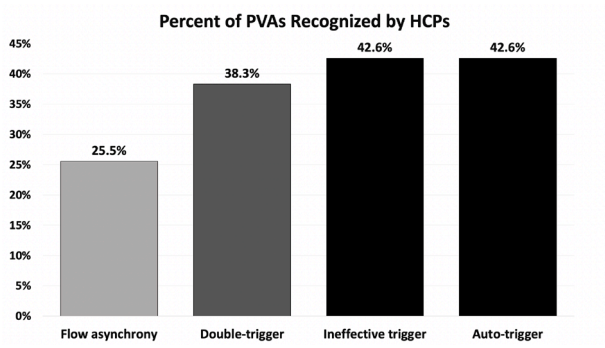
IBM SPSS Statistics v.25 (Chicago, IL) was used for data analysis. Descriptive data are expressed as means and standard deviations. Medians and interquartile ranges were used to report years of experience. A Pearson coefficient was used to determine the correlation between profession/credential, prior training in mechanical ventilation and waveform interpretation, years of experience, hours of training in mechanical ventilation, and the ability to correctly identify PVA. Paired t-tests were used to analyze differences between groups. Statistical significance was defined at a *P* value of <0.05.

Results

A total of 47 HCPs, including 21 respiratory therapists (44.6%) (2 Certified Respiratory Therapist and 19 Registered Respiratory Therapist), 6 internal medicine residents (15%) (1 Postgraduate year [PGY]1; 2 PGY2; 1 PGY3), 1 intensivist (2%) and 7 critical care fellows (23%) (2 PGY4; 1 PGY5; 2 PGY6), 11 nurses (23%) and 1 physician assistant (2%) completed the evaluation. The general characteristics of the HCPs are summarized in Table 1.

Ineffective trigger and auto-trigger were the PVAs most often identified by HCPs (Figure 2).

Figure 2. Percent of PVAs Recognized by HCPs



Only 19.1% of HCPs (n=9) identified the 4 types of PVA correctly, whereas 19.1% (n=9) identified 2 types of PVA and 34.0% (n=16) identified 1 PVA correctly. None of the HCPs evaluated identified 3 PVAs and 27.6% (n=13) did not identify any PVAs. The number of HCPs with training on ventilator graphics (VG) who identified 4 PVAs (n=-5) was not statistically higher than the non-trained group (n=4; P=1.00), while the number of HCPs with training on VG (n=7) who identified 2 PVAs was statistically higher than the non-trained group (n=2; *P* = 0.005). Similarly, the number of HCPs with training on VG (n=6) who identified 1 PVA was statistically higher than the non-trained group (n=4, *P*=0.001). Of those HCPs who did not identify any PVA, the number of non-trained HCPs (n=10) was significantly higher than those HCPs with prior training on VG (n= 3; *P*=0.001) (Figure 3).

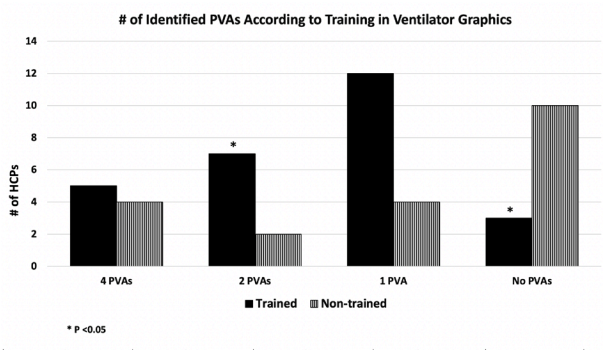
While there was a significantly higher percentage of HCPs with prior training on mechanical ventilation (78.7%; n=37) than those who had received training on PVA recognition

Table 1. Characteristics of Healthcare Professionals (N=47).

Characteristics	Values
Age, mean (SD)	35.3 (10.5)
Gender	
Male, n (%)	21 (44.7)
Female, n (%)	26 (55.3)
Level of Education	
AS, n (%)	13 (27.6)
BS, n (%)	17 (36.2)
MS, n (%)	3 (6.4)
MD/DO, n (%)	14 (29.8)
Years of experience in ICU, median (IQR)	6.0 (2-10)
Type of ICU	
Medical, n (%)	16 (35.6)
Surgical, n (%)	14 (31.1)
Neurological, n (%)	2 (4.4)
Cardiac, n (%)	8 (17.8)
NICU, n (%)	3 (6.7)
PICU, n (%)	2 (4.4)
Training on mechanical ventilation	
YES, n (%)	37 (78.7)
NO, n (%)	10 (21.3)
Number of hours trained on mechanical ventilation	
< 5 hours, n (%)	16 (43.2)
5-20 hours, n (%)	9 (33.3)
20 hours, n (%)	12 (32.5)
Training on Patient-Ventilator Asynchrony	
YES, n (%)	25 (53.2)
NO, n (%)	22 (46.8)

Note: NICU=Neonatal Intensive Care Unit;
PICU=Pediatric Intensive Care Unit;
SD=Standard deviation; IQR=Interquartile range;
n=number of respondents; %=percentage out of all respondents.

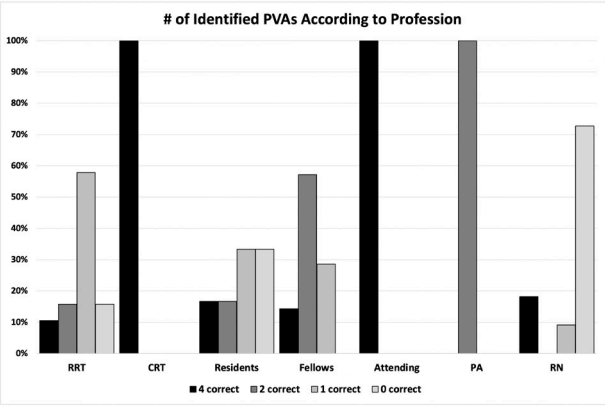
Figure 3. Percent of PVAs recognized by HCPs.



