Respiratory Care Education Annual

The American Association for Respiratory Care

Volume 21 Fall 2012

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Baccalaureate Entry-Level Education in Respiratory Care

Will Beachey, PhD, RRT, FAARC

Editorial

As the respiratory therapy profession continues to evolve and new graduates are required to possess ever higher levels of competency, the adequacy of the associate degree as minimum educational preparation has been questioned. This issue is inherently controversial and emotionally charged since most respiratory therapy education in the United States is delivered at the associate degree level (over 380 out of about 435 programs[1]) and many are located in two-year colleges. Although many faculty members and deans of these programs oppose higher minimum degree requirements, everyone agrees their graduates should be encouraged to pursue higher degrees.

Individuals skeptical of the need for increased minimum educational requirements generally contend that there is no evidence to support it, notwithstanding the fact that many associate degree programs have ballooned far beyond two years in length, with some requiring well over 90 semester credits for graduation. Compelling evidence continues to mount with the publication of findings that emerged from three conferences hosted by the AARC, which were held for the purpose of identifying changes needed in the educational system to produce competent respiratory therapists (RTs) in the year 2015 and beyond. The first conference, held in 2008, confirmed that the United States healthcare system is on the verge of dramatic change, driven by the need to increase quality while decreasing costs; conferees concluded that much more emphasis will be placed on managing chronic care, wellness and prevention.[2] The second conference, held in April 2009, identified the skills, knowledge and competencies that graduate RTs need to enter practice in 2015. These competencies and their definitions were agreed upon by over 80% of conference participants and are delineated in a paper published in the May 2010 issue of *Respiratory Care*.[3] The general tenor of this paper is perhaps best summed up in a statement found on page 608: "The graduate RT must be prepared to enter [the] work environment as an expert on respiratory care and be ready to consult on the provision of respiratory care." Few respiratory therapy educators would disagree with this statement.

At the third conference, held in July 2010, participants formulated and approved several resolutions, among which was the resolution that the baccalaureate entry-level should be phased in by the year 2020; conference participants overwhelmingly supported this resolution.[4] A very recent publication lends credence to this resolution; important differences exist between associate and baccalaureate degree programs in their ability to provide graduates with the competencies identified in the RT 2015 conferences.[5] Notably, competencies related

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to evidence-based medicine and respiratory therapy protocols were taught significantly less often in associate degree programs than in baccalaureate degree programs.

The fact that the respiratory therapy profession perennially struggles to gain Medicare recognition is not divorced from the reality that the associate degree is the norm for preparing "expert consultants" to enter practice. Medicare recognition is undeniably important, but the argument for higher minimum entry level preparation is primarily based on modern demands of the profession. The second AARC conference identified RT competencies needed to enter practice in 2015, but it could easily be argued that these competencies are needed to enter the workforce today; perhaps the respiratory therapy community has waited so long to articulate the competencies currently needed that when they are finally made explicit they sound like future competencies. Even so, the second RT 2015 paper is significant because it finally documents evidence that many RTs empirically knew existed; no longer can anyone claim that evidence for educational preparation beyond the associate degree is lacking.

New graduates today need to know how to evaluate knowledge for its relevance; how to read the scientific literature and assess its validity; how to apply the principles of evidence-based medicine to practice; how to function effectively as a member or a leader of a care planning team; and how to teach patients self-care strategies and disease management principles. In addition, they need to develop lifelong learning habits, appreciate ethical and cultural issues, communicate effectively, and understand healthcare reimbursement and cost-effectiveness issues. Simply stated, the reason for at least a baccalaureate entry level is to better help students develop professional dispositions.

Some educators believe minimum degree requirements should be based on the results of the NBRC's national task analysis; however, a task analysis is insensitive to the presence of non-task oriented professional attributes, the development of which is the chief rationale for a baccalaureate entry level. The findings of the AARC's RT 2015 conferences provide a valid basis for change in entry level requirements; we should all know by now that respiratory therapy has evolved beyond its task-oriented roots.

It is important to understand that improved performance on the NBRC examinations is not the rationale for a baccalaureate or higher entry level degree. In fact, there is no evidence that the average BS graduate outperforms the average AS graduate on the credentialing exams; this is not surprising when one considers that AS program faculty must devote so much time to teaching the content of the credentialing exam matrices that their ability to address non task-oriented professional competencies—which the exams do not address anyway—is severely restricted. Some educators believe that the clinical simulation portion of the registry exams (CSE) is specific for the assessment of critical thinking skills; although this is a popular notion, it is not well supported in the literature. Studies that have addressed this question reveal that at best, decision making scores on the CSE account for less than 25% of the variability of scores on the Watson-Glaser Critical Thinking Appraisal (WGCTA; r^2=0.10—0.24),[6-8] and at least one study showed no significant correlation.[9] Another study revealed that the reliability of the CSE's decision-making section was less than that of the written registry exam (WRE), and that CSE and WRE scores were strongly correlated (r = 0.86), calling into question the premise that the CSE adds to the validity or reliability of the registry exams.[10] All of the foregoing studies involved the self-assessment CSE; the only published study involving actual NBRC registry exam results found no relationship between student performance on the clinical simulation component of the exam and the WGCTA score.[11]

As the profession contemplates its future and how best to serve the needs of its communities (including students, patients, and the public), some questions that need to be asked are: is the associate degree entry-level consistent with the degree of professional competence we expect of graduates? Does the associate degree help or hinder recruitment of the high achieving, professionally-minded students we hope to attract into the profession? Does the associate degree send the desired message to third party payers such as Medicare? And perhaps the most important question: is the associate degree a just reward for students who have completed over 90 semester hours to meet graduation requirements?

The final recommendations that emerged from the RT 2015 conferences are clear and well-substantiated. The road to a baccalaureate entry-level will be fraught with logistical difficulties, but it is hard to see how the stakes could be higher. An initial important step in this transition would be for the Commission on Accreditation for Respiratory Care to require that new programs seeking initial accreditation must grant, at minimum, the baccalaureate degree to its graduates; this would allow existing AS programs to continue as long as they meet accreditation Standards. The continued viability of the respiratory therapy profession depends on its leadership's unwavering resolve to achieve this transition.

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Associate Degree Entry Level Education in Respiratory Care A Response to Baccalaureate Entry-level Education in Respiratory Care

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In 2007, the AARC Executive Director was directed by the AARC President to organize a series of three conferences to provide a vision of the future healthcare system, identify the roles respiratory therapists could fulfill and the competencies required to fulfill those roles and to develop a plan to transition the profession from the present to the future. These conferences were held in 2008, 2009 and 2010. The proceedings of those conferences were subsequently published in RESPIRATORY CARE.

One of the recommendations for transitioning the profession that emerged from the last conference is:

> **Recommendation:** That *the AARC request CoARC to change, by 7/1/12, accreditation standard 1.01 to read as follows:*
> *1.01 The sponsoring institution must be a post-secondary academic institution accredited by a regional or national accrediting agency that is recognized by the U.S. Department of Education (USDE) and must be authorized under applicable law or other acceptable authority to award graduates of the program a baccalaureate or graduate degree at the completion of the program. Programs accredited prior to 2013 that do not currently offer a baccalaureate or graduate degree must transition to conferring a baccalaureate or graduate degree, which should be awarded by the sponsoring institution, upon all RT students who matriculate into the program after 2020.*[1]

Although the AARC Board of Directors has not yet taken action on this recommendation, it has generated much discussion, controversy and concern because if enacted, it would eventually prevent the CoARC accreditation of future respiratory therapist education programs that grant associate degrees.

Many of the other recommendations from the conferences will help to promote and improve the quality of respiratory therapists in the workforce. The focus on evidence based medicine and protocol establishment will definitely enhance the autonomy of respiratory

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therapists. However, before the profession jumps on the bandwagon to advance the entry level degree, we need to look at other professions who have increased requirements for entry into their professions. After reviewing the current status of other Allied Health professions which have increased their entry level degree requirements; it may be evident that changing the entry level degree to a baccalaureate may not be the best way to achieve this goal.

A major barrier to raising entry level is to recognize a large number of respiratory care programs are based in community colleges. Data reported in 2010, by the 2015 and Beyond conference, indicated that there are 356 community college RT programs that award associate degrees, yet there are only 55 programs that award baccalaureate degrees.[2] Some colleges may not have the resources or access to undergraduate degree offering. Moving from an associate degree to baccalaureate degree may be impossible for some colleges and technical schools. As a result, programs could close and creating regional shortages of therapists.

The AARC 2009 Human Resources Study reported that 75% of RT faculty from accredited programs plans to retire by 2020.[3] At the same time we are losing faculty from the profession it will be difficult to increase the degree requirement to a baccalaureate when currently there are only four CoARC accredited master's level programs listed on the CoARC website. With the lack of younger faculty and the low number of RTs with graduate degrees finding personnel to teach the higher level programs and to meet the needs of the workforce will be challenging.

Another consideration is what employers are asking for. Like nursing, many hospitals desire the lower level, and less expensive LPNs and associate degree prepared nurse. Despite the nursing profession recognizing better patient outcomes with baccalaureate prepared nurses, the supply and demand of lower level nurses still prevails. This is also true for respiratory therapists. For these reasons, we need to be careful as we pursue increasing our entry level.

An article in The Chronicle Review, examined the pros and cons of various programs that were increased to clinical doctorial level. This article found three adverse reactions that can arise for advancing entry level degrees. First, the explosion of the clinical doctorate degrees threatens research because many of the clinical doctorate programs require minimal *original* research from their students. Second, because higher level degrees require more time and thus tuition, an increase in the entry level degree may reduce the number of new graduates at a time when health-care workers are in increasingly short supply. Historically, as mentioned above, the healthcare market may respond by using assistants and technicians to provide more clinical services and using people with the higher degrees or credentials to become managers or supervisors. Unfortunately this can lead to a decline in job satisfaction and morale because these higher level practitioners have less chance to use their clinical expertise and interact with patients. Third, the article stated that the increased cost of the higher level degree could exacerbate the ever increasing level of healthcare disparities in this country because many minority populations would not be able to afford the cost and would therefore see the assistant or technician opportunities to be a better alternative. The result would be minority assistants providing care to patients while supervisors and managers would be seen as coming from more privileged backgrounds because they could afford the higher cost. [4]

It appears to me some professions may have increased their entry level degree requirements before the profession had the need. As a result, the professions were forced to in-

crease assistants to help with the workload and reduce the healthcare costs. Prior to making a decision on advancing the degree requirements, the profession of respiratory therapy needs to look at other professions to ensure we do not make the same mistakes they did.

Prior to accreditation changes, I managed an associate's degree program in respiratory therapy which allowed graduates to sit for the CRT exam. The program also provided an additional year for those who wanted to become an advanced level therapist. The extra training to those students who wanted to advance proved extremely successful and was geared toward those students who had a desire to be autonomous and have more critical thinking skills. Those students who chose not to continue were used by many area facilities for general floor therapy so that the specialty trained therapist could concentrate on the more critical patients. The model worked very well for the students, the facilities, and the profession as a whole.

My recommendation is that the associate degree remains the entry point to the profession and the requirement for sitting for the CRT exam; however, to help advance the profession and follow the recommendations of the 2015 and Beyond conference recommendations, require a bachelor's degree for the RRT credential. This would allow the profession to already have the "assistant pool" to handle day to day routine respiratory care tasks while allowing those therapists with advanced education and degrees to be utilized in the intensive care units and outpatient care facilities where critical thinking and autonomy are vital.

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The evolution of self-directedness in an undergraduate healthcare ethics course

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Abstract

Background: This study focused on the impact of the course delivery method on the evolution of self-directedness in the undergraduate student. The primary research question addressed by this study was, how does the undergraduate learner's readiness to be self-directed evolve during a health care ethics course? **Methods:** This study surveyed 66 undergraduate students who completed a healthcare ethics course via one of three delivery methods: face-to-face (traditional), blended, and online. The participants completed the Self-Directed Learning Readiness Scale (SDLRS) before and after the studied semester. The individual scores on the pre- and post-course assessments were compared to identify potential changes in readiness for self-directed learning. **Results:** While all three sections demonstrated an increase in SDLRS scores, none were statistically significant. The blended learning cohort demonstrated the most dramatic change of the three cohorts. **Conclusions:** The researcher discovered the differences between cohort results were not statistically significant, which leads to the assertion that course delivery method does not impact the undergraduate student's ability to be self-directed in a given 16-week semester, though the blended learning environment may provide a better opportunity for developing self-directedness in learning.
Key words: self-directedness, education, blended learning, online learning, traditional learning, ethics, undergraduate education, adult learning theory

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The evolution of self-directedness in an undergraduate healthcare ethics course

Adult learners bring to the classroom experiences, ideas and values. The exchange of ideas and experiences within the classroom setting enhances learning for all persons involved. The relationship between learners, their peers and their instructors is a vital component of both the learning process and the path to becoming a lifelong learner. That relationship augments written, verbal and non-verbal communication; indeed, interaction is the foundation upon which all true learning occurs.

The importance of relationships is more readily apparent in certain learning environments. This is the case with ethics classes. An undergraduate course in healthcare ethics is typically designed around several key components used to generate discussion.[1] Included in these components is the interaction with peers and course instructors that occurs during in-class discussion. Learners are presented with information that guides them to identify their personal morality and the values that they have developed throughout their lives. An opportunity is created for the discussion of various ethical theories and approaches to making healthcare decisions in the modern era. The learners' discussion of controversial ethical dilemmas and problems encountered in healthcare in an environment is the clearest example of relationships fostering the lifelong learner. It was for this reason that the researcher chose this learning environment to evaluate self-directed learning. Would the enhanced interaction and relationship-building of this specific learning environment augment the development of self-directedness in undergraduate learners?

Conceptual Framework

Encouraging the learner's readiness to accept responsibility for his/her learning is a vital part of the teaching process. As course delivery adapts to various technological formats, the maturity and evolution of the learner stays the same. The learner-centered concept of andragogy encourages the learner to gradually accept responsibility for learning. The ability to understand the learner's experience and how the learning environment affected his/her ability to be more self-directed is imperative to understanding how the course instructor can best facilitate such growth. The research question and literature review emerged from this theoretical framework.