(53.2%; n=25; *P*=0.008), there was not a significant difference in the number of PVAs recognized between HCPs with training on mechanical ventilation and those with training on PVA recognition (*P*= 0.42).

There was no correlation between either the HCP profession or the number of hours HCPs received training on mechanical ventilation and the number of PVAs that could be recognized (r= 0.144 and r=0.01, respectively). The overall rate of recognition of 4 PVAs for RTs and RNs was very similar (19.0%; n=4, and 18.2%; n=2, respectively) and slightly lower in MDs undergoing training (residents and fellows) (15.4% n=2). While the 2 CRTs recognized all 4 PVAs, the RRTs had the lowest rate of recognition of 4 PVAs (10.5%), except for the single PA who recognized 2 PVAs (Figure 4).

Figure 4. Number of PVAs identified correctly according to profession



Almost two-thirds of HCPs (61.7%; n=29) evaluate waveforms routinely during their patient assessment, only 23.4% (n=11) of them discuss waveform interpretation during patient rounds. Of note, 90.1% (n=10) of those who responded positively to discussing waveforms during rounds recognized at least one PVA, compared to only 69.4% (n=11) of those HCPs who did not.

Discussion

This observational study assessed HCPs ability to recognize PVA. Our results reveal a small percentage of HCPs (19.1%) were able to correctly identify all 4 PVAs. This is important because there is a 25% chance that mechanically ventilated patients will experience PVA and HCPs are responsible for maintaining appropriate patient-ventilator interaction.[19]

We found 26.7% of experienced HCPs were unable to identify any PVA, which is similar to results obtained by Younes et al.,[26] and Ramirez et al.,[19] who reported 17-20% of asynchronies were unrecognized by HCPs. Our results are also similar to other studies that report HCPs have a low PVA recognition rate.[1,17,19,21,27]

On the other hand, a small percentage of HCPs (19.1%) were able to correctly identify all 4 PVA which agree with previous studies on asynchrony recognition. Ramirez et al.,[19] recently compared the ability of physicians, nurses and physiotherapists in Chile to identify asynchrony by visual inspection of three videos and found that only 21.3% of participants recognized the 3 types of PVAs. Alqahtani et al.,[21] found only 10.2% of physicians, nurses, and respiratory therapists in Saudi Arabia correctly recognized 3 types of PVA using the same method at Ramirez et al.[19] The rate of recognition of all the PVAs by RRTs in this study (10.5%) was similar to the rate reported by Alqahtani. In contrast with similar studies, none of the participants in the present study recognized 3 PVAs.

Additionally, one of the goals of this study was to assess the ability of HCPs to recognize PVA according to official prior training in mechanical ventilation. There was a significantly higher number of HCPs with prior training on mechanical ventilation than those who had received training on waveform interpretation and PVA recognition. However, this training was not associated with a significantly higher number of PVAs recognized. Ramirez et al.,[19] found a higher percentage of trained physicians, nurses, and physiotherapists (30.4%) being able to identify PVA compared to the untrained group (9.4%). Furthermore, in this study most HCPs who identified one or zero PVA were untrained in mechanical ventilation. Ramirez et al.,[19] and Alqahtani et al.,[21] found training on mechanical ventilation could predict correctly identifying PVAs. Lynch-Smith et al.,[28] described a PVA education program, its impact on clinicians' level of knowledge and patients' mean duration of mechanical ventilation following the education program. Lynch-Smith et al.,[28] found the PVA education program had a significant effect on nurses and respiratory therapist's knowledge gain, but the duration of mechanical ventilation did not change. Years of critical care experience was independent of increase in knowledge of PVA.[28] Given the fact that RRTs usually receive more formal training on mechanical ventilation and waveforms interpretation than other professionals, it is interesting that in this study they did not perform better on PVA recognition than other HCPs.

Additionally, we assessed the ability of HCP to recognize PVA according to their years of experience and profession. A significantly higher percentage of HCPs in our study were unable to identify any PVAs (27.6%) than those reported by Ramirez et al.,[19] (16.7%), although Ramirez et al.,19 did not include respiratory therapists nor advance practice providers. Colombo et al.,[17] who compared expert and non-expert ICU physicians to identify asynchrony by visual inspection of pressure versus time and flow versus time waveforms. The results showed that the rate of detection of asynchrony by waveform inspection was less than one third (28%) in the expert group and 16% in the nonexpert group.[17] Thille et al.,[7] and de Wit et al.,[8] described increase knowledge and interpretation of PVA among nurses and respiratory therapists significantly decreased the number of events and mechanical ventilation duration. The most common PVA identified in these two studies was auto-trigger,[7,8] while Ramirez et al.,[19] reported double-trigger being identified by a significantly higher number of HCPs (58.2% vs. 38.2%) and Alqahtni et al.,[21] also reported 48.7% of their HCPs identified double trigger most often. Our study found 38.8% of our HCPs

identified double-trigger and that 42.6% of HCP identified auto trigger and ineffective trigger more often than flow trigger (25.5%).

This study does have several limitations. First, the PVA waveforms do not include all types of PVA, yet the study focused on the four more commonly reported PVAs. Second, all the waveforms were created using a single ventilator and a single mode. However, this is the type of ventilator used in the clinical setting where the evaluation was conducted. Last, our results reflect a relatively small sample size at a single center, yet the results are consistent with larger and multicenter studies.

Conclusion

A limited number of HCPs recognized PVA. While profession and years of experience were not relevant factors to identify all types of PVA using waveform analysis, those HCPs with previous training in mechanical ventilation had the ability to recognize PVA more frequently. Patients depend on clinicians to recognize PVA and properly correct the PVA. Frequent PVA recognition exposure and continued education are needed. A higher emphasis on patient-ventilator interaction before graduation from respiratory care programs and continuing education on waveform analysis can increase recognition of PVA in the ICU and improve safety of patients undergoing mechanical ventilation.

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Appendix 1

Recognition of Patient Asynchrony Using Ventilator Graphics

Please give about 5 minutes of your time to complete the questionnaire and the knowledge assessment on the recognition of patient-ventilator dyssynchrony.

Your response will help us better understand the role of ventilator graphics in patient care. Your participation will be greatly appreciated. The purpose of the survey is to assess your background and your knowledge of ventilator graphics.

Please be assured that all the information you will be providing will be held in strict confidence and that neither you nor your facility will be identified in any reports that are to be published because of this study. Your participation is entirely voluntary.

Thank you for your time and consideration.

Demographics

Please provide answers to the following questions:

1. Your gender a. Male b. Female	2. Your age: _____
3. The ICU you mostly work at: a. Medical b. Surgical c. Neuro d. Cardiac e. Burn	4. What is your credential? a. RT b. CRT c. Resident (please include postgraduate year) PGY _____ d. Fellow (please include postgraduate year) PGY _____ e. Intensivist (please circle one) Less than 5 years More than 5 years f. PA g. NP h. RN
5. Number of years you have worked in the ICU? _____	6. Education level: a. AS b. BS c. MS d. PhD e. MD/DO

Questionnaire

Please provide answers to the following questions.

1. Have you had formal training on mechanical ventilation?
    a. NO
    b. YES

2. Have you had formal training on waveform interpretation?
    a. NO
    b. YES

3. Have you had formal training on recognizing patient-ventilator asynchrony?
    a. NO
    b. YES

4. If the answer to item 1 was yes, how many hours of formal training did you receive?
    a. < 5 Hours
    b. 5-20 Hours
    c. > 20 Hours

5. Do you routinely use ventilator waveforms to assess the patient's condition?
    a. NO
    b. YES

6. Are ventilator waveforms discussed during patient rounds?
    a. NO
    b. YES

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The Effectiveness of Simulation in Increasing Respiratory Therapy Students' Confidence Levels in a Fundamental Patient Assessment Course

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Abstract

Background: High-fidelity simulation has become a popular educational practice throughout healthcare education with numerous studies that support its effectiveness. However, existing research in respiratory therapy simulation practices is limited and often reserved for advanced skills. **Purpose:** This study examined the use of high-fidelity simulation when incorporated into a fundamental course, and its effect on the perceived confidence in patient assessment skills among entry-level respiratory therapy students. **Methods:** This study followed a quasi-experimental one-group pretest/posttest design, using primary data that were collected from students enrolled in an entry-level respiratory program. High-fidelity simulators were used to teach clinical skills which included, conducting a patient interview, performing a physical exam of the chest, identifying breath sounds through auscultation, and administering basic oxygen therapy. The change in perceived confidence was evaluated at baseline during the first week of the course and post-intervention during week five; after the course. **Results:** Using a Wilcoxon signed-rank test, the results suggest statistically significant changes of perceived confidence across all patient assessment skills assessed in this study. **Conclusions:** These findings suggest the use of high-fidelity simulation can increase perceived confidence through realistic application of even the most fundamental of skills. As shown in this study, high-fidelity simulation could significantly improve student self-efficacy before students enter the clinical environment. Future research should examine the retention of confidence and any implications this may have on the application of clinical skills.

Keywords: respiratory therapy, high-fidelity simulation, experiential learning, confidence, quasi-experimental, respiratory therapy education, respiratory therapy students.

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Introduction

High-fidelity simulation has gained widespread use throughout medical education and other healthcare-related programs. The Association of American Medical Colleges reported that 86 of the 90 medical schools surveyed reported the use of simulation throughout their course content.[1] High-fidelity simulation provides the needed connection from classroom learning to real-life clinical application. The use of simulation has been widely studied in the nursing profession to include procedural skills, self-confidence, patient safety, decision making, and teamwork.[2,3] However, high-fidelity simulation in respiratory therapy education is often reserved for advanced skills. Although today's simulation capabilities are well suited for respiratory concepts and application, they are often underutilized in comparison to other fields.[4,5]

Problem Statement

The demand for health care students to possess higher levels of critical thinking and clinical judgment makes high fidelity simulation well suited for respiratory therapy education.[6] Although simulation's effectiveness has been praised by many health care professions and educators, data specific to respiratory therapy is very limited.[7,8] A greater understanding of the use of simulation in respiratory therapy education may lead to improved simulation practices and improved confidence in clinical skills. The practical application of skills in the clinical setting can often be unpredictable in relation to the content of the didactic course, which can lead to deficiencies in the students' understanding, application, and confidence. Therefore, simulation can assist programs in meeting their educational objectives by providing deliberate practice of learned skills.[5,9]

Purpose Statement

Evidence shows a lack of self-confidence can be associated with poor performance of clinical skills and patient care.[10] High-fidelity simulation has frequently been linked to increased levels of self-confidence using the National League of Nursing's *Student Satisfaction and Self-Confidence* in Learning instrument.[10,11] Although existing literature extensively covers simulation and confidence within nursing education, many of these findings are also applicable to other fields. Sergakis et al.[12] reported in a qualitative review that improved self-confidence was among the valuable skills obtained through simulation experiences. The purpose of this study was to examine the use of high-fidelity simulation when incorporated into a fundamental course, and its effect on the perceived confidence in patient assessment skills among entry-level respiratory therapy students.