Self-Directed Learning

Self-directed learning, as described by Knowles, occurs when learners take control of their learning.[2] The learner, with or without the help of others, takes responsibility for understanding his or her own learning needs, as well as determining goals for the learning experience, and identifying the proper resources necessary to accomplish these goals. Knowles notes that when learners are internally motivated and take charge of their learning experience, the learning is more effective and the retention of knowledge is improved. He also notes that this learning model assists in the natural progression of maturity as the person progresses from childhood to adulthood.[2]

It must be understood that not all individuals are equally self-directed or are ready to become self-directed, regardless of acquisition of knowledge or age. In addition, a learner's

ability to be self-directed in one situation or course may not translate to other situations or courses.[3] Discovering the individual learner's readiness is an important aspect to encouraging the learner to become self-directed.

A healthcare ethics course can cultivate a self-directed environment. The immediacy and practicality of application of the knowledge gained and the relevancy of the cases to the learner's future career can foster internal motivators so the learner will fully explore the phenomenon in question. The sharing of experiences within the course and the relationship built between the learner, his or her peers and the course instructor can be a powerful influence on the learning process. All of these factors, within an inclusive and respectful environment, may promote a more self-directed approach to learning.

Various Course Delivery Methods

The stereotypical vision of the college undergraduate academic experience is one of a large lecture hall with a professor delivering course content from a podium. While this type of course still exists in modern university settings, technology has allowed for alternative forms of course delivery methods to become common. Many institutions not only offer individual courses using these alternative methods but also entire programs of study. The options available for course delivery provide many learners with the opportunity to choose a course delivery method that suits their learning needs and styles.

Not all persons who desire a college education are able to access a traditional setting. Some of the barriers are as simple as extreme distances from the institution while others face more complicated issues of familial obligations and time constraints.[4] One alternative method frequently used is online course delivery via the Internet. Many learners who have elected to complete courses online are pleased with the flexibility in time and location. This flexibility in location allows the learner to attend the institution of his or her choice, further enhancing the internal motivation toward self-direction.[4,5,6,7] Others, however, reported that the major weakness of online learning environments is the lack of consistent, efficient communication with the course instructor.[8] Still other studies report that the lack of synchronous, face-to-face interaction with the course instructor and feelings of isolation are major drawbacks to this learning environment.[4,9]

In an attempt to provide the learner with the best of both worlds, some institutions and educators opt to enhance their course by adding Internet course materials while still maintaining the face-to-face interaction between instructor and learner. The term blended or hybrid refers to courses that meet in the traditional classroom but are also supplemented with electronic media.[10] While these courses still have traditional course meetings, the amount of time spent on campus may be less frequent than the traditional course. Some believe that this blended approach enhances learning in the course by providing the learner with independent activities to reinforce course concepts. Researchers remind the educator that the success of the blended environment is dependent upon active participation from both course instructor and learner.[11]

Self-Directedness in Various Course Delivery Methods

It is widely accepted that learners who choose to complete a course through alternative methods (i.e. online and blended courses) should possess a higher level of motivation and

readiness to be self-directed.[12,13,14] Many studies have examined the potential relationship of SDLRS scores with various markers of success in online and blended environments: grade point averages (GPA), course grades, and course completion.[12] One study compared SDLRS scores between online courses and traditional courses but did not find that one cohort fared better academically as a group; rather, the individuals with higher SDLRS scores successfully completed the course regardless of course delivery method.[15] While these studies have expanded the literature base concerned with prediction of academic success, none of the studies have focused on the learners' journey toward self-directedness. Indeed, lacking in this reviewed research is any study of the evolution of self-directedness during the various course delivery methods.

Research Design

Problem Statement

Past research into the efficacy of various course delivery methods and self-directedness in undergraduate learners is abundant.[6,12,16,17] While many studies have investigated satisfaction and learning outcomes differences among the various course delivery methods as well as relationships between self-directedness and various indicators of success, none have explored the evolution of self-directedness that may or may not occur in these settings. As the participants in this study are beginning their journey into the healthcare arena, self-directedness in learning about ethical issues in healthcare can have a major impact on their future career.

Purpose

The purpose of this study was to determine how the learners' perception of self-directedness evolved during a healthcare ethics course. In addition to identifying the evolution of self-directedness for an individual, the study compared the three different sections to discover what differences existed among the variable course delivery methods with regard to the evolution of the participants' perceptions of self-directedness.

This study sought to answer the question, to what extent does the undergraduate learner's readiness to be self-directed evolve during a health care ethics course? Further, how does the evolution of readiness to be self-directed differ among course delivery methods?

With respect to the main research question above, the null hypothesis was that the post-course assessment would show that all sections of the course have not increased their readiness to be self-directed. With regards to the sub-question, an alternative hypothesis was that the online section would demonstrate a more dramatic increase in self-directedness as compared to the blended and traditional sections. Another alternative hypothesis is that the traditional section would have the least dramatic increase in self-directedness as compared to those in the online and blended sections.

Sample/Population

The participants consisted of 66 undergraduate students who enrolled in a large Midwestern university health care ethics course. The convenience sample of participants varied widely with regards to gender, age, grade point average and class standing (i.e. freshman, sophomore, junior, senior or graduate). Three sections of the course were offered in the studied semester and the same professor taught all sections. One section was delivered in the tra-

ditional format, one in the blended format and one in the online format. The traditional format section consisted of 23 participants. The blended format section consisted of 25 participants. The online format section consisted of 20 participants. The participants were able to self-select the section of their choice, thereby eliminating the randomness of the sample.

Instrumentation and Procedures

The Self-Directed Learning Readiness Scale (SDLRS) was used to allow the participants to self-assess their attitudes toward learning and readiness to manage their own learning. This survey is composed of 58 questions that require a Likert-scale type of response.[18] The SDLRS is a reliable and validated tool and the most commonly used for the purpose of evaluating readiness for self-directed learning.[19,20,] In keeping with the recommended practice of administering the survey, the title was altered to read "Learning Preferences Assessment" to eliminate response bias. The participants completed the survey at the beginning of the course and again at the conclusion of the course. This survey was delivered at the beginning and at the end of the semester and was accompanied by a permission letter approved by the Institutional Review Board (IRB).

The post-course SDLRS score for each participant was compared with his or her pre-course SDLRS score. The SDLRS was evaluated for each participant's pre-course and post-course responses. Analysis of the SDLRS outcome consisted of a two-way analysis of variance (ANOVA). An assumption of the ANOVA model is that errors are normally distributed with constant variance. Constructing a histogram of the standardized residuals and performing the Anderson-Darling test of normality evaluated the normality of this data set.

Results

The primary research question addressed by this study was, how does the undergraduate learner's readiness to be self-directed evolve during a health care ethics course? To answer that question, the researcher utilized the SDLRS questionnaire both at the beginning of the studied semester and at the conclusion of the studied semester. The null hypothesis devel-

Table 1

Summary SDLRS statistics for all three sections of the studied course.

Course Format	Variable	N	Mean	Range
Traditional	SDLRS pre	23	225.6	178-284
	SDLRS post	23	226.9	177-271
	Change	23	1.3	(-38)-36
Blended	SDLRS pre	25	221.8	201-250
	SDLRS post	25	223.96	196-255
	Change	25	2.1	(-20)-28
Online	SDLRS pre	20	218.0	185-245
	SDLRS post	18	216.7	180-239
	Change	18	0.8	(-42)-21

Table 2
ANOVA significance levels.

Effect	Num DF	Den DF	F value	Pr>F (p-value)
Class format	2	65	1.18	0.313
Time	1	65	0.43	0.513
Time*Class format	2	65	0.09	0.914

oped by the researcher was that the post-course SDLRS assessment would show that the participants in all sections of the course would not increase their readiness to be self-directed.

The initial findings of the SDLRS scores show the mean scores for all three sections of the studied course fall in the *average* level for readiness of self-directedness as established by Guglielmino.[19] The range of individual scores spans all three categories, both in pre-course results and post-course results. The only cohort to demonstrate a change in category of level of readiness was the traditional section, changing from *average* to *above average* (Table 1).

Analysis of the SDLRS scores consisted of a two-way analysis of variance with ANOVA factors being class format and time as a repeated factor. The model also includes an interaction effect for class format and time. Significance levels (*p* values) demonstrate no statistically significant effects (Table 2).

When evaluating the differences between all individuals who participated in the study, it is interesting to note that 63.64% (42 of 66 participants) had minimal changes in their scores and no subsequent change in SDLRS level of readiness. Of those participants whose scores demonstrated a change, nine participants (13.64%) demonstrated a decline in post-course SDLRS scores dramatic enough to change their SDLRS level designation. The remaining 15 participants (22.72%) demonstrated an increase in post-course SDLRS scores high enough to change their SDLRS level designation. While all individuals did not increase their readiness to be self-directed as interpreted by the SDLRS, the majority of the three sections either maintained their readiness level or improved it. These findings reject the null hypothesis, as it states that all sections would not increase their readiness to be self-directed.

The sub-question posed by the researcher was, how does the evolution of readiness to be self-directed differ among course delivery methods? One hypothesis presented was that the online section would demonstrate a more dramatic increase than the other two sections in self-directedness as interpreted by the SDLRS. A second hypothesis was that the traditional section would show the least dramatic increase in self-directed readiness of the three sections. Neither of these hypotheses was accepted.

When observing the group data for the three sections of the studied course, it is noted that all three sections had a positive change in mean SDLRS score. The online section did not demonstrate the most dramatic increase between pre-course and post-course SDLRS scores. Instead, the blended section of the studied course produced the most dramatic change between pre-course and post-course SDLRS scores at 2.1 points. In fact, the online section of the studied course produced the least dramatic change in SDLRS scores at a mean change of 0.8 points. As previously noted, the traditional section was the only section to produce a change large enough to alter the level of readiness for learning, though the change was not

statistically significant (1.3 points). Due to this statistically insignificant change, the improvement in the level of readiness does not imply that this group achieved a higher state of readiness. Thus, as stated above, both hypotheses were not accepted.

The results of this study are consistent with current literature. One study focused on undergraduate engineering students who were completing their university capstone courses and produced similar results. The 24 participants in their study completed a pre-course and post-course SDLRS. The pre-course SDLRS was administered in week three of the studied semester and the post-course SDLRS was administered 10 weeks later to "determine whether capstone courses increase their readiness for self-directed learning."[21] Their results showed a mean pre-course SDLRS score of 228.7 and a mean post-course SDLRS score of 236.2. These scores produced a mean change of 7.5 points. The authors discuss that, even though this change was positive, it was not statistically significant within the scope of their study. While this change is larger than the change discovered in the study at hand, it should also be noted that the participants in this 2003 study scored in the *above average* level on the pre-SDLRS. This could indicate that the group studied had previously attained a higher level of self-directedness.

The researcher's first hypothesis that the online section would demonstrate a greater increase in SDLRS scores than the other two sections was not accepted. This result prompted the researcher to ask, does lack of face-to-face contact alter the level of a learner's readiness for self-directed learning? Lowe discussed the online learner's lack of preparedness for accepting responsibility for his or her learning. His perception is that the majority of learners in traditional classrooms are not taught how to be self-directed, nor are they encouraged to take personal responsibility for learning in the traditional setting. This led to dependency upon the course instructor and a passive learning attitude toward self-direction.[22] As online classes are becoming increasingly popular on traditional campuses, the lack of skill needed to be self-directed in learning may negatively impact the learners' academic performance.

The researcher's second hypothesis was that the participants in the traditional section of the studied course would show the least dramatic increase in SDLRS scores of the three sections of the studied course. Even though the traditional section produced a change large enough to move the cohort from the *average* SDLRS level to the *above average* level, the change was not the most dramatic, nor was the change the least dramatic. It was discovered that the blended section participants demonstrated the most dramatic change in SDLRS scores. Therefore, this hypothesis was not accepted.

The inference that blended courses may help learners develop self-directed learning skills is supported by the reviewed literature. Some research reports that the blended course environment can promote an increased engagement by the learner in the course context while simultaneously providing more opportunities for improvement on an independent level.[23] Others support this as well, noting that the face-to-face meetings reinforce the relationships necessary to foster self-directedness.[24]

Conclusions

Based on the results determined by this study, it can be concluded that the undergraduate learner's readiness to be self-directed does not significantly evolve during a health care

ethics course. While each section demonstrated an improvement in self-directedness as measured by the SDLRS, none demonstrated a dramatic change that would indicate that course format impacts the evolution of self-directedness in the studied course. The sample size of the study and the sample technique may be limitations to the generalizability of the study findings. The lack of randomization may be a threat to validity; however, the process in which the students enrolled in the course limited the researcher's ability to randomize. While the sample was diverse in age, gender and career path within the health professions, it was not an accurate sample of the entire university population. The studied course is of interest only to students who are either currently enrolled in a health professions program or seek to enroll in a health professions program. Future research should focus on longitudinal studies that follow cohorts immersed in various programs of study as well as identifying blended programs of study that may foster self-directedness.

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Respiratory Care Education Annual
Volume 21, Fall 2012, 19-26

The Need for and Impact of Requiring the Registered Respiratory Therapist Credential for a License

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Abstract

Introduction: Concern regarding the March 2010 CoARC position statement indicating that the RRT credential would no longer be used for assessing examination-based program outcomes lead the Ohio Respiratory Care Board to evaluate their licensure examination requirement. **Methods:** The AARC's White Paper on the RRT Credential was the basis for development of an on-line survey of employers of respiratory therapists regarding the credential of those performing advanced level competencies, impact of requiring RRT credential for employment, and perceived impacts of requiring RRT credential for future licensure. **Results:** 220 employers responded and provided survey data. Over 50% of employers reported therapists with the CRT credential perform advanced level competencies. 46% of respondents require staff to be a RRT at time of employment or a condition of continuing employment. For employers who require the RRT credential, positive and negative impacts were identified. Of those that do not require the RRT credential positive and negative impacts were also identified along with 59% of these employers foresee being registered as a required minimum hiring qualification within the next three years. **Conclusions:** Over utilization of CRTs by expecting them to practice in advanced roles was identified. Positive impacts of requiring the RRT credential were indentified, including improving patient care and safety and enhancing professionalism with some experiencing increased staffing costs. The perceived future impacts of requiring RRT for licensure did not match the actual experiences of employers who require RRT. **Key Words: Respiratory therapy credentialing, respiratory therapist licensing, Registered Respiratory Therapist.**

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The Need for and Impact of Requiring the Registered Respiratory Therapist Credential for a License

Introduction

In June 2010, the Ohio Respiratory Care Board (ORCB) voted to consider using the National Board for Respiratory Care's (NBRC) Registered Respiratory Therapist (RRT) examinations as the examination for licensure, replacing the Certified Respiratory Therapist (CRT) examination.[1] This was the result of concern from the Board regarding the March 2010 Commission on Accreditation for Respiratory Care (CoARC) position statement indicating that the RRT credential would no longer be used for assessing program outcomes.[2] Part of the rationale for this new standard was that since no states required the RRT examinations to obtain a license and enter practice, graduates can choose to delay or forego the RRT examinations, thus decreasing its utility as a measure of educational program effectiveness.