Research Question

The following research questions were examined in this study:

1. What is the impact of using simulation in a fundamental therapeutics course on the perceived confidence in patient assessment skills of respiratory therapy students?
2. Are there any statistically significant differences in measurements of perceived confidence in patient assessment skills measured at Week 1 and Week 5 (pre-and post-simulation)?

Methods

This is a quasi-experimental one-group, repeated measures study using a convenience sample of students enrolled in an entry-level respiratory program. Patient assessment skills were assessed at baseline (Week 1), and then again after completion of the course (Week 5). The students were treated as one group, and exposure to simulation occurred at the same time for all students, ensuring that the students had equal exposure to all learning experiences throughout the course.

Sampling Procedures

Prior to the initiation of this study, IRB approval was obtained. The sample population for this study included a convenience sample of the 2020-2021 entry-level respiratory therapy students, enrolled in their first term. Recruitment measures were sent via email one week prior to the start of the course. Communication with potential participants addressed the voluntary nature of participation, and that it would not have any bearing on the participant's grades or performance within the course. A minimum sample size of 20 participants was calculated using G*Power analysis with inputs of alpha (α err prob) - 0.05, medium effect size - 0.7, and power (1-β err prob) - 0.80. Inclusion criteria for participation covered all students currently enrolled in the course, while exclusion criteria included students who did not meet at least a 90% attendance rate for the five-week duration of the course. No participants were removed based on this criteria, resulting in 20 participants completing both the pre- and post-course assessments.

Simulation Materials and Course Delivery

These simulator models included in this study were the Laerdal SimMan Essential and the Laerdal SimMan 3G. Students experienced simulation during the initial delivery and practice of the skills, using a manual simulation mode. The manual mode allowed for frequent manipulation of the settings, such as speech, breathing patterns, and breath sounds. Students encountered simulation again during their skills assessment, using the automatic mode when appropriate. The automatic mode allows for real-time adjustments, such as heart rate and oxygen saturation levels, based on the students' performance of the skill being measured. The fundamental course included patient assessment skills such as, conducting a patient interview, performing a physical exam of the chest, identifying breath sounds through auscultation, and the administration of basic oxygen therapy. The course was taught over a period of 5 weeks. The didactic components were introduced in the classroom and then reinforced in the laboratory setting using high-fidelity simulation. All course materials and simulation experiences were taught by respiratory faculty.

Survey Instrument

The survey instrument was derived from an adaptation of survey developed by an expert panel of an osteopathic medical school faculty for use in its simulation-based education. Following adaptation for this study, the new survey was reviewed for content validity by fellow respiratory therapy faculty and non-participatory students to ensure the accuracy of the content being assessed (Appendix A). A pilot study was conducted to assess the reliability and validity of the survey modifications, in which no modifications were required.

Data Collection

The survey was administered using the online learning platform Top Hat, which allowed for anonymous responses. The initial pre-survey was made available in the Top Hat learning platform at the beginning of Week 1, after obtaining informed consent. The post-assessment survey was made available in the Top Hat learning platform at the beginning of Week 5. Once the weekly deadline had passed for both the pre- and post-assessments, the surveys were closed for further responses.

Statistical Testing and Analysis

Data analysis was carried out using IBM's SPSS Version 27. The difference between the pre- and post-simulation scores of the perceived confidence levels at Weeks 1 and 5 (pre- and post-intervention) were measured using a two-tailed Wilcoxon-signed rank test. The distribution of percentages, frequencies, and central tendencies (mean, median, standard deviation) were conducted separately on the four questions in the pre-and post-simulation data and results were considered significant at $p < .05$.

Results

The distribution of participants' responses show the majority of participating students were female (75.0%) compared to male students (25.0%); their ages ranged from 20 to 30 years. The majority of participants self-reported as White (50.0%) and not of Hispanic, Latino, or Spanish ethnicities (50%); about 20% of the population self-identified as Black/African American, and 30% as other races.

Pre-Course Outcomes of Perceived Confidence

Pre-course, participants reported a median and interquartile range of 3(1) for perceived confidence in conducting a patient interview, 4(1) for perceived confidence in performing a physical exam of the chest, 3(1) for perceived confidence in identifying breath sounds through auscultation, and 2(2) for perceived confidence in the delivery of oxygen therapy (Table 1).

Post-Course Outcomes of Perceived Confidence

Post-course, participants reported a median of 5(1) for perceived confidence in conducting a patient interview, 5(1) for perceived confidence in performing a physical exam of the chest, 4(1) for perceived confidence in identifying breath sounds through auscultation, and 4 (1) for perceived confidence in the delivery of oxygen therapy. The post-assessment of perceived confidence suggests a general increase in median scores across all variables (Table 1).

A two-tailed Wilcoxon signed-rank test was used to determine the statistical significance, if any, of the median difference between participants' perceived confidence in patient assessment skills.

Table 1. Pre- and Post-Course Confidence Scores

	N Statistic	Minimum Statistic	Maximum Statistic	Median Statistic	IQR Statistic
Confidence_Patient Interview Pre-Course	20	1	5	3.00	1.0
Confidence_Patient Interview Post-Course	20	4	5	5.00	1.0
Confidence_Breath Sounds Pre-Course	20	2	4	3.00	1.0
Confidence_Breath Sounds Post-Course	20	3	5	4.00	1.0
Confidence_Physical Exam Pre-Course	20	2	4	4.00	1.0
Confidence_Physical Exam Post-Course	20	4	5	5.00	1.0
Confidence_Delivery of Oxygen Pre-Course	20	1	5	2.00	2.0
Confidence_Delivery of Oxygen Post-Course	20	3	5	5.00	1.0

- Conducting a patient interview: Participants' perceived confidence in patient interview were statistically significantly higher post-simulation (5[1]) than pre-simulation (3[1]), $z = -3.49$, $p < 0.001$ (Table 2).
- Performing a physical exam of the chest: Participants' perceived confidence in performing a physical exam of the chest were statistically significantly higher post- simulation (5[1]) than pre- simulation (4[1]), $z = -3.22$, $p < 0.001$ (Table 2).
- Identifying breath sounds through auscultation: Participants' perceived confidence in identifying breath sounds through auscultation were statistically significantly higher post- simulation (4[1]) than pre- simulation (3[1]), $z = -3.49$, $p < 0.001$ (Table 2).
- The delivery of oxygen therapy: Participants' perceived confidence in the delivery of oxygen therapy were statistically significantly higher post-simulation (5[1]) than pre-simulation (2[2]), $z = -3.87$, $p < 0.001$ (Table 2).

Table 2. Wilcoxon Signed-Rank Test Statistic

	Confidence Patient Interview Post-Course - Confidence Patient Interview Pre-Course	Confidence Physical Exam Post-Course - Confidence Physical Exam Pre-Course	Confidence Breath Sounds Post-Course -Confidence Breath Sounds Pre-Course	Confidence Delivery of Oxygen Post-Course - Confidence Delivery of Oxygen Pre-Course
Z	-3.49	-3.22	-3.49	-3.87
Asymp. Sig. (2-tailed)	.000	.001	.000	.000

Discussion

The majority of existing respiratory simulation research has been used to study more advanced modalities and therapeutic interventions. This study's findings suggest the use of high-fidelity simulation is also effective in increasing perceived confidence in fundamental skills. Oxygen delivery is a fundamental, yet critical skill among respiratory therapy students throughout their education and anticipated career, and competency in this clinical skill should not be underestimated. This use of high-fidelity simulation provides educators with the ability to create scenarios to replicate this process, which corresponds with increased confidence among students when exposed to high-fidelity simulation throughout their education and course content.[6,13] The identification of breath sounds through auscultation is an educational concept that has required some form of simulation for many years, as some sounds cannot be replicated in healthy individuals. The use of high-fidelity simulators provides a realistic breath sound assessment by not only mimicking lung sounds, but also providing movement and expansion of the chest wall. The ability to perform a physical exam of the chest is vital to respiratory therapists in recognizing normal and abnormal patient conditions. Similar to breath sound identification, the use of high-fidelity simulation provides realistic chest movement that can be modified to mimic various physical conditions. These findings correlate with the belief that contextual practice and application of skills in a simulated patient scenario is as valuable as understanding the skill alone in respiratory therapy education.[4,6] In the clinical setting, the initial patient interview occurs upon admission or when a diagnosis is made that requires respiratory support. However, many respiratory conditions limit the patient's ability to complete an interview altogether. Therefore, this is a patient encounter that students may lack experience simply due to the timing of their clinical rotations. High-fidelity simulation helps to reinforce these skills that are difficult to capture during the student's clinical experience, which aligns with the findings of other studies that support the use of simulation to reinforce low-frequency skills.[14]

Limitations

This study must be considered in the context of its limitations. This research was a first- look study, which limits the ability to compare the findings of this study to others within the same population. This study used a small convenience sample from one respiratory program due to the limited cohort sizes found in most respiratory programs; this affected the generalizability of its findings. Another limitation is the quasi-experimental design which limits causal inferences between intervention and outcome. To minimize the impact of history and maturation, the students had limited access to the simulators outside of the therapeutics course used in this study. Although the results were collected anonymously, this study is also susceptible to the Hawthorne effect, as the clinical faculty were regularly involved in the simulation experiences. Despite such limitations, this study suggests that high-fidelity simulation impacts the perceived confidence levels in patient assessment among entry-level respiratory therapy students.

Recommendations

There is a need to expand future research to include the retention of confidence and any implications this may have on the continued application of clinical skills in students of respiratory therapy programs. A collaboration between respiratory programs or additional cohorts would increase the sample size and diversity among participants, which would impact the generalizability of results throughout respiratory therapy education. Although simulation is not approved as a substitute for clinical experience, it is encouraged as a method of improving student exposure to foundational skills as required for accreditation.[15] A longer timeframe may allow for repeated exposure to simulation, further enhancing the student's skills, understanding, and/or confidence throughout the required curriculum content among respiratory therapy programs. Increased simulation research over time may also provide the opportunity to develop and study best- practices for respiratory simulation.

Conclusion

As respiratory therapy educators seek effective teaching strategies to meet the various needs of today's learner, high-fidelity simulation has been shown to positively impact the interactive learning experience by providing and enhancing targeted skill sets, such as confidence, communication, and procedure performance which, in turn, leads to competency. As shown in this study, high-fidelity simulation could significantly improve student self-efficacy before they enter the clinical environment. This type of simulation gives respiratory therapy students the opportunity to apply the learned skills to a variety of patient conditions, providing a realistic experience that can be associated with increased confidence in bedside performance, which existing studies have shown to have an integral role in patient safety and health outcomes.