The ORCB had been monitoring educational programs for their RRT exam outcomes in the state since 2004. In 2007, the Board became concerned that CoARC was not adhering to their thresholds of success for RRT exam pass rates since 11 of 18 accredited schools in Ohio had RRT exam pass rates less than 50%.[3] In 2009, it was reported that the average RRT exam success rate of Ohio programs for 2006-08 was 62.9%.[4] Some members of the Board believed that since all educational programs in the state of Ohio are accredited as RRT-level educational programs, it would be an appropriate time to consider changing the examination requirements for licensure.

The purposes of this project were to have the Examinations Requirement Workgroup evaluate the need for requiring the RRT credential for a license as a Respiratory Care Professional (RCP) in Ohio, to describe the actual impacts of requiring new staff to have earned the RRT credential to be eligible for employment and the perceived impacts of requiring the RRT credential for future licensure requirements. This report contributed to the Workgroup's recommendation to the Board regarding the minimum competency standards for licensure in the state of Ohio. These findings may be of interest to other state licensing boards and professional societies.

Methods

In April 2011, an Examinations Requirement Workgroup convened with charge by the ORCB to conduct an evaluation of the minimum competency expectations of those that hire therapists and how those expectations match the examination required for initial licensure and to gather data on the current needs and trends for minimum competency expectations of the respiratory therapy workforce (Examination Requirements Workgroup Charter April 8, 2011) To this end, the Workgroup consulted the American Association for Respiratory Care's (AARC) White Paper on the RRT Credential, specifically the conclusions of the document asserting that therapists involved in the performance of assessment-based care; problem solving and critical thinking; protocol application; diagnostic critical thinking; respiratory care plan development, implementation and analysis; disease management; mechanical ventilatory support; critical care; and critical care monitoring should possess the Registered Respiratory Therapist credential.[5] This was the basis for development of an online survey of employers of respiratory therapists regarding the credentials of those currently

Table 1

Advanced Competencies Preformed by Credential Type.

Advanced Competencies (Examples)	All Respondents with RT Staff (n = 220)			Metropolitan Facilities (n = 107)		Non-Metro Facilities (n = 113)	
	NA	CRT	RRT	CRT	RRT	CRT	RRT
Assessment-based respiratory care (eg. Evaluate patients and modify therapy based on clinical assessment)	39 (18%)	125 (57%)	163 (74%)	61 (57%)	82 (77%)	64 (60%)	81 (76%)
Application of clinical respiratory care protocols (eg. Implement clinical guidelines for oxygen therapy, bronchopulmonary hygiene, hyperinflation therapy, mechanical ventilation, etc.)	49 (22%)	128 (58%)	154 (70%)	59 (55%)	75 (70%)	69 (64%)	79 (74%)
Diagnostic critical thinking (eg. Recommend ABG, EKG, PFT, etc; interpret results; recommend respiratory care based on results)	36 (16%)	135 (61%)	171 (78%)	65 (61%)	83 (78%)	70 (65%)	88 (82%)
Respiratory care plan development (eg. Based upon subjective, objective, assessments for inpatients, for discharge planning, for continuing care to assure best outcomes)	51 (23%)	112 (51%)	153 (70%)	55 (51%)	76 (71%)	57 (53%)	77 (42%)
Respiratory care plan implementation (eg. Assess resources, provide appropriate respiratory care)	22 (10%)	148 (67%)	181 (82%)	70 (65%)	89 (83%)	78 (73%)	92 (86%)
Respiratory care plan analysis (eg. Make recommendations to change care plan based on patient's response to therapy)	23 (10%)	140 (64%)	180 (82%)	67 (63%)	88 (82%)	73 (68%)	92 (86%)
Respiratory disease management (eg. For COPD, asthma, pulmonary fibrosis, ARDS, HF, trauma)	42 (19%)	127 (58%)	163 (74%)	59 (55%)	80 (75%)	68 (64%)	83 (78%)
Mechanical ventilatory support (eg. Provide, monitor, manage & assure appropriate invasive & non-invasive ventilation)	29 (13%)	149 (68%)	177 (80%)	68 (64%)	85 (79%)	81 (76%)	92 (86%)
Respiratory care for critically-ill patients (eg. Provide airway management, medical gases & aerosols, bronchopulmonary hygiene, hyperinflation therapy)	37 (17%)	143 (65%)	167 (76%)	63 (59%)	78 (73%)	80 (75%)	89 (83%)
Critical care monitoring (eg. Understand and utilize arterial pressure, EKG, vital signs, ABG, waveforms)	57 (26%)	132 (60%)	151 (69%)	58 (54%)	71 (66%)	74 (69%)	80 (75%)

performing the above competencies and addressing their minimum competency expectations in the state of Ohio.

This survey was conducted between June 15 and July 14, 2011 using Survey Monkey®. The survey instrument was developed, field-tested, and refined by members of the Exami-

nation Requirements Workgroup. Examples of the 10 advanced competencies as described by the AARC White Paper were developed by members of the workgroup (Table 1).

The Examination Requirements Workgroup also developed impact statements to judge the positive and negative impacts of requiring the RRT credential for licensure. These included 14 statements directed toward employers who require the RRT credential and 16 statements for employers who do not require staff to be a RRT. A higher proportion responding positively or negatively determined the type of impact (i.e., positive or negative). Four of the statements posed negative impacts, requiring respondents to "disagree" to be considered a positive impact.

To conduct the survey, the Executive Director of the ORCB sent requests for participation via first class mail to 963 Nursing Homes – provided by the Ohio Health Care Association, to 619 Home Medical Equipment Companies – actively licensed by the ORCB, and to 183 directors and managers of respiratory therapy and cardiopulmonary departments of Ohio hospitals- provided by The Ohio Hospital Association. To increase the response rate of hospitals, 177 directors and managers of respiratory therapy departments of Ohio hospitals with known email addresses also received the request via email, and they received a second email reminder on July 6, 2011. The data were imported into Microsoft Excel; sorted by IP addresses, number of beds, and number of staff. For respondents who have respiratory therapists on their staffs, data were sorted by facility or organization location and type, and descriptive statistics were calculated.

Results

There were 379 total respondents with 220 facilities or organizations reporting to have one or more staff respiratory therapists. Respondents included 107 facilities located in metropolitan Ohio counties and 113 facilities in non-metropolitan Ohio counties. Data represented 140 hospitals (36 teaching, 99 community, 5 children's), 56 durable medical equipment companies (DME), 14 non-acute long term care facilities, 7 long term acute care (LTAC), and 3 others (Diagnostic center, Sleep lab, Physician's office). One hundred sixty three (73%) respondents earned the RRT credential; 27 (12%) were CRTs; 9 (4%) respondents did not have either credential; or 7 (3%) did not respond to the question regarding credential status.

On average for the 220 facilities and organizations, 73% of the clinical staff were RRTs, including 77% RRTs in metropolitan counties and 66% RRTs in non-metropolitan counties. Table 1 reports on how many of the ten advanced practice competencies are practiced by both the RRT and CRT from data gathered from the 220 respondents and for facility location. Greater than 50% of all respondents reported that therapists with the CRT credential perform all 10 advanced level competencies; the percentages in non-metropolitan facilities and organizations were consistently greater than those in metropolitan counties.

Fifty (24%) employers only employ RRTs; 162 (76%) employers hire CRTs or limited permit holders for their clinical respiratory care staff; 8 employers did not respond to the question. Forty-eight (22%) of those who hire CRTs or limited permit holders require newly hired CRTs or limited permit holders to become a RRT within a certain

period of time as a condition of continued employment. On average, these 48 employers allowed 13.4 months for these staff to earn their RRT credential, including 14 months in metropolitan counties and 12.3 months in non-metropolitan counties. The 50 employers who only hire RRTs and the 48 who require new staff to be a RRT as a condition of employment were combined as requiring RRT and they represented 46% of respondents. One hundred fourteen employers do not require staff to be a RRT which represented 54% of respondents.

The impact of requiring the RRT credential by the 50 employers who only hire RRTs and by the 48 who require new hires to earn RRT credential is described in Table 2 for all respondents including location and types of facility. Thirteen of the impact statements were deemed positive and one statement was deemed negative for all respondents, for metropolitan and non-metropolitan facilities and organizations, and for hospitals. The negative impact statement "Increased staffing cost" was consistently cited by respondents. For DMEs, 13 statements were deemed positive. For "other facilities and organizations," 11 statements were deemed positive, and 2 were neutral.

Of the 162 employers who hire CRTs or limited permit holders for their clinical respiratory care staff, 114 (70%) do not require newly hired staff to become a RRT. Of these 114 employers, 68 (59%) foresee their required minimum hiring qualifications for respiratory care staff will be RRT in the next 3 years. Forty-seven (41%) do not foresee a change to requiring the RRT credential. As foreseen by these employers, the potential future impacts of the ORCB requiring the RRT credential are described in Table 3 for all respondents including location and type of facility. Eight of the impact statements were positive and eight were negative for all 112 respondents. All of the

Table 2

The impact of requiring RRT for staff for all respondents (n = 96)

What has been the impact on your department or organization of your requiring RRT for your staff?					
Impact Statements	**SA**	**A**	**N**	**D**	**SD**
Difficulty filling staff vacancies	3	6	22	39	26
Increased staffing cost	4	31	32	21	8
Increased opportunities to implement patient care protocols	23	30	27	10	6
Reduced liability	11	29	41	10	5
Increased respect for staff	20	41	27	6	2
Enhanced staff professionalism	36	37	18	4	1
Created conflict between CRT and RRT staff	0	7	38	33	18
Improved staff morale	10	31	43	11	1
Improved patient care decisions	18	49	26	2	1
Improved patient assessment and evaluations	23	45	24	3	1
Expanded scope of services	22	41	27	6	0
Improved patient care efficiency	17	41	29	6	3
Reduced length of stay	3	16	66	7	4
Increased assurance care is medically necessary	10	31	47	4	4

Table 3

The potential impact of requiring RRT for staff for all respondents (n = 112)

If the RRT examination were to be required in the future for a newly licensed RCP in the state of Ohio, what might be the impact on your department or organization?	**SA**	**A**	**N**	**D**	**SD**
Difficulty filling future staffing vacancies	14	25	24	42	7
Increase future staffing cost	27	52	16	13	4
Increased opportunities to implement patient care protocols	11	32	32	26	11
Reduce liability	5	15	46	35	11
Increase respect for staff	13	38	30	23	8
Enhance staff professionalism	27	33	27	16	9
Create conflict between CRT and RRT staff	7	13	30	51	11
Improve staff morale	8	12	49	31	12
Improve patient care decisions	16	40	25	23	8
Improve patient assessment and evaluations	15	42	24	24	7
Able to expand scope of services	12	30	36	26	8
Improve patient care efficiency	10	22	43	29	8
Reduce length of stay	2	12	53	35	10
Increase assurance care is medically necessary	7	15	44	38	8
Enhance distinctions between CRT and RRT staff	13	24	34	30	11
Termination of patient-care assignments for NEW CRT staff after expiration of their limited permit	8	24	44	28	8

positive and negative impacts were consistent among these groups. For metropolitan facilities, DMEs, and other facilities, the majority of impact statements were deemed negative (Table 3)

One hundred eleven respondents provided written comments which were analyzed. Seventy-two (65%) comments were judged by members of the Workgroup as positive and supportive of requiring staff to b a RRT for a future license. Twenty-three (21%) of the comments were considered negative and non-supportive of the change and 16 (14%) were neutral or not relevant.

Discussion

This survey was directed towards employers of RCPs in Ohio, including hospitals, long term care and nursing home facilities, and DMEs. The number of actual employers is unknown, so an overall response rate was not calculated for the survey. Hospitals are generally thought to be the major employers of RCPs, so hospital directors and managers received three invitations to participate, and 140 of 183 (76%) hospitals are represented in the data. The distribution of hospitals included teaching, community, pediatric, metropolitan and non-metropolitan facilities.

With 98 (45%) respondents currently requiring the RRT credential for their staff respiratory therapists combined with 68 (31%) who foresee the requirement in the next three years indicates that most respiratory therapists are expected or will be expected to practice at an advanced level in Ohio. The data supports a significant percent of staff who are CRTs

and perform advanced level competencies. This constitutes over utilization of some CRTs in advanced roles which is more common in non-metropolitan facilities. Due to Ohio's 2-year minimum respiratory therapy educational standard, these CRTs may have had the education to perform at an advanced level, but they have not demonstrated their advanced competency by examination. Employers who over utilize their CRTs are not consistent with the AARC's position statement on advanced practice.[5]

For the 96 (44%) respondents who currently require the RRT credential for all staff, the impact on the department or organization has been overwhelmingly positive. They report improvements in patient care and patient safety, specifically improved patient care decisions, improved patient assessments and evaluations along with improved patient care efficiency. The respondents also reported increased respect for staff and enhanced staff professionalism as positive impacts of the requirement. These positive impacts have been realized in all locations and facility types, including metropolitan facilities and DMEs. An expected negative impact of raising hiring standards, such as difficulty filling staff vacancies was not reported by the vast majority of respondents who currently require the RRT credential.