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Appendix A

Pre and Post Assessment of Perceived Confidence

1.Please rate your confidence in conducting a patient interview.						
Not at all Confident	1	2	3	4	5	Completely Confident
2.Please rate your confidence in performing a physical exam of the chest.						
Not at all Confident	1	2	3	4	5	Completely Confident
3.Please rate your confidence in identifying breath sounds through auscultation.						
Not at all Confident	1	2	3	4	5	Completely Confident
4.Please rate your confidence in the delivery of oxygen therapy.						
Not at all Confident	1	2	3	4	5	Completely Confident

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New Models for Strengthening Graduate Respiratory Care Education

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Abstract

Strengthening graduate education for respiratory therapists (RTs) is urgently warranted, particularly due to increases in job market demands for advanced practice RT's (APRTs), medical scientists, and faculty positions, along with the heightened interest in pursuing graduate education among RTs to achieve leadership positions in healthcare and management. Increasing the number of graduate programs, strengthening existing RT graduate programs, and increasing the number of RT graduate faculty will greatly improve the field of Respiratory Therapy. We recommend that RT graduate programs offer post-professional graduate degree programs, entry-to-practice master's degree programs, and doctoral programs. We also recommend that RT graduate education programs integrate simulation-based learning, implement immersive clinical activities, emphasize interprofessional collaboration and learning, and integrate entrustable professional activities (EPAs) into competencies. This paper will discuss these recommendations for RT graduate education programs and research supporting these new models.

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Background

Respiratory therapists (RTs) continue to seek advanced education for increased autonomy, more responsibilities in clinical practice, and an expansion of career opportunities that accompany graduate degrees. The expected surge of career opportunities such as medical scientists and advanced practice RT's will require an increase in RT graduate programs and strengthening of existing RT graduate programs. This paper seeks to identify ways to strengthen RT graduate education by adapting other health profession's models of graduate education and strengthening existing RT programs. We propose that RT graduate education programs integrate simulation-based learning, implement immersive clinical activities, emphasize interprofessional collaboration and learning, and integrate entrustable professional activities (EPA) into competencies.

Strategies and Opportunities for Enhancing and Expanding Clinical Experiences

In order to achieve the core competency domains established by the AARC 2015 and Beyond initiative,[1] respiratory therapy graduate education programs provide opportunity to develop innovative strategies for enhancing and expanding clinical experiences.[2] There is a need for Advanced Practice Respiratory Therapists (APRTs) in acute care settings for complex respiratory disease management and in outpatient settings, as the need for community-based prevention and treatment programs are increasing.[3-5] Therefore, with the expansion of skills and competencies that APRTs will possess, clinical experiences will grow beyond the traditional acute care settings for entry-level RTs. Additionally, APRTs in community-based settings may prove to be a major source of cost savings for the healthcare sector, as the field of respiratory therapy has the opportunity to shift into the prevention practice space.

Several strategies for improving clinical experiences for graduate-level RT's are recommended: integrating simulation and technology, academic practice co-design of the clinical experience, standardized pre-clinical preparation and student clinical assessment, EPAs, immersive clinical experiences, interprofessional education for team-based care, and peer assisted learning.

Use of Simulation and Technology in Graduate Healthcare Education

The use of technology and simulation in healthcare professional training and education is increasing in response to the need to provide similar learning experiences that mimics bedside interprofessional care. This learning experience can be easily integrated into graduate RT programs. Clinical simulation assists students in developing and shaping their clinical skills in a safe environment without the risk of patient harm and ultimately makes initial interactions with patients safer.[6] Clinical experiences can often be opportunistic and unstructured; therefore, simulation-based learning allows the ability to create complex and high-risk scenarios that may not be frequently encountered in clinical settings.[7] Simulation technologies encompass a diverse range of devices (ie. virtual reality simulators, low- and high-fidelity human patient simulators, task trainers, plastic models, augmented reality, eye tracking) that facilitate learner interactions to mimic an aspect of patient care.[8, 9]

In respiratory care, simulation has been recognized and encouraged by the Commission on Accreditation for Respiratory Care (CoARC) to be implemented in the curriculum. The implementation of simulation-based learning (SBL) can be used as an additional clinical mastery assessment for skills and critical thinking and can aid in overcoming any potential obstacles with clinical placements. Additionally, SBL can augment clinical experiences for RT graduate education by providing a wide range of clinical scenarios that students may otherwise not experience in each clinical rotation.

Academic Practice Co-Design of the Clinical Education Experience

The collaborative design of clinical education experience consists of establishing organizational partnerships to co-design a clinical education model.[10] There are opportunities for collaboration with national and state leaders when setting and initiating policy, regulations, and standards associated with licensure and accreditation. Local level partnerships between academic and practice partners would present the opportunity to facilitate the development of curriculums, clinical experiences, student and preceptor orientation, and program evaluation to promote a rich clinical experience and maximize resource utilization.

Standardized clinical preparation

Developing standardized core content and simulation activities could create more consistency in pre-clinical preparation to ultimately reduce the burden on clinical preceptors related to variations in preparation and skill level among students entering clinical rotations.[10] For example, nurse practitioner programs have implemented standard core content in pre-clinical preparation, and RT graduate programs might benefit from adapting these standardizations from nursing.[10] The additional work required by clinical preceptors to compensate for inadequately prepared students may contribute to preceptor reluctance to work with and assume responsibility for students. Excellent pre-clinical preparation will be especially important during periods of patient load surge during a global pandemic.

Standardized student assessment

Creating a standardized approach to student assessment that considers existing student experience and expertise would minimize unnecessary repetition of content and clinical experiences in which the student may already be proficient.10 An onboarding process would allow for early assessment to identify strengths and weaknesses and create an individual development plan, thus creating a more effective and efficient use of the clinical preceptor's time and effort.

Immersive clinical experiences

Health professions programs typically use an integrated clinical model in which students complete didactic and clinical course work concurrently, which can lead to episodic and fragmented clinical education.[10,11] Clinical immersion involves placing students in a dedicated clinical site at or near a full-time basis over an extended period of time with little to no didactic work concurrently.[11] Using this model facilitates more meaningful learning experiences, greater levels of confidence and competence, higher levels of satisfaction among students and preceptors, and creates an opportunity to integrate EPAs.[10] A hybrid integrated/immersion model is another option that would front-load the majority of the didactic content while not engaging in clinical experiences. The majority of the clinical experiences would come near the end of the curriculum while only taking 1-2 courses.[11] Several advanced practice programs use hybrid or immersive clinical experiences, including occupational therapists, physical therapists, athletic trainers, pharmacists, nurse practitioners and physician assistants.

Interprofessional education for team-based care

Interprofessional clinical experiences emphasizing team-based aspects of healthcare will help prepare students to become collaborative ready practitioners.[10] Using a clinical immersion model would allow more time in one clinical facility to facilitate interprofessional experiences. Additionally, emphasizing the importance of participating in clinical rounds as a respiratory therapy student will also increase exposure and confidence in interprofessional experiences. Interprofessional education and participation is especially important for graduate-level RTs since many advanced educational opportunities will arise from these interprofessional experiences.[12] Additionally, interprofessional education and team-based care can ultimately reduce patient errors in the clinical environment.[13] The potential of interprofessional education and team-based care in graduate RT programs can also introduce hospital-level outcomes to students, such as concepts of reducing patient errors and improving communication, that are important for graduate RT students seeking APRT practice or management positions.

Peer-assisted learning

Peer assisted learning (PAL) or peer-to-peer teaching is an active learning strategy for students to acquire knowledge and skills through support from peers.[14] PAL is used across many advanced practice curricula mostly among medical education, physical therapy, occupational therapy, and speech pathology.[15] PAL is often found in pre-clinical preparation. However, PAL may be useful in the clinical settings to expand clinical opportunities beyond the traditional 1:1 student-preceptor model in advanced practice clinical education with appropriate training of preceptors and students in the planning and use of PAL. Moreover, PAL can be combined with SBL in RT graduate education programs to promote a wide variety of patient scenarios in a controlled, non-clinical setting.[16] The combination of PAL and SBL has the potential to provide a comprehensive, interdisciplinary approach to patient care at a graduate education level for RTs.

Competency-Based Education and Assessment in Advanced RT Education

Competency-based education (CBE) is another aspect of RT graduate education that can strengthen student learning. CBE is one of the leading and well-known evaluation and assessment tools in health professions education programs. A typical CBE in any profession has measurable outcomes that assesses the individual from a formative and a summative standpoint. CBE not only addresses non-cognitive competencies, but it focuses on non-cognitive areas such as the psychomotor domain. The 2015 and Beyond project that was sponsored by the AARC, reported the needed competencies for future and graduate respiratory therapists. The project concluded with a recommendation of having the following competencies graduate respiratory therapists must achieve (Table 1).[1] For advanced respiratory therapy education, CoARC developed six different core competencies a graduate advanced respiratory therapist should have by the time of graduation as well (Table 2).

Table1. Description of Respiratory Therapy competencies from Barnes et al 2010.

Competency Name	Description of what the competency involves
Diagnostics	Pulmonary Function Test, Sleep, and Invasive Procedures
Disease Management	Chronic and Acute Disease Management
Evidence Based Medicine and Respiratory Care Protocols	Evidence Based Medicine, Respiratory Care Protocols.
Patient Assessment	Patient assessment, diagnostic data, and physical examination.
Leadership	Team member, healthcare regulatory systems, written and verbal communication, healthcare finance, and team leader.
Emergency and Critical Care	Emergency care, Critical care
Therapeutics	Assessment of the need of therapy, Assessment prior to therapy, administration of therapy, and evaluation of therapy.
Therapeutics –application to respiratory care practice	Medical Gas Therapy, humidity therapy, aerosol therapy, and hyperinflation therapy, bronchial hygiene therapy, airway management, and mechanical ventilation.

Table 2. CoARC competency areas for Graduate Advanced Respiratory Therapist

	Competency Area	Definition
1	Respiratory Care Knowledge	Graduate knowledge in respiratory care must include an understanding of pathophysiology, symptomatology, differential diagnosis, disease management, health promotion and disease prevention of/for respiratory disease. Graduates must have an understanding of biomedical and clinical sciences and how to apply this knowledge to patient care in their area of advanced practice. In addition, graduates are expected to demonstrate an analytical approach to clinical situations and an understanding of the potential for research that such situations provide.
2	Interpersonal and communication skills	Graduates must demonstrate interpersonal and communication skills, both verbal and nonverbal, that result in effective information exchange with patients, their patients' families, physicians, professional associates, and the healthcare system.
3	Patient care	Patient care includes age appropriate assessment, management and follow-up. Graduates must demonstrate care that is effective, patient-centered, timely, efficient, and equitable including the use and prescription of pharmacologic and non-pharmacologic interventions whether or not a graduate later chooses or is able to gain prescriptive authority.
4	Professionalism	Professionalism is the expression of positive values and ideals as care is delivered. Foremost, it involves prioritizing the interests of those being served above one's own. Graduates must know their professional and personal limitations. Professionalism also requires that graduates practice without impairment from substance use, cognitive deficiency, or [untreated] mental illness. Graduates must demonstrate a high level of responsibility, ethical practice and confidentiality, sensitivity to a diverse patient population, and adherence to legal and regulatory requirements.
5	System based practice	Systems-based practice encompasses the societal, organizational, and economic environments in which health care is delivered. Graduates must demonstrate awareness of and responsiveness to the health care system of which their practices are a part to provide patient care that is of optimal value. Graduates should use their experience with the healthcare system to evaluate and help address any shortcomings of which they are aware.
6	Inter-professional practice	Inter-professional practice includes preparing students to be effective members of clinical teams with the goal of providing safer, patient-centered health is a central tenet of inter-professional education.