The most common negative impact from those respondents who currently require the RRT credential for their staff respiratory therapists, regardless of location or type of facility was an increased staffing cost. An increase in staffing costs was also a common potential future negative impact on those employers who do not currently require the RRT credential for their staff. Since the ORCB proposal does not affect existing CRTs, then over years of attrition and hiring new graduates, costs may increase as a higher proportion of a facility's staff become RRTs. The positive impacts of having all RRTs on staff could outweigh the increased manpower costs.

Those departments that do not require the RRT credential indicated that having RRT for initial licensure would be a negative impact with metropolitan facilities and DMEs foreseeing the most negative impacts. They did not foresee many of the positive impacts such as reduce liability, improve staff morale, improve patient care efficiency, or reduce length of stay as a result of the RRT credential being entry-level into employment. Although a high proportion of these respondents predict some difficulty filling future staffing vacancies, the majority of them did not. However, when comparisons are made by location and facility type to those who already require the RRT credential for all staff, it appears that the positive impacts have been experienced and difficulty filling future staffing vacancies has not been an issue. Recent data from Ohio indicate that the state actually has a staff therapist vacancy rate of 3.3%. This vacancy rate is less than the AARC's national estimate of 4.4%.[6] Coupled with data indicating that Ohio's educational programs produce approximately 400 new graduates each year,[4] there is evidence that staffing shortages are not currently experienced in Ohio.

The distribution of the positive and negative comments appears similar to the distribution of responses by facilities which require the RRT credential and those that do not. Several of the negative comments described experienced CRTs with advanced skills and strong professional attributes, and therefore no need to require the RRT credential. A few comments expressed the continuing need for an entry-level therapist with suggestions to differentiate CRT and RRT scopes of practice. Several comments supported the RRT licensing requirement and the elimination of the CRT credential. A number of written responses reflect a lack of understanding of the ORCB's RRT entry-level proposal; specifically that it would impact only new exam candidates of the NBRC examination process.

Limitations

This was a survey collecting the opinions of the respondents regarding the impacts or foreseen potential impacts of requiring RRT credential for licensure. No data were collected to support the opinions expressed such as evidence of difficulty filling staffing vacancies, increased staffing costs, or any of the other impact statements. Respondents were not required to answer every question. Hospital administrators were not included in this survey; their opinions may differ or support those of their managers. The number of actual employers of RCPs in Ohio is unknown, making an overall survey response rate of RCP employers unknown.

Conclusions

Considering the 10 advanced level competencies listed in AARC's White Paper on the RRT Credential,[5] greater than 50% of all respondents reported that Licensed Respiratory Care Professionals in Ohio with the CRT credential practice at an advanced level. Employers who require the RRT credential for all staff report the impact on their department or organization as overwhelmingly positive, improving patient care and safety and enhancing professionalism, with some experiencing increased staffing costs. Those employers who do not require the RRT credential foresee multiple negative impacts and do not foresee many of the positive impacts of the increased entry-level requirement. Based on their comments, some managers and directors may not understand the ORCB's RRT proposal, the NBRC credentialing process, and the role of the ORCB. The results of this survey provide a perspective from employers of RCPs in Ohio for the ORCB to consider.

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Respiratory Care Education Annual
Volume 21, Fall 2012, 27-33

Evaluation of Peer Teaching in the Respiratory Therapy Laboratory

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Abstract

Background: Laboratory instruction is an important component of respiratory therapy (RT) education. Research has shown that peer teaching, pairing first-year and second-year students, is not only an effective method of instruction, but also enhances students' professional and personal development. Implementing peer-teaching in the respiratory therapy laboratory can offer opportunities for developing leadership skills and for enhancing instruction. **Method:** Twenty-two second-year RT students conducted laboratory sessions for 22 first-year RT students on a variety of topics related to mechanical ventilation and arterial blood gases. First and second-year students completed evaluations of the peer learning and peer teaching experience, respectively, at the end of each lab session. Students rated the quality of their experience using a 5-point Likert-type scale and open-ended questions. **Results:** 94% of first-year and 93% of second-year students reported increased levels of confidence and improved communication skills, understanding and retention of the topics covered as a result of the peer teaching experience. Positive aspects of peer teaching reported by second-year students included feelings of satisfaction, responsibility, and respect in addition to mastery of the material as a result of required preparation time. On the other hand, the amount of preparation was time-consuming, and some felt apprehensive or uncomfortable while conducting their lab session. First-year students responded that they felt less intimidated and appreciated practical tips from students who had recently been in their position. Conversely, they reported that some second-year students were impatient with their questions. Students reported that the experience was positive and that they would like to repeat it. **Conclusions:** Peer teaching represents an underutilized, yet potentially effective resource for RT laboratory instruction. It likely plays an important role for both teacher (developing professional skills like communication, decision-making, leadership, confidence, and respect) and learner (improved understanding and retention of topics learned).

Key Words: respiratory therapy education, peer teaching.

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Introduction

Laboratory instruction is an important component of respiratory therapy (RT) education. Increasing student enrollment without an accompanying increase in teaching staff requires RT faculty to enlist creative options to maintain quality instruction in the classroom and laboratory. One method to increase efficiency in the laboratory setting is to utilize peer teachers. Research has shown that peer teaching, pairing first-year and second-year students, is not only an effective method of instruction, but also enhances professional and personal development.[1-3]

Reciprocal peer teaching (RPT), where students alternate roles as teacher and student, has been used with success in athletic training programs, nursing programs, and gross anatomy labs.[1] Krych and colleagues reported that 100% of students who participated in RPT in gross anatomy labs perceived a greater understanding of the topics they taught; 97% reported increased retention of information; and 92% believed that RPT improved their communication skills.[4] Similar results in this setting have been reported by Hendelman and Boss[5] and Bentley and Hill.[6]

Peer assessment of psychomotor laboratory skills was evaluated in an Athletic Training program by Marty and colleagues. Students were able to accurately assess their peers 96% of the time when using a validated assessment tools while observing videos of 3 different phychomotor skills.[7] When peer teaching was implemented in a nursing school, third-year students reported increased confidence in their knowledge and teaching abilities, and found the experience rewarding. First-year nursing students reported feeling comfortable learning skills from their peers, and also found the experience rewarding.[8]

Peer teaching represents an underutilized, yet potentially effective resource for RT laboratory instruction. It likely plays an important role for both teacher (developing professional skills like communication, decision-making, leadership, confidence, and respect) and learner (improved understanding and retention of topics learned). A review of the medical literature revealed that no study has been done evaluating the impact of peer teaching in RT education. The purpose of this study was to evaluate the effectiveness of a peer teaching model in RT labs from both teaching and learning perspectives.

Methods

Design

The research was accomplished using a non-experimental, descriptive research design. The study was approved by the Institutional Review Board. Second-year respiratory therapy students were enrolled in an advanced clinical course and first-year respiratory therapy students were enrolled in a mechanical ventilation and an arterial blood gases course during the same term. The clinical course was designed to provide the students with experiences that develop leadership skills, including experiences in respiratory therapy education. Clinical assignments for the second-year students included peer teaching in the laboratory experiences associated with the first-year-level courses. The second-year students were also concurrently enrolled in a respiratory therapy education course, which addressed a variety

of educational topics including classroom teaching and assessment techniques.

Twenty-two second-year peer teachers were assigned to 33 of the 60 laboratory sessions during the term. Each second-year student was assigned to be the peer teacher in two of the mechanical ventilation and one of the arterial blood gas laboratories. Second-year students received a standardized orientation to the laboratory teaching experience prior to each of their lab teaching sessions that addressed not only the content to be covered during the lab session, but also issues related to providing constructive feedback, establishing the importance of participation, demonstration of techniques, providing examples from previous clinical experiences, and handling questions from students in the laboratory setting.

All students were provided an informational letter prior to the first laboratory session involving second-year peer teachers explaining the purpose of the research, their role, responsibilities and time commitment, and assuring the confidentiality of the data collected. The letter also explained that the students were under no obligation to participate in the research and that choosing not to participate would not result in any penalties. All 22 of the second-year students and all 22 of the first-year students were invited and agreed to participate in the study.

Every laboratory session was supervised by the instructor of the course, and all instructors were veteran educators with experience mentoring students. The instructors served as resources for both second-year and first-year students during the laboratory sessions, addressing questions and monitoring instruction provided by the second-year peer teachers. The course instructors created all learning activities and developed all materials used during the laboratory sessions.

Instrumentation

Data were collected utilizing two survey instruments. The survey instrument was adapted from a valid and reliable instrument as established by Krych et al.[4] The second-year students completed an instrument at the conclusion of their third peer teaching session to evaluate their perceptions of the peer teaching experience. The first-year students completed an evaluation of the peer learning experience upon completion of each laboratory session that utilized second-year peer teachers. All evaluations were collected anonymously, as no identifying information was collected.

In addition, all students were asked to respond to a set of four open-ended questions at the conclusion of their peer teaching or learning experiences. The questions asked students to describe their favorite peer teaching or learning experience, a description of what they liked and disliked about the experience and any suggestions for improvement of the experience in the future. The responses to these open-ended questions were also collected anonymously.

Data Analysis

Data collected from first-year and second-year surveys was analyzed using SPSS version 19 (SPSS Inc., Chicago, IL). Descriptive statistics were utilized to address the objectives of the study. In addition, the authors used triangulation to identify themes present in student comments about their experiences.

Results

All 22 second-year students and all 22 first-year students chose to participate in the study. The mean age of the second-year students was 23.2 years, and 41% were male. For the first-year students, the mean age was 22.0 years and 18% were male. The first-year students were enrolled in their 2nd of 7 terms, and the second-year students were enrolled in their 6th of 7 terms. Other than necessary updates to course content, the laboratory experiences remained the same from the time the second-year students were enrolled in the courses until they were peer teachers in the same courses. In addition to successfully completing the arterial blood gas and mechanical ventilation courses, the second-year peer teachers completed a minimum of 340 hours of supervised critical care clinical experience prior to their assigned laboratories and were concurrently enrolled in a supervised critical care clinical course.

Peer Learning Evaluations

The first-year students' evaluations of their peer learning experiences are included in Table 1. Each statement was evaluated on a five-point Likert-type scale with 1 = strongly disagree and 5 = strongly agree. Overall, 94% of the ratings by the first-year students were 4.0 and above, and 3 of the 9 statements were rated 4.0 and above on the Likert-type scale. This indicates that the first-year students reported increased levels of confidence, improved understanding and retention of the topics covered and improved communication skills as a result of the peer teaching experience.

Peer Teaching Evaluations

Second-year students evaluated their peer teaching experiences at the conclusion of their three assigned lab sessions (Table 2) on the same five-point Likert-type scale with 1 = strongly disagree and 5 = strongly agree. Five of the 10 evaluation statements were rated above 4.0,

Table 1

First-year students ratings of peer learning experience (scale 1 = strongly disagree and 5 = strongly agree) (n = 62).

Regarding your peer learning experience, rate the following:	**1 (SD) n (%)**	**2 (D) n (%)**	**3 (U) n (%)**	**4 (A) n (%)**	**5 (SD) n (%)**
Increased confidence in performance of the task/skill	0	0	0	25 (40.3)	37 (59.7)
A positive experience	0	0	0	20 (32.2)	42 (67.7)
Increased confidence on exams	0	0	3 (11.3)	30 (48.4)	25 (40.3)
Improved communications skills	0	1 (1.6)	8 (12.9)	32 (51.6)	21 (33.9)
Improved integration of respiratory terminology into your vocabulary	0	1 (1.6)	5 (8.1)	29 (46.8)	27 (43.5)
Improved ability to communicate with future patients	0	0	4 (6.5)	28 (45.1)	30 (48.4)
Improved understanding of the topic learned	0	0	0	15 (24.2)	47 (75.8)
Improved retention of the topic learned	0	0	1 (1.6)	26 (41.9)	35 (56.5)
Would like to be taught again by peers	0	2 (3.2)	2 (3.2)	19 (30.6)	39 (62.9)

Table 2

Second-year students ratings of peer teaching experience (scale 1 = strongly disagree and 5 = strongly agree) (n = 21).

Regarding your peer teaching experience, rate the following:	**1 (SD) n (%)**	**2 (D) n (%)**	**3 (U) n (%)**	**4 (A) n (%)**	**5 (SD) n (%)**
Increased confidence in teaching	0	0	0	7 (33.3)	14 (66.7)
A positive experience	0	0	0	6 (28.6)	15 (71.4)
Increased confidence on exams	0	0	7 (33.3)	11 (52.4)	3 (14.3)
Improved communications skills	0	0	0	6 (28.6)	15 (71.4)
Development of teaching skills	0	0	0	3 (14.3)	18 (85.7)
Improved integration of respiratory terminology into your vocabulary	0	1 (4.8)	2 (9.5)	10 (47.6)	8 (38.1)
Improved ability to communicate with future patients	0	0	1 (4.8)	8 (38.1)	12 (57.1)
Improved understanding of the topic taught	0	0	1 (4.8)	7 (33.3)	12 (57.1)
Improved retention of the topic taught	0	0	0	7 (33.3)	14 (66.7)
Would like to do more peer teaching	0	1 (4.8)	1 (4.8)	5 (23.8	14 (66.7)

and 93% of the overall ratings were 4.0 or greater on the Likert-type scale. This indicates that second-year students reported increased levels of confidence, improved communication skills, and improved understanding and retention of the topics taught, and were able to develop teaching skills as a result of the peer teaching experience.

Evaluation commentary

All of the RT students reported that the experience was positive and that they would like to repeat it. First-year students responded that they felt less intimidated and appreciated practical tips from students who had recently been in their position. Positive aspects of peer teaching reported by second-year students included feelings of satisfaction, responsibility, and respect in addition to mastery of the material as a result of required prep time. Some of their comments related to the theme of mastery include:

"I think it's good because I feel that you truly know something when you can explain it (correctly and completely) to another person."

"I was able to know the material much better since I knew I would have to teach it."

"It was a very good review and allowed me to brush up on some things I forgot."

"Allowed me to better understand the material by answering questions as well as build up confidence as a teacher. "

"It gave me the opportunity to see what teaching is like and if I am comfortable with it."

On the other hand, the second-year students reported that the amount of preparation was time-consuming, and some felt apprehensive or uncomfortable while conducting their lab session. Some comments from the second-year students related to the theme of authenticity include:

"I did feel as if some students "blew us off" because we were only a little older."

"It was difficult to get the students involved; I don't think they took us seriously."

"The one tough thing is that to have a positive in-class experience, you must prepare out of class almost double. It's worth it though to have a good class."

The first-year students also reported that some second-year students were impatient with their questions. Comments from first-year students related to the theme authenticity include:

"Sometimes they were unable to answer my questions or explain something so I could understand."

"I didn't really enjoy it. I fell ill prepared for the practical. I would prefer to be taught by a professor."

"Sometimes felt like I wasn't getting enough information."

Conclusions

Despite minimal risk, peer teaching represents an underutilized, yet potentially effective resource for RT laboratory instruction. It likely plays an important role for both teacher (developing professional skills) and learner (improved understanding and retention of topics learned).

Students that engage in experiences as a peer teacher gain confidence, skills and experience personal growth through this opportunity to function as a content "expert." These sentiments were reflected in a number of the second-year students' comments at the conclusion of the teaching experiences. Responsibility for the educational content increases the peer teachers' understanding, which can lead to mastery of content. Optimally, the peer teacher then translates this mastery to their peer learner.

The peer teacher is able to develop and fine-tune important leadership skills like communication, decision-making, management, confidence, and respect. Moreover, after graduation, these positive teaching experiences might influence the individual to pursue other future education opportunities including the role of mentor, preceptor or patient educator.

The timing of these teaching experiences in the second-year may also be integral to the direction of their RT career pathway. The near-graduate RT could consider a role they otherwise might not have pursued. More graduates pursuing education as a niche in respiratory therapy will address future needs and fill the anticipated void left by faculty retirees. According to the 2009 AARC Human Resources Survey, two-thirds of RT Program Direc-

tors will retire in the next 10 years.[9] Directors of Clinical Education in RT programs are expected to retire at similar rates.

Admittedly, there are also drawbacks to peer teaching. There is the potential for the peer learner to feel the experience was not optimal. Isolated comments from the first-year students reflect sentiments echoed in related literature. For example, Knobe and colleagues instituted peer teaching for 3rd and 4th year medical students who were learning ultrasound imaging. Although students rated their learning experiences the same whether instruction was delivered by student teachers or experienced physicians, students ranked their physician teachers significantly higher on competency.[10]

The coordination and oversight involved in implementation of peer teaching in the laboratory is time-consuming and takes close monitoring by RT faculty. Merely placing first and second-year students together in the same laboratory does not capture the spirit of the peer teaching experience. To maximize benefit, the RT faculty coordinator must carefully plan and prepare the second-year student for their role and cannot exit the learning environment, but provide facilitation and mediation over the process. However, this investment in mentoring of students can lead to significant benefits for the students themselves as well as for the future of the profession of respiratory therapy. All in all, this teaching-learning strategy can be utilized as a win-win for both students and learners alike.

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Respiratory Care Education Annual
Volume 21, Fall 2012, 35-41

The History and Impact of Mandatory Student Health Insurance in Respiratory Care

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Introduction

Policies in healthcare are continuously changing. The current changes that may be affecting respiratory therapy (RT) programs are clinical site requirements for students to provide healthcare coverage to attend clinical rotations. This paper looks at the issues associated with student medical insurance coverage and how it impacts the student and the school.

All RT programs are required by the Commission on Accreditation for Respiratory Care (CoARC) to have clinical contracts for each clinical site. Each contract is unique to each institution; however, it is unlikely that clinical sites are willing to bear any care, if needed, for a student while participating in a clinical rotation. It may be customary for a clinical site to care for a student if an accident, such as a needle stick, occurs, however, a closer look at the institution's polices may reveal the student is responsible for payment for any service. Furthermore, expensive diagnostics such as computed tomography (CT) or magnetic resonance imaging (MRI) are not likely to be covered by the clinical site. If a student is uninsured, the cost of medical care may be financially devastating. A student's progress in school may be stopped if they do not have the financial means pay for any medical bills.

The rising cost of tuition, insurance, and healthcare place students in a difficult position. If clinical sites mandate students to have health insurance, the cost of a RT program will increase dramatically. If colleges and universities mandate health insurance for all enrolled students the cost to a student may rise considerably. Awareness and understanding of health insurance for all students in a RT program is vital to the program. This paper will discuss the history and impact of mandatory health insurance for students.

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History of the Policy

The purpose of mandatory student health insurance is to reduce student attrition secondary to the financial devastation that is often associated with the illness or injury of uninsured students. While health insurance related issues are in the media, by no means is the move toward mandatory coverage for students a new concept.

Factors Contributing to the High Rate of Uninsured Students

Many factors contribute to the high rate of uninsured college students. Medicaid coverage is limited to the disabled, elderly, or pregnant women.[3] Students who attend school less than full-time are often removed from their parents' plan at age 19, while coverage for full-time students can occur up to the age of 26 under new health care reform.[3] Over 50% of all young adults have had a period of time without health insurance during the last five years, and as a result, 75% of these students have incurred unpaid medical debt.[3] Compounding the effects of a lack of insurance coverage are medical issues that are often seen with young adults such as obesity-related illness, pregnancies, HIV infection and injury-related visits to the emergency department, which are more prevalent among young adults than any other age group.[3] Adding to these factors is the prevalence of risky behavior among young adults, and the idea that some students may go without coverage due to a combination of choice and the sense of invincibility often associated with young adulthood. This combination of risky behavior and lack of coverage sets the foundation for financial devastation among uninsured young adults who are faced with the large medical debt. In fact, a report by the Government Accountability Office found that 18% of uninsured students aged 18 to 23 received some form of uncompensated health care in the year 2005 alone, and that the estimated cost of this care, previously believed to be somewhere between $120 million and $255 million, is probably understated in today's market.[3]

As of 2009, only the states of Massachusetts and New Jersey have passed legislation requiring insurance coverage for all college and university students. While some state higher education governing boards have implemented the requirement for various educational institutions, many schools are left to decide for themselves whether to require student coverage. According to the Government Accountability Office, approximately 30% of all schools require some degree of insurance coverage, while approximately 50% offer coverage to their students.[3]

Current Policy in the State of Maryland

An analysis performed by the Maryland Health Care Commission found that approximately 9,500 uninsured young adults received treatment at an acute care facility within the state in the year 2007. The average cost of each hospital visit was $6,800, resulting in a total cost of over $64.5 million. The state of Maryland attempted to require student insurance through the passage of H.B. 603 in 2008, but the bill was never passed into law. Nationally, institutions that offer student health coverage usually follow one of four models: voluntary, soft waiver, hard waiver, and mandatory. Under the voluntary model,

students have the option of purchasing coverage through the school, but are not forced to carry any coverage at all as a condition of attendance. Under the soft waiver model, students who do not have coverage are technically required to purchase it, however, no formal evidence of current coverage is required in order to receive a waiver. The hard waiver model requires students to present formal proof of coverage in order to obtain a waiver, and the mandatory model requires students to purchase coverage regardless of whether or not they already have it. The majority of private institutions within the state of Maryland already mandate student coverage, while most public institutions offer an insurance plan but do not require coverage. Interestingly, there is no single statewide contract, and even public institutions are left to obtain independent policies to offer their students. The cost of these policies ranges from $30 to $600 per semester. No community college within the state currently offers student health coverage. In their 2009 publication *Health Insurance Coverage Among College Students*, The Maryland Health Care Commission recommended four institutional options regarding student health coverage. The first involved mandating that all schools simply provide students with information on coverage options during registration. A second option consists of requiring all public institutions within the state to offer student coverage through a school-sponsored plan. A third option requires all four-year institutions, both public and private, to offer a student health policy, while option four requires all institutions of higher education within the state of Maryland to mandate student health coverage. However, to date, no action has been taken by the state legislature to incorporate any of these recommendations into a new statewide policy.

Current Policy in the State of Massachusetts

Under state law G.L. c. 15A, § 18, Massachusetts has required coverage since 1989 for all college students enrolled in 75% or more of a full-time curriculum.[4] With 12 credit hours being considered the minimum for full-time enrollment, this equates to mandatory coverage for all students enrolled in nine or more credit hours of study per semester. Students are billed for their premiums, and can waive the fee only by showing proof of comparable coverage that offers services *accessible in the area where the student attends school.* This accessibility clause acts to prevent students from participating in a Health Maintenance Organization (HMO) plan where they must travel a considerable distance to receive ongoing or preventive care, and is in line with previous published literature on the idea that HMO coverage may result in "de facto uninsured status" if students are expected to travel a considerable distance to receive such care.[2]

The Massachusetts Department of Medical Security was initially assigned the responsibility of establishing minimum coverage standards for students. In 1996, oversight was transferred to the state Division of Health Care and Finance Policy, whose regulation 114.6 CMR 3.00 requires student coverage in Massachusetts to include preventive and primary care, emergency services, hospitalization, ambulatory services, and mental health services, with a minimum of $50,000 of coverage per year, and a deductible that may not exceed $250 per year.[4]

A Comparison of Policy at Georgia State University and Mercer University

Georgia State University mandates student insurance coverage for select students under the plan set forth by the Board of Regents of the University System of Georgia.[5] Coverage is required for international students holding F-1 or J-1 visas. F-1 visas are granted for long-term, rather open-ended academic work, such as graduate school, while J-1 visas are for comparably short-time academic work, such as a visiting scholar or temporary undergraduate work. By comparison, F-1 and J-1 visas are granted for dependants of the students, such as children or spouses, so that they may enter the country as well. Students in certain academic programs may also be required to obtain insurance under the Board of Regents plan. While no academic programs at Georgia State require this coverage, an investigation into other University System schools found that both the nursing and respiratory therapy programs at Macon State College require coverage, as do all students at the Medical College of Georgia.[6] Health coverage is also required for the majority of graduate students attending state institutions. Those receiving qualified graduate assistantships, fellowships, or training grants must also have coverage. The reason for this mandate lays in the fact that prior to the Obama Administration's healthcare reform bill; many graduate students were dropped from coverage under their parents' plans at age 23 to 25, and became disenfranchised. A waiver process is available for all students who can prove that they already have comparable coverage. The basic plan at Georgia State has limits of $1 million per lifetime and $300,000 per policy year. The fall 2011 student premium at Georgia State was $499, while the spring and summer semesters of 2012 premium is listed at $662. Spousal coverage is offered at nearly triple the cost of student coverage, while coverage for dependent children is approximately twice that for students. Unless students purchase specific riders, however, the policy is for sickness and accidents only and does not cover any preventive care visits. Coverage at Georgia State is also available for any undergraduate student enrolled in six or more credit hours per semester.

Since 2006, the private institution, Mercer University in Georgia mandates coverage for all students. Mercer employs a hard waiver model of student coverage, requiring students to provide undeniable proof of comparable coverage in order for the premium to be waived. The criteria for comparable coverage include a $10,000 per year maximum out of pocket expense, minimum benefits of $50,000 per injury and $1 million per lifetime, prescription drug benefits, an adequate selection of providers located near campus, and coverage for physician office visits, surgical procedures, hospitalization, and emergency department visits. Students who hold an academic visa are also required to carry a $10,000 medical evacuation policy that includes $7,500 in repatriation coverage. The cost of student coverage at Mercer is surprisingly less expensive than at Georgia State, listing at $379 for fall semester 2010, and $379 for 2011 spring and summer semesters. Spousal and dependant coverage is also available at Mercer. The insurance at both Georiga State and Mercer is subcontracted to an outside vendor and does not use the State of Georgia insurance options.

Legal Implications of Current Policy

Legal issues associated with student health insurance requirements include the case of Goehring v. Brophy in 1996 and the passage of Michelle's Law in 2008.[7] In Goehring v.

Brophy (94 f.3d 1294), students as UCLA-Davis sued the university on grounds that the portion of their student fees that was used to pay for mandatory student health coverage violated their freedom of religion. Apparently the student plan allowed for birth control coverage that included terminating pregancies. As practicing Catholics, students felt that they could not provide financial support for such a plan, as it went against their fundamental religious beliefs. The District Court granted summary judgment for the university, and the case was settled in favor of the University. This judgment was upheld on appeal to the Ninth Circuit Court.

Former President George Bush signed Michelle's Law (H.R. 2851) in the fall of 2008.[8] The law was inspired by Michelle Morse, a student at Plymouth State University in New Hampshire. In an effort to maintain her status as a covered dependant under her parents' insurance plan, the now-deceased Ms. Morse was forced to maintain a full academic course load of 12 or more hours while undergoing treatment for colon cancer. Michelle's Law requires insurers to provide one-year extended coverage for students taking a medical leave of absence from their studies to treat a long-term illness. The student may also choose to reduce their course load to less than full-time for the same time period. The law applies to all students who are covered under their parents' insurance plan.

Future Issues and Concerns

President Obama signed The Patient Protection and Affordable Care Act (H.R. 3590) into law on March 23, 2010. This relatively new law may have a significant impact on the need for student coverage. One aspect of the law requires insurers to provide coverage for dependent children until age 26, regardless of their marital status or whether or not they are enrolled in school. This creates the potential for the law to negate the need for many school-sponsored policies, as graduate students who previously found themselves without coverage at age 23 may be able to maintain their plan until they complete graduate school. In an effort to prevent prior exclusion, the law also requires insurers to allow young adults to rejoin their parents' plan, even if they have already been "aged off" of the policy.

Another area of concern is the lack of reliability found in most waiver processes. A 2002 study performed by at Cornell University found that 31 of 372 students (8.3%) were not actually covered under the alternate plan listed on their waiver.[9] Furthermore, 16% of sampled students did not actually have insurance that provided care either at the university health center or within the local community. Another 12% of the alternate plans failed to provide an annual coverage benefit of $500,000 or more. All told, more than 40% of the students surveyed either had a policy that was out of compliance with minimum university standards, or had no effective coverage whatsoever.