Beyond Competency-Based Education in Advanced RT: Entrustable Professional Activities

As the profession shows promise of the need of having advanced practice respiratory therapists, the idea of using CBE as a sole framework for assessing and evaluation of clinical/program competence should be reconsidered. Entrustable professional activities (EPAs) are a complementary approach to CBE.[17,18] EPAs are simply descriptors of "clinical work/practice" rather than descriptors of the practitioner in which it adds the element of "trust" by the clinical educator of their learner to execute assigned tasks independently (i.e., Advanced RT student). One EPA might have multiple competencies/sub-competencies. Since Cate introduced the concept of EPAs,[19] the Association of American Medical Colleges along with accreditation council for graduate medical education developed a task force to come up with core EPAs for graduate medical education programs in medicine. This resulted in developing 13 EPAs that needs to be achieved for entering residency programs. In addition, sub-specialties, such as pulmonary and critical care medicine, started to develop their own EPAs. Most of the developed EPAs in the pulmonary and critical care medicine specialty are similar to what CoARC defines as required competencies in terms of its area or theme. Fessler et al. (2014) developed EPAs that can be used for fellows training in pulmonary and critical care medicine.[20] These EPAs can be used as a starting point for developing EPAs for advanced RTs by a selected working group within the profession along with multidisciplinary educators in health professions education.[18] The list of pulmonary EPA's and potential EPAs for advanced RTs are listed in Table 3. While some of the potential EPAs for advanced RTs are already practiced by RTs with bachelor's or associate's educational levels, many EPAs introduced in Table 3 emphasize the autonomy of advanced RTs in the healthcare field. For example, administering preventive medicine in primary care settings, providing consultations, managing care of acute pulmonary diseases, and performing advanced RT procedures (including bronchoscopy, arterial lines, etc.) are all potential EPAs that can elevate graduate-level education for RTs and prepare students for advanced RT positions. This elevation due to this added method of assessment and evaluation, EPA, the clinical educator or graduate program can use to assess and evaluate Advanced RT graduate. Doing so, this should match the expected high and advanced skills these graduates are expected to perform in the workplace upon graduation. Most importantly, when these Advanced RT graduates are expected to be mentored by healthcare professionals (pulmonary and critical care physicians) who used EPA as an evaluation and assessment method during their training program. [21]

Table 3. Entrustable Professional Activities for Pulmonary Medicine (Fessler et al. 2014) and Potential Advanced Respiratory Therapy Entrustable Professional Activities (Alismail, 2020)

EPA's for Pulmonary Medicine [20]	Potential EPA's for Advanced RT's [18]
Manage care of patients with acute pulmonary diseases across multiple care settings	Manage care of patients with acute pulmonary diseases across multiple care settings
Manage care of patients with acute complex pulmonary diseases across multiple settings	Manage care of patients with acute complex pulmonary diseases across multiple settings
Manage care of patients with chronic, advanced, or end-stage pulmonary diseases across multiple care settings	Manage care of patients with chronic, advanced, or end-stage pulmonary diseases across multiple care settings
Resuscitate, stabilize, and care for unstable or critically ill patients	Resuscitate, stabilize, and care for unstable or critically ill patients
Provide perioperative pulmonary assessment and care	Provide perioperative pulmonary assessment and care
Provide pulmonary medicine consultation to other medical and nonmedical specialties in both inpatient and outpatient settings	Provide respiratory therapy consultation to other medical and nonmedical specialties in both inpatient and outpatient settings
Lead a multidisciplinary critical care medicine team	Participate in multidisciplinary critical care medicine team meetings
Manage transitions of care across multiple healthcare settings	Participate in transitions of care across multiple healthcare settings
Advocate for individual patients	Advocate for individual patients
Facilitate the learning of patients, families, and members of the interdisciplinary team	Facilitate the learning of patients, families, and members of the interdisciplinary team
Facilitate family meetings including advanced directive and end-of-life decisions	Participate in family meetings and discussions about advanced directives and end-of-life decisions
Safely and efficiently perform common pulmonary and critical care procedures, including bronchoscopy, thoracentesis, central venous catheter placement, and ultrasound	Safely and efficiently perform common respiratory therapy procedures, including intubation, arterial blood gas sampling and line placements, bronchoscopy, ultrasound and tracheostomy change
Provide appropriate screening and preventive care	Provide appropriate screening and preventive care
Interpret pulmonary function and cardiopulmonary exercise tests	Interpret pulmonary function and cardiopulmonary exercise tests
Practice personal habits of lifelong learning	Practice personal habits of lifelong learning
Demonstrate professional behavior	Demonstrate professional behavior
Improve the quality and safety of healthcare at both the individual and systems levels	Improve the quality and safety of healthcare at both the individual and systems levels

Conclusions

Strengthening graduate education and creating advanced practice RT programs is the next step in positioning respiratory therapy as a growing, autonomous, and strong field. Strategies to improve and strengthen graduate education include integrating simulation-based learning, standardized assessments, immersive clinical activities, interprofessional collaboration and learning, and integrating entrustable professional activities into competencies. While some of these elements may be easily integrated into Bachelor's and Associate's RT programs, we provide these recommendations in the context of RT graduate education programs for students seeking advanced RT positions. The demand for advanced RT positions is growing and expanding, and these recommendations for graduate-level RT education can respond to these demands by strengthening existing RT graduate education programs and creating new RT graduate education programs.

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