Recommendations and Conclusion

Recommendations for improved coverage include the consideration of a move toward availability at the community college level, a mandatory state-wide contract (also open to private institutions) to reduce the premiums, required coverage for spouses and dependants, and the recommendation that institutions explore self-insurance models wherever the infrastructure exists to provide such care.

One recommendation for improving current policy involves considering a move toward student health coverage at the community college level. Disappointingly few two-year institutions currently offer student coverage. Students at this level are just as susceptible to devastating cost of uninsured health care as those at four-year institutions. With a large number of RT and healthcare programs offered at the community and technical college level, appropriate and affordable access to health insurance is needed.

Another recommendation involves mandating state-wide contracts that would include all state sponsored institutions in an effort to reduce the cost of student insurance premiums. While they would receive no state supplementation, private institutions could have the option to join such collective bargaining as well in an effort to increase overall purchasing power. The basic premise behind health insurance has always been that the premiums of the healthy subsidize the expenditures of the sick, and the main drivers of cost continue to be the size of the student body and the percentage of the student body that is involved in the plan. Allowing individual schools to make arrangements for their own student insurance plans negates the ability of the state to contract with a single provider and receive a more preferable rate on student premiums.

A third recommendation involves requiring coverage not only for students, but for their spouses and dependents as well. Uninsured illness or injury to a spouse or child can be just as financially devastating to a student's academic career as their own affliction could be. Only by covering the entire family could a plan hope to effectively reduce the risk of financial impact.

A final recommendation is that institutions explore self-insurance models wherever the infrastructure exists to provide such care. Many schools have affiliations with local or regional medical centers, whether it is an academic-related teaching hospital or simply the facility where students seek care most often. Insurance companies make money by charging premiums that allow them to pay for necessary care while recording the remaining funds as annual profit. If schools are able to self-insure their student body and negotiate preferable payment options with local health care providers, the potential exists to cut out the "middle man" thereby reducing program cost. While there would undoubtedly be an initial cost associated with making the move toward self-insurance, over time both the student body and the institution would stand to save a great deal.

In conclusion, institutional policies regarding student health coverage are still being developed and expanded. No ideal plan currently exists, and the landscape in which these policies are being offered is ever-changing. As the federal government begins to take a firmer hold on national health care policy, current plans may change drastically in an effort to fill the gap between parental coverage and no coverage. Firm documentation of the financial impact uninsured students have on state finances may be necessary in order to push through much-needed change. RT programs should take steps to determine the impact uninsured students may have on their current and future program.

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Respiratory Care Education Annual
Volume 21, Fall 2012, 43-56

The Relationship Between Respiratory Care Program Director Leadership Styles And Program Outcomes

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Abstract

Background: As a leader, the program director is ultimately responsible for program curriculum development, organization, administration, review, and accountability of program outcomes as established by CoARC. Purpose: The purpose of this study was to understand the relationship between the directors' leadership behaviors and program outcomes. **Method:** Program directors leadership styles were measured by the Multifactor Leadership Questionnaire (MLQ). Program director, faculty and program demographics were compiled with a researcher-designed questionnaire. CoARC accredited program directors (n=321) and their full and part-time faculty (n=172) received an e-mail requesting participation in the study with a web link to obtain demographic information. Faculty members received an e-mail from Mind Garden, Inc. with a web link to complete the MLQ. **Results:** This study found that none of the predictor's transformational, transactional, and passive/avoidant leadership behaviors were significant predictors of program outcomes ($p > .0125$). Furthermore, this study found no moderation effects of program director years in current position on the relationship between program director's leadership behaviors, program completion rate and RRT exam pass rate ($p > .05$). **Conclusion:** Program director leadership behavior is only one of many factors that would influence program outcomes. Regardless of this study's findings, the ultimate responsibility for accountability of the program rests on the director.

Key words: transformational leadership, respiratory care, and program outcomes.

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The Relationship Between Respiratory Care Program Director Leadership Styles And Program Outcomes

Introduction

Future expectations require higher education programs in respiratory care, to keep pace with the knowledge and skills needed for the advancement of the profession. The program director along with their leadership ability is ultimately responsible for program curriculum development, organization, administration, review, and accountability of program outcomes as established by the Commission on Accreditation for Respiratory Care (CoARC). Program outcomes include program and credentialing exam pass rates, graduate and employer satisfaction, and job placement rate.[1] Minimum thresholds established by CoARC must be reported annually by the program director. Program directors must be able to meet the ongoing evaluation criteria in order to keep its accreditation status and to assure program quality. The purpose of this study was to determine the relationship between respiratory care program director leadership behaviors and program outcomes, employing Bass and Avolio's Full-Range leadership model that ranges from transformational behaviors on one end of the spectrum to passive/avoidant behaviors on the other.[2]

Review of the Literature

Allied health programs of institutions of higher education are accredited in order to assure quality. According to the Council for Higher Education (CHEA), the definition of "Accreditation" is the review of quality.[3] The accreditation process is designed to hold institutions and programs accountable for guaranteeing that a quality education is provided to each student. Whether the student takes advantage of this opportunity is the student's personal decision.

According to Aft,[4] benefits of accreditation include assurances to parents and students that a program meets "minimum" standards. "Minimum" is the key word. Institutions and programs must go beyond the "minimum" requirements to assure a "quality" education. Respiratory care programs, in particular, have a duty to assure the public that graduates are of the highest quality. A challenge of accreditation is there is no single definition of quality. It depends on what you are trying to measure. Therefore, quality is determined by what is important to the stakeholder. Scrabec,[5] elaborates on the definition of stakeholders when he defines the student as the recipient of help and defines society, industry, and parents as the beneficiaries of that student's quality education. Haworth and Conrad[6] view quality more holistically when they discuss the notion that quality is dependent on a number of variables including faculty, resources, student quality and effort, and curriculum requirements. The author's state that there is a strong relationship between faculty education and training, research productivity, funding, and awards received and program quality. Educational resources are imperative to high quality programs as well. Resources include, but are not limited to, human (the number of faculty to students), financial (endowments, faculty salaries, and research funds) and physical (library strength, laboratory, and classrooms). Additionally, students themselves are vital to program quality.[7] It has been shown that students

that are involved and motivated are key to high quality programs.[6]

When students are engaged in diverse learning experiences, there is a positive effect on their growth and development. For instance, critical dialogue, mentoring, cooperative learning, out of class requirements, hands on activities, and guest speakers were all found to foster student growth and development.[6]

In order to assure quality and successful outcomes, the program director must be mindful of the different stakeholders, including but not limited to, faculty, students, and administration. Quality programs begin with the hiring and retention of quality faculty. Hiring diverse and engaging faculty requires a two-fold process. The first is to hire faculty members that are valued and that have both a theoretical and applied point of view. Secondly, reward faculty for engaging in scholarly activities and focus on teaching strategies that have positive student outcomes. Across the board, quality institutions deliberately recruit faculty who are willing to go far beyond the status quo.[6] Quality programs must recruit students that are as equally diverse and are as willing to engage themselves as the faculty. Strategies used to cultivate quality students were also two-fold. First, they only admitted students that were well rounded not only academically but also experientially and with a passion for learning as well. Secondly, they screened and admitted students whose professional interests and goals fit together well with the program.[6] Student investment in their own learning is essential for successful outcomes.

Finally, quality programs must have the support of engaged leaders who are willing to be actively involved. In order to achieve the goal of attracting and retaining engaged leaders, programs need to hire department or program chairs that would be committed to success. Secondly, the institution engaged administrators and faculty in activities that were designed to support leaders. Leaders who are present and communicative were sought after and preferred for not only assuring but also advancing quality programs.[6]

In the "Full-Range" leadership model, Bass and Avolio[2] describe transformational leaders as those whose magnetic behavior influences followers by inspiration, motivation, and providing the confidence to exceed expectations. Transactional leaders set goals and provide feedback to their followers. It has been proposed that transformational leadership augments transactional leadership. Transactional leadership is often seen at lower levels of the leader's performance or change. Finally, passive/avoidant leaders wait until there is a crisis to respond if they respond at all.[2]

Methods

Research Design

With Institutional Review Board approval, all accredited respiratory care program directors in the United States (n = 350) were invited to participate in this study and were contacted via e-mail and received introductory information explaining the purpose of the study along with an internet web-based link to a researcher-developed survey. A total of 78 program directors responded to the request to participate in the study.[8]

As part of the web-based demographic survey process, program directors were asked to submit the names and e-mail addresses of their full and part-time faculty members. A total of 172 faculty names and e-mail addresses were obtained from program directors. The fac-

ulty were contacted by e-mail and sent introductory information explaining the study and a web link to a researcher-developed survey designed to collect faculty demographics. A total of 53 faculty members responded and completed the researcher-designed faculty demographic questionnaire.[8] The program faculty members were sent an e-mail from Mind Garden, Inc., a publication company that provides reproducible assessments, collects and stores data for the researcher, inviting them to participate in the research study along with a web link to complete the Bass and Avolio's Multifactor Leadership Questionnaire (MLQ).[9] Faculty self-selected as to whether or not they wanted to participate in the research study by filling out the survey or deleting the e-mail. A total of 151 faculty members completed the MLQ [9] portion of the study. In order to assure anonymity, Mind Garden, Inc.[10] was responsible for coding and matching program directors and faculty participating in this study. The researcher did not have access to names of individual faculty members who completed the MLQ.

Instrumentation

Three survey instruments were used to gather data for this study. The first instrument was a researcher-designed questionnaire for the purpose of collecting program director demographics and program outcomes. The second instrument was a researcher-designed questionnaire for the purpose of collecting faculty demographics (see Appendix A and B). The third instrument used in the study was Bass and Avolio's Multifactor Leadership Questionnaire (MLQ).[9] Due to the copyright of the MLQ, a copy of this instrument is not available in the Appendix.

Each leadership style score for transformational, transactional, and passive/avoidant styles was averaged separately to obtain a single composite score by summing and dividing by the number for each of the scales that comprise the leadership style. Responses to the MLQ[9] were based on a five point Likert Scale (0 = Not at all, 1 = Once in a while, 2 = Sometimes, 3 = Fairly often, 4 = Frequently, if not always) .[9] The MLQ[9] has been tested and revised numerous times over the past 20 years, and is considered the benchmark measure used in transformational leadership research.[11] Reliability for all of the MLQ-R (Form 5x-Short) for each of the leadership factor scales ranged from .70 to .84, and included United States raters that were subordinates of their leader within the organization. A test-retest reliability of .44 to .74 was also reported. Validity of the full nine-factor model was measured by a confirmatory factor analysis (CFA) performed using LISREL resulting in a goodness of fit index (GFI) of .92. [9]

Limitations

The following limitations for the study included:

1. Program demographic information collected was self reported by the program director and was limited to the accuracy of the information provided.
2. The program directors' response rate to the researcher-designed survey was a limitation due to the small sample size.
3. The faculty response rate to the researcher-designed survey and for the MLQ-R (5x-Short)[9] was a limitation due to the small sample size.

Results

The data obtained from the MLQ-R (5x-Short) [9] along with the researcher designed questionnaires, were analyzed utilizing Statistical Program for Social Science (SPSS) 16.0 computer software. Seventy-eight program directors of accredited respiratory care programs in the United States responded to the researcher-designed questionnaire for the purpose of collecting program director, institutional, and program demographics. The majority of the participants were male (55.1%, n = 43). The mean age of the program directors was 50.8 years with a range between 35 and 67 years of age. Overwhelmingly, (88.5%, n = 69) reported that they had attended some form of leadership training whether it was a college degree, college credit, workshop, seminar, or a combination of the above. There was a fairly even divide in the number of years in current position with a third (32.1%, n = 25) having less than 5 years of experience, (33.3%, n = 26) having 6-15 years of experience, and (34.6%, n = 27) having greater than 15 years of experience.[8]

Participating program directors provided information regarding their institution. The majority of the programs were public (88.5%, n = 69) with a large number of the programs at the community college level (61.5%, n = 48). Program directors reported that the majority of the programs (75.6%, n = 59) had one or two full-time faculty members (not including themselves) and one to three part-time faculty members (38.5%, n = 30). Additionally, most of the programs offered an associate degree as the highest degree awarded (82.1%, n = 64).[8]

Program outcomes that are essential in the assessment of program quality and are required for CoARC accreditation were also reported. The majority of the program directors (82.1%, n = 64) reported a completion rate of more than 70 percent, while (53.8%, n = 42) of the program directors reported a 100 percent pass rate on the CRT exam and (71.8%, n = 56) reported more than a 50 percent pass rate on the RRT exam. The majority of program directors reported 100 percent job placement rate (67.9%, n = 53) and an overwhelming number (79.5 %, n = 62) reported a 10-year CoARC accreditation award.[8]

Fifty-three faculty members of accredited respiratory care programs in the United States participated in the researcher-designed questionnaire for the purpose of collecting demographic, educational, and professional information. The gender of the participants was nearly split with females holding a slight edge (50.9%, n = 27). The mean age of the faculty was 46.6 years with a range between 25 and 67 years of age. A small number (15.1%, n = 8) of the faculty reported that they held a doctorate degree with the majority reporting that they held a master's degree (39.6%, n = 21). Over one-half (52.8% n = 28) reporting that they had been in the field for over 20 years. The majority of the participants considered themselves to be full-time (71.7%, n = 38).[8]

In order to answer the question, *what is the relationship between the directors' leadership style and program outcomes?* a multiple regression analysis was performed using program director transformational, transactional, and passive/avoidant leadership behaviors and program outcomes (program completion rate, credentialing exam pass rate, and job placement rate).

This study found that simple correlations between the program outcomes and each of the predictors transformational, transactional, and passive/avoidant leadership behaviors were not significant, $p > .0125$ (see Table 1).

Table 1

Correlations Among Leadership Behaviors and Program Outcomes

Variable	Completion Rate	CRT Pass Rate	RRT Pass Rate	Job Placement
Transformational	.057	-.012	-.027	-.143
Transactional	.110	-.034	-.206	-.098
Passive/Avoidant	-.017	.070	.103	.177

Further investigation into moderation effects of program director years in current position on the relationship between program director's leadership behaviors, program completion rate and RRT exam pass rate. A multiple regression analysis was performed using two individual variables along with the product of the variables as a three predictor model. The predictor variables included transformational, transactional, passive/avoidant leadership behaviors, and years in position. The product variables included transformational by years in position, transactional by years in position, and passive/avoidant by years in position. The above variables were used to predict the moderation effect of program completion rate and RRT exam pass rate.

This study found that there was no moderation effect for program completion rate and RRT exam pass rate, and each of the predictors or product variables, $p > .05$ (see Table 2 and 3).

Table 2

Moderation Effect of Transformational, Transactional, and Passive/Avoidant Leadership Behaviors by Years in Position and Program Completion Rate

Variable	β	t	p
Transformational by Years in Position	-.013	-.089	.930
Transactional by Years in Position	-.038	-.265	.792
Passive/Avoidant by Years in Position	.039	.264	.793

a. Dependent Variable: Program Completion Rate

Table 3

Moderation Effect of Transformational, Transactional, and Passive/Avoidant Leadership Behaviors by Years in Position and RRT Exam Pass Rate

Variable	β	t	p
Transformational by Years in Position	.273	1.979	.053
Transactional by Years in Position	-.034	-.241	.810
Passive/Avoidant by Years in Position	-.083	-.561	.578

b. Dependent Variable: RRT Exam Pass Rate

Discussion

This study found that none of the predictor's transformational, transactional, and passive/avoidant leadership behaviors were significant predictors of program outcomes. Furthermore, this study found no moderation effects of program director years in current position on the relationship between program director's leadership behaviors, program completion rate and RRT exam pass rate. These findings were similar to Shaver [12] who also found no significant relationship with the majority of radiography program outcomes with the exception of the American Registry of Radiologic Technologist (ARRT) exam pass rate.

Although review of the literature supports that leadership may have some influence on organizational outcomes, there are many variables that may also have an effect as well (e.g., teaching style, quality of student, admission criteria, faculty effectiveness, program funding, and other resources).[6,7] Therefore, the leadership behaviors of the program director would only be one of many factors that would influence program outcomes. Regardless of this study's findings, the ultimate responsibility for accountability of the program rests on the director.

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Appendix A
Program Director Questionnaire
Program ID_____

* For the purpose of this study the Respiratory Care Program Director is defined as the person responsible for the organization and administration of the program. Additionally they are responsible for curriculum development, program effectiveness, program evaluation, and program outcomes.

Directions: Please Answer each of the following questions by selecting the appropriate response for each item.

Section I: Personal Information

1. What is your gender?
   _____ Female _____ Male

2. What is your age?
   _____ Years

3. Which of these best describes your ethnic background?
   _____ Asian or Pacific Islander
   _____ American Indian or Alaskan Native
   _____ Black, non-Hispanic
   _____ Caucasian (White), non-Hispanic
   _____ Hispanic
   _____ Other (please specify)_____
   _____ I would prefer not to say

4. What is your current title?
   _____ Program Director
   _____ Department Chair
   _____ Department Chair/Program Director
   _____ Other (please specify) _____

5. What is your current appointment status?
   _____ Permanent
   _____ Interim
   _____ Acting

6. How long have you been in your current position?
   _____ Less than six months
   _____ Greater than six months, but less than one year
   _____ Total number of Years

7. Are you responsible for programs other than Respiratory Care?
   _____ Yes
   _____ No

8. How long have you been a Registered Respiratory Therapist?
   _____ Less than 5 years
   _____ 5 – 10 years
   _____ 11 – 15 years
   _____ 16 – 20 years
   _____ More than 20 years

Section II: Educational Background

1. Which of the following designates your highest academic degree obtained?
   _____ Doctoral degree
   _____ Masters degree
   _____ Bachelors degree
   _____ Associate degree

2. Which discipline is associated with your highest academic degree obtained?
   _____ Respiratory Care
   _____ Education
   _____ Business
   _____ Health Administration
   _____ Other (please specify) _____

3. If you have participated in continuing or formal education in the area of leadership, please select all that apply:
   _____ College degree
   _____ College credit course(s)
   _____ Workshop (one or two-day)
   _____ Seminar (more than two days)

Section III: Institutional Information

1. Which of the following best describes your institution?
   _____ Public
   _____ Private
   _____ For Profit

2. Which of the following best describes your institution?
   _____ Research University
   _____ University
   _____ Baccalaureate College
   _____Community College
   _____Technical College

3. Which of the following best describes your institution's fall semester's Full Time Equivalent (FTE) enrollment status?

_____Less than 1,999
_____2,000 - 4,999
_____5,000 - 9,999
_____More than 10,000
_____I don't know

4. Upon completion of your institution's respiratory care program, which of the following degrees does your graduate receive?

_____ Associate of Science
_____ Baccalaureate Degree
_____ Master's Degree
_____ Other (please specify) _____

Section IV: Program Information

* For the purposes of this study, a part-time or full-time faculty member is defined as any person that is employed by the educational institution or by a clinical affiliated institution whose responsibilities includes instruction in the classroom, and/or laboratory and/or clinical setting.

1. Number of full-time faculty members * (not including yourself):

_____

2. Number of part-time faculty members *:

_____

3. Total student capacity:

_____

4. Average number of first-year students admitted annually:

_____ Less than eight
_____ 8 – 15
_____ 16 – 25
_____ 26 – 35
_____ More than 35

5. Three-year average NBRC Entry Level CRT Exam pass rate (the number of program graduates who pass the Entry Level CRT credentialing examination divided by the number of graduates who take the examination on the first attempt):

_____%

6. Three-year average NBRC Written Registry Exam pass rate (the number of program graduates who pass the Written Registry credentialing examination divided by the number of graduates who take the examination on the first attempt):
_____%

7. Three-year average NBRC Clinical Simulation Exam pass rate (the number of program graduates who pass the Clinical Simulation credentialing examination divided by the number of graduates who take the examination on the first attempt):
_____%

8. Three-year average program completion rate (the number of students initially enrolled divided by the number of students who complete the program):
_____%

9. Three-year average job-placement rate (number of graduates actively seeking employment in the respiratory care profession divided by the number of graduates employed in the respiratory care profession within 6 months of graduation):
_____%

10. Most recent CoARC accreditation action or award:
_____ 10 years
_____ 5 years
_____ 1 year
_____ Probation
_____ Other (please specify) _____

Faculty Contact Information

Please list the names and email addresses of faculty members associated with your program. Faculty members will be contacted and asked to complete the Multifactor Leadership Questionnaire (MLQ). The MLQ is designed to assess your leadership skills and your effectiveness as perceived by the faculty member. All responses will be kept confidential.

* For the purposes of this study, a full-time or part-time faculty member is defined as any person that is employed by the educational institution or by a clinical affiliated institution whose responsibilities includes instruction in the classroom, and/or laboratory and/or clinical setting.

Name:_____

Email Address:_____

Check One: Full-time Part-time

Name:_____

Email Address:_____

Check One: Full-time Part-time

Name:_____

Email Address:_____

Check One: Full-time Part-time

Name:_____

Email Address:_____

Check One: Full-time Part-time

Name:_____

Email Address:_____

Check One: Full-time Part-time

Appendix B
Faculty Questionnaire
Program ID_____

Directions: Please Answer each of the following questions by selecting the appropriate response for each item.

Section I: Personal Information

1. What is your gender?

   _____ Female _____ Male

2. What is your age?
   _____ Years

3. Which of these best describes your ethnic background?
   _____ Asian or Pacific Islander
   _____ American Indian or Alaskan Native
   _____ Black, non-Hispanic
   _____ Caucasian (White), non-Hispanic
   _____ Hispanic
   _____ Other (please specify)_____
   _____ I would prefer not to say

Section II: Educational Background

1. Which of the following designates your highest academic degree obtained?
   _____ Doctoral degree
   _____ Masters degree
   _____ Bachelors degree
   _____ Associate degree

2. Which discipline is associated with your highest academic degree obtained?
   _____ Respiratory Care
   _____ Education
   _____ Business
   _____ Health Administration
   _____ Other (please specify) _____

Section III: Professional Information

1. Which of the following best describes your affiliation with the respiratory care program?
   _____ Full-time
   _____ Part-time

2. Which of the following best describes your employer?
   _____ Academic institution (i.e., college, university)
   _____ Clinical education setting (i.e., hospital, clinic, rehab)
   _____ Other (please specify) _____

3. How long have you been a Registered Respiratory Therapist?
   _____ Less than 5 years
   _____ 5 – 10 years
   _____ 11 – 15 years
   _____ 16 – 20 years
   _____ More than 20 years

Respiratory Care Education Annual
Volume 21, Fall 2012, 57-66

The Allen Test: A Historical Literature Review and Recommendations

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Abstract

In 1929, Dr. Edgar V.N. Allen introduced the Allen test with the specific purpose of diagnosing chronic occlusive arterial lesions. The modified Allen test was later introduced in 1952 as an alternative method to test for collateral circulation. This article is a historical literature review of the Allen test that outlines how variations to its original version have developed over time. Each individual section within the article (technique, terminology, and flush return time) provides a chronological history of the Allen test and its modified version. The primary purposes of this paper are 1) to review the pertinent literature related to the Allen test and the modified Allen test procedures, 2) to review the impact of proper technique on test results, 3) to review the terminology and time frames associated with the test results, and 4) to offer a recommendation for educators and practitioners when using either test.

Key Words: Allen Test, modified Allen test, collateral circulation, flush return time, patent or occlusion

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The Allen Test: A Historical Literature Review and Recommendation

Introduction

Dr. Edgar V. N. Allen introduced the Allen test in 1929 with a specific purpose of diagnosing chronic occlusive arterial lesions distal to the wrist.[1] He did not believe the assessment of vascular disease required "mechanical contrivances." Using three illustrative cases Dr. Allen attempted to prove "critical examination by vision and palpation, and simple tests reinforced with an intelligently procured anamnesis, are sufficient."[1pp237] The Allen test and its modified version are still considered surrogates to objective assessments of arterial occlusions and collateral blood flow to the hands. Dr. Allen's seminal piece intended to describe a simple diagnostic assessment for occlusive lesions in arteries distal to the wrist.[1] Subsequent publications have altered that intention, modified the original procedure, created terminology to describe the test results and established a degree of confusion as a result. The primary purposes of this paper are 1) to review the pertinent literature related to the Allen test and the modified Allen test procedures, 2) to review the impact of proper technique on test results, 3) to review the terminology and time frames associated with the test results, and 4) to offer a recommendation for educators and practitioners when using either test. Within each section of this review information will follow a chronological order based on year of publication originating with Dr. Allen's paper. This literature review will exclude scientific evidence related to the validity of the original Allen test and modified Allen test to provide an assessment of collateral flow or arterial occlusion prior to arterial punctures and cannulation. A review of that specific literature will occur in a subsequent publication.

The Procedures

In an effort to accurately communicate the methods developed by Dr. Allen, an excerpt of the procedure, from Dr. Allen's 1929 article, is included below.

> The hands of the patient are held in front of him or over his head. The examiner stands at the side of or in front of the patient. If obstruction of the ulnar artery is suspected, the radial arteries are located by their pulsations; the examiner places one thumb lightly over each radial, with the four fingers of each hand behind the patient's wrist, thus holding the wrist lightly between the thumb and fingers. The patient closes his hands as tightly as possible for a period of one minute in order to squeeze the blood out of the hand; the examiner compresses each wrist between his thumb and fingers, thus occluding the radial arteries; the patient quickly extends his fingers partially while compression of the radial arteries is maintained by the examiner. The return of color to the hand and fingers is noted. [1pp238]

Compression of the radial arteries allows the examiner to assess the adequacy of ulnar blood flow. In patients without occlusive disease of the ulnar artery "pallor is quickly replaced by rubor which gradually fades to a normal color."[1pp238] The examiner is encouraged to repeat the test while compressing both ulnar arteries thus providing an assessment of radial artery occlusion and blood flow.[1] Dr. Allen did not indicate a time for normal color re-

turn in his case publication. Likewise, he did not use the terms *positive* and *negative* to describe the test outcome. Rather, his assessment of the ulnar and radial arteries in this manner provides evidence on the *presence* or *absence* of occlusive lesions.

The method for the modified Allen test was first described by Wright[2] in 1952. An explanation for modifying Allen's original method was not offered. Once again, in an effort to accurately reflect the steps associated with the modified Allen test an excerpt from Dr. Wright's textbook is included.

> The examiner stands beside the patient and faces in the same direction. With one thumb placed over the patient's radial artery and the other over the ulnar artery, the following maneuver is carried out. The patient elevates his hand above his head and clenches his fist to force out as much blood as possible. The examiner presses his thumbs firmly to occlude the patient's radial and ulnar arteries. The patient's hand is then lowered to a dependent position and it is opened, but relaxed, not stretched in hypoextension [sic]. The hand remains pale. The thumb over the radial artery is then released. Normally, a flush will spread rapidly over the hand and fingers from the radial side. If the radial artery is occluded, the hand will remain pale. An identical test is then performed, but this time the thumb over the ulnar artery is released to determine whether it is patent. Patches of residual pallor may indicate obstructive lesions in the arterial arch or smaller vessels of the hand or digits. Both hands should be tested in this fashion. pp38

Wright did not specify a time for pallor to reverse nor did he describe the test results using the terms *positive* or *negative*. In addition, neither test was developed to provide a justification for arterial blood gas procurement, arterial line placement, or radial artery harvest for bypass grafting. These procedures were not available to the medical community until after 1952. Whether intentional or not, the methods described above provide the means to assess collateral blood flow to the hand.

Proper Technique

In 1966 Ejrup et al.[3] conducted an experimental study to assess the impact of hand position on Allen test results. The authors conducted the Allen test on 50 normal subjects and 50 subjects diagnosed with cerebrovascular disease without vascular symptoms in the hands. In an effort to evaluate the influence of hand position on test results, the authors also evaluated the Allen test on 50 healthy subjects using three different hand positions, e.g. hand hyperextended, hand straight, and hand slightly flexed. Ejrup et al. make no distinction between the 50 normal subjects and the 50 healthy subjects. The time from the hand opening to the reappearance of flush was recording using a stopwatch. The results confirmed that a flexed hand position following the Allen test or modified Allen test equated to the shortest time for color return and the hyperextended hand position resulted in the longest time for color return in the 50 healthy subjects. Furthermore, when the hand was held in a slightly flexed position all arteries demonstrated a flush return that averaged less than 3 seconds and no single value exceeded 6 seconds. The authors concluded, "When the test is performed under optimal conditions with the hand slightly flexed…prolonged blanching of more than 6 seconds is unusual in normal subjects and should raise suspicion of partial or total occlu-

sion of the artery being tested."[3(pp780)] Of the 50 normal subjects and 50 cerebrovascular disease subjects a hyperextended hand position implied arterial occlusion in 97 of those 100 subjects. Ejrup et al. also demonstrated that subjects will spontaneously hyperextend the hand versus assuming a straight or flexed hand position. Therefore, when conducting the Allen test or modified version the practitioner must be acutely aware of the patient's actions.

The Ejrup article was the first scholarly record documenting the impact of hand position on Allen test or modified Allen test results. The authors stress the importance of proper technique when performing the Allen's test or modified Allen's test as well as proper coaching during either procedure. Wright directly addressed the avoidance of hand hyperextension in his methods. It was debatable whether Allen addressed this issue; however, in the description of his method he states, "the patient quickly extends his fingers partially." Dr. Allen was an accomplished cardiovascular physician and professor at the Mayo clinic in 1929; so one could surmise that the use of the word *partially* suggests a non-hyperextended hand position.

Greenhow published a single case example in 1972 that demonstrated the impact of improper modified Allen test technique on ulnar blood flow return.[4] Once again, the modified Allen test requires the hand to be extended but not hyperextended prior to artery pressure release. Greenhow included photographs demonstrating the impact of proper and improper hand position on ulnar blood flow. It is clear that hyperextension will delay the return of flush for a period of time and thus the hand will remain blanched. This practice should be closely monitored when performing the Allen test or modified Allen test. Greenhow's article was the first to associate the modified Allen test with radial artery cannulation and supports the use of the test prior to the cannulation procedure.

In 1976, Kamienecki et al.[5] assessed the impact of hand position on blood flow return following arterial occlusion. The authors intended to perform the Allen test emphasizing improper technique and the modified Allen test emphasizing proper technique. However, the modified Allen test technique was performed on all subjects with a hyperextended hand and without a hyperextended hand. The authors imply the difference between the Allen test and modified Allen test is proper hand position. All modified Allen test procedures were followed by doppler velocity assessment in an attempt to confirm continuity of blood flow to the palmar arch. Using the non-hyperextended method all but one subject demonstrated normal capillary filling. When hyperextension was allowed 73% of the subjects demonstrated a deficit in reperfusion that was refuted using doppler ultrasound. The authors concluded hyperextension of the hand leads to a false-positive decision and the incorrect assumption that flow is occluded or inadequate.

The work of Ejrup, Greenhow and Kamienecki established the importance of proper technique when performing the Allen test or modified Allen test. The remaining sources reviewed for this paper did not investigate the impact of various hand positions on Allen or modified Allen test results. From the few studies directly assessing the impact of hand position on Allen test or modified Allen test results, it is clear that the flexed or straight position is ideal. In addition, the practitioner must actively ensure the patient does not spontaneously hyperextend the hand when assessing for flush return. The flexed position resulted in the shortest time for flush return in a majority of subjects.

Test Result Terminology

Numerous authors have supplied a terminology label to describe Allen test and modified Allen test results. Some have attempted to remain consistent with Dr. Allen's and Dr. Wright's original descriptions thus labeling the results as patent or occluded, while others have developed unique terminology to describe test results. A review of the available literature demonstrated the following terminology to describe Allen test or modified Allen test results: positive/negative (including false-positive/false-negative),[3-17] patent/occluded,[1,2,16,18-21] refill time,[5,16,21] delay time,[11,23] recovery time,[24] time to maximum blush/palm flush,[25] and normal/abnormal.[26-29]

In 1952 Schwartz and Cooper[6] performed the Allen test on 15 subjects with polycythemia, either current or in remission. The authors described the Allen test results as *positive* or *negative* thus marking the first time those terms are used in the available literature. A positive Allen test, per Schwartz and Cooper, would signal an occluded artery. Nine patients with current polycythemia demonstrated a positive Allen test result and 6 patients with polycythemia in remission demonstrated negative Allen test results. Furthermore, the authors introduced *false-positive* as a descriptor for Allen test results stating, "A positive Allen test in patients with polycythemia is a reflection of the increased blood viscosity and retarded circulation, and does not necessarily indicate occlusive arterial disease. In such cases this finding would better be termed a 'false-positive' Allen test."[6(pp321)] The authors consulted Dr. Allen and Dr. Wright regarding the findings. One could surmise that use of the terms positive and negative to describe Allen test and modified Allen test results would have been acceptable to both individuals. Schwartz and Cooper, like Allen and Wright, did not provide a time for normal color return. Although, a comment is made that additional evaluation of the Allen test is warranted, "particularly as regards quantitative studies from a time standpoint." [6(pp321)]

In 1970 Richards[18] included a description of the modified Allen test in his textbook, *Peripheral Artery Disease* that is similar to Wright's procedure. However, Richards recommends a two-minute fist clench to force blood from the hand and believes it should only take "a few seconds" for hyperaemia [sic] to return. The artery was labeled occluded when color return was delayed. Richard's terminology is more consistent with that of Allen and Wright. Similar to previous authors Richards was not associating the modified Allen test with arterial punctures or cannulation.

As mentioned previously, Greenhow demonstrated the effect of hand hyperextension on vessel filling when performing the modified Allen test.[4,18] Greenhow provided two figures to substantiate his claim. Figure one illustrated the examiner occluding the radial artery only, there is hyperextension of the patient's hand, and the palm appears blanched indicating poor vessel filling. Figure two illustrated the examiner occluding the radial artery only, there is partial opening of the subject's hand, and the palm appears to have a normal color. Greenhow described figure one as poor vessel filling and attached the label *false-negative result*. Greenhow associated the term *negative* with poor circulation and indicated the result was due to hyperextension versus vessel occlusion, i.e. it is a false-negative result. Greenhow's nomenclature contrasts that of Schwartz and Cooper and other authors using the *positive* and *negative* labels. Prior to Greenhow, the label *positive* was associated with arterial occlusion, inadequate arterial flow or delayed flush return. Greenhow implies a *negative* test signals in-

adequate flow to the palmar vessels and thus a *positive* test signals adequate flow. Greenhow's label adds confusion for practitioners conducting and describing test results.

In 1977 Shapiro et al.[8] published the second edition of *Clinical Application of Blood Gases* and continued the terminology confusion by recommending different labels for the Allen test and modified Allen test results. His naming convention extended into the 5th edition and is stated as follows, "…a positive Allen test denotes the presence of radial artery occlusion."[10(pp303)] In referencing the modified Allen test he states, "Flushing of the palm, fingers and thumb within 10 seconds documents that the ulnar artery is capable of supplying the entire hand while the radial artery is occluded – a *positive* modified Allen test."[10(pp303)] Clearly from Shapiro's texts he is describing different arterial characteristics, e.g. radial artery occlusion versus ulnar artery collateral blood flow. However, Allen and Wright did not stress different intentions with each of their tests. As demonstrated above both tests are addressing the assessment of vascular obstruction. In addition, Shapiro's explanation for different terminology is understandable if we treat the Allen test and the modified Allen test as two individual tests with two separate methodologies. However, we believe the test names are used interchangeably thus preventing us to adopt Shapiro's naming schema. As a single example, Greenhow's title is *Incorrect Performance of Allen's Test* yet he is performing the modified Allen test for his case. Since the two tests are forever linked together it seems appropriate to use the same terminology to describe test results.

Various correspondence articles published in 1981 share our sentiment regarding the confusing terminology related to the test results. Peters and Chapin[23] disagreed with labeling the Allen test results as *positive* or *negative*. The authors recommend describing the results "according to length of delay in return of arterial blush."[23(pp85)] In an editorial reply to Peters and Chapin, Messick[22] offered a different suggestion for reporting test results. Messick believed reporting the refill time for each artery would create the least confusion. The use of refill time is applicable whether using the Allen test or its modified version.

Three additional examples of reverse terminology, i.e. a positive test equals adequate collateral flow or vessel filling, to describe Allen test or modified Allen test results occur by Wilkins et al.[12] in 1985, by the American Association for Respiratory Care Clinical Practice Guidelines: Sampling for Arterial Blood Gas Analysis[14] in 1992 and by Benit et al.[15] in 1996. Wilkins et al. cite Greenhow as a source and more than likely subscribed to his terminology. The AARC CPGs state inadequate blood supply to the hand is denoted with a *negative* result on a modified Allen test. The CPGs cite Shapiro[9] as a source thus explaining the origination of their label. Benit et al.[15] described results of the modified Allen test as *positive* if color returns within 10 seconds, which added multiple levels to the terminology. The authors characterized results into three categories: clearly positive, moderately positive, and negative based on the time for color return.[15] Although their research was clearly stated, it is not common practice or common knowledge to describe results of the modified Allen test as clearly positive or moderately positive thus creating further confusion for the practitioner.

Flush Return Time

The first mention of a time coinciding with performing the Allen test or modified Allen test came in 1954.[7] Due to skepticism over its usefulness, Baumann performed the Allen test

on sixteen normal subjects ranging in age from 20 to 46 years. Obliterative vascular disease was indicated if pallor continued for 15 second or more once ulnar or radial artery occlusion was released. Four additional authors adhered to the 15 seconds time initiated by Baumann.[4,12,19,21] This time was selected without scientific investigation.

In addition to investigating the ideal hand position when assessing arterial occlusion, Ejrup et al. (1966) recorded the time for flush return as a consequence of each hand position in 50 normal subjects. As noted above, the flexed and straight positions corresponded with the shortest time for flush return the ensuing recommendation. The authors concluded, "…prolonged blanching of more than 6 seconds is unusual in normal subjects and should raise suspicion of partial or total occlusion of the artery being tested."[3(pp780)] Ejrup et al. are the first authors to assess time after performing the modified Allen test versus preselecting a time for flush return. Four additional articles support the use of a 6 second time period[5,11,27,30] and one article supports six seconds or greater.[31] Puttarajappa and Rajan[32] reported effective collateral circulation as a range between 5-6 seconds. Bedford,[20] Peters[23] and Furhman[28] recommended a refill time of less than or equal to 5 seconds.

Richards[18] in 1970 and McGregor[13] in 1987 suggested a time of a few seconds. Although we could assume the authors intended "a few seconds" to indicate three seconds neither author provides an actual number. As demonstrated by Ejrup et al. a three second refill time in normal subjects is possible.

Beginning in 1977 multiple authors subscribed to a flush return time of 10 seconds or less to indicate sufficient collateral circulation from the ulnar artery.[8-10,15,24,25,33-35] All of these authors arbitrarily selected a time frame of 10 seconds or less prior to conducting the Allen test or modified Allen test.

In 1981 Gelberman and Blasingame[36] assessed time for revascularization in the radial and ulnar arteries of nearly 400 subjects. The modified Allen test was performed on each hand for each artery. The average revascularization time for the ulnar artery for each hand was 2.4 ± 1.2 seconds. The average revascularization time for the radial artery for each hand was 2.3 ± 1.0 seconds. The authors chose six seconds to indicate delayed revascularization. Their results indicated that 91% of the hands filled within six seconds for the radial and ulnar arteries. The ulnar arteries displayed a greater percentage of delayed filling compared to the radial arteries, 7% versus 2% respectively.

In 2000 Jarvis et al.[17] provided information on sensitivity, specificity and diagnostic accuracy of the modified Allen test procedure in relation to several different time frames. One examiner noted the time for flush return while another examiner assessed thumb blood flow via doppler ultrasound. The authors' results indicated that a 5-second time generated the highest diagnostic accuracy compared to the 6-second and the 3-second time periods. Jarvis' work specifically addressed the diagnostic accuracy of the time periods selected and was not intended to imply accuracy of the modified Allen test procedure in relation to objective measures.

Recommendations

We reviewed the pertinent literature as it relates to method, technique, terminology and flush return time. Due to space limitations, we deliberately avoided reviewing literature re-

lated to the comparison of the Allen test and modified Allen test to objective measurements or devices. We believe the current review and subsequent recommendations are useful to the respiratory care educator and bedside clinician. If you are attempting the Allen test or modified version or educating students on these tests we believe the following recommendations can guide your actions when conducting either test.

We recommend avoiding hand hyperextension due to the possibility of generating falsely long refill times.[2-5] The ideal hand positions appear to be straight or slightly flexed. We recommend adopting one set of terminology when communicating the Allen test or modified Allen test results. Our suggestion mirrors the recommendations outlined in prior publications that suggested to report results based on refill time to avert any misunderstanding in the interpretation of the test.[22,23] Refill time can be applied to either the Allen test or modified Allen test and thus thwart any further confusion regarding test results. The Allen test and modified Allen test are subjective assessments. Realistically the examiner cannot determine if there is occlusion, he or she can only determine the time for flush return and then make an educated guess regarding occlusion/collateral flow.

In addition to reporting refill time to clarify the results of an Allen test or modified Allen test, we recommend one universal time as a cut-off point for conducting arterial blood gas puncture or radial cannulation. This is a more difficulty recommendation because of the limited amount of support for any particular time frame. We recommend using a refill time of 5 seconds as the cut-off point.[3,17,20,28] We believe this recommendation errs on the side of caution and warrants selection of an alternative site. It should be noted that two of the authors we cite for the refill time recommendation do not support the Allen test or modified version as a reliable test.[17,28] However, their results demonstrated to us the benefits of using a 5-second refill time over longer time frames. Lastly, we recommend performing the Allen test or modified version on both the ulnar and the radial artery.[36] We believe it is equally important to assess the status of the radial artery prior to arterial puncture. Therefore, the preferred site of puncture or cannulation should demonstrate an acceptable flow, as should the collateral artery. As stated above the Allen's test and the modified Allen's test are subjective assessments and results should always be interpreted with this understanding even if our recommendations are followed.

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