Predicting Academic Success, Based On The Psychological Services Bureau Test, In A Nontraditional Respiratory Care Program

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ABSTRACT

Hospitals are constantly looking for ways to obtain the best return from their investment. The largest expense a typical hospital has is personnel costs. In order to address this expense, Hendrick Medical Center chose to develop a nontraditional Respiratory Care Program in order to obtain qualified Respiratory Care Practitioners in the most cost effective manner.

The Program attempts to successfully identify applicants who are likely to succeed, graduate and pass the National Board for Respiratory Care's Certification exam. If a student fails to continue in the program due to unsatisfactory academic performance the graduating class size decreases and the Hospital cost per student increases.

The purpose of this study was to investigate whether, in a nontraditional Respiratory Care Program, there was any relationship between sections of the Psychological Services Bureau entrance exam and a student's academic success as measured by the National Board for Respiratory Care's Certification exam. Tests results were taken for both the PSB exam and the NBRC's exam and were analyzed using Pearson Product Moment correlation.

A significant correlation was found between the Natural Science portion of the PSB exam and predicted NBRC success. These scores explained almost 15% of the variation in NBRC scores. The PSB Academic Aptitude appeared the second strongest predictor of the NBRC

scores, explaining another 5.7% of the NBRC score variation.

The results of this study should be useful to predicting academic success for nontraditional Respiratory Care school applicants.

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Predicting Academic Success, Based on the PSB Test,

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Introduction

Methods for predicting the potential for academic success have been studied extensively (Oliver, 1985; Shaw, 1995). Most of the research is based on the assumption that a need exists for a reliable means of identifying the potentially unsuccessful candidate (Hayes, 1981). When a student does not successfully complete a program, there is an economic loss both to the student and to the educational institution. In order to attempt to prevent such loss, current allied health program admission requirements typically include previously earned transcripts with acceptable course work and a grade point average (GPA) greater than 2.0 (Garza, 1976). Other standard admission requirements include data thought to predict a prospective student's performance, such as ACT scores, high school English scores, high school rank, biology scores, and science-math GPA (Op't Holt, 1992; Schmalz, 1995). While the validity of these prediction variables has been confirmed through various studies reported by numerous investigators, they have all concerned the traditional student entering the typical campus-based respiratory care program (Flanning, 1985). The traditional student is one who has recently graduated from high school, not been in the work force on a full-time basis, and attends daily classes on campus. Although the majority of students attending respiratory care schools and/or college fit this traditional role, an increasing number of nontraditional students enter educational programs each year. These students typically have been away from formal education for a number of years. Tremendous

economic and social demands have encouraged many such students to return to school. Nontraditional programs offer unique educational opportunities to students who cannot afford to leave their jobs or to relocate to attend regularly scheduled classes. Some programs have flexible schedules or are self-paced to allow students the opportunity to continue employment (Tompkins, 1990).

Nontraditional students are often quite successful. In fact, one study reported that the most successful students are the older, more mature students (Montgomery, 1976). However, to date, there are few published studies regarding determination of the applicant's potential for success in a nontraditional respiratory care program.

Nontraditional Respiratory Care Students

Nontraditional students are defined as students who attend non campus-based courses at a hospital based nontraditional Respiratory Care School and may or may not be employed. Tremendous economic and social demands have encouraged many such students to return to school. The nontraditional program offers the student the opportunity to obtain their education without relocating or leaving their jobs. Nontraditional students typically have been away from formal education for a number of years. The age range of nontraditional students can be extremely varied. Ethnic backgrounds of nontraditional students are varied. (Tompkins, 1990). However, to date, there are few published studies regarding determination of an applicant's potential for success in a nontraditional program.

Psychological Services Bureau Test (PSB)

Hendrick Medical Center's nontraditional Respiratory Care Program requires all applicants to sit for the Health Occupations Aptitude Examination. The Psychological Services Bureau is staffed by a group of professional psychologists. The majority of these psychologists are affiliated with the Indiana University of Pennsylvania, Indiana, Pennsylvania. The Psychological Services Bureau has been functioning for approximately twenty years providing educational and psychological test development, educational and vocational advisement, consumer preference and opinion surveys, general industrial and organizational consultation, personal counseling, and research and development (Psychological Services Bureau, 1995). The standardized Health Occupations Aptitude exam, constructed and distributed by the Psychological Services Bureau, is a specialized aptitude exam consisting of a battery of tests that attempt to match training occupations and job requirements with the specific pattern of abilities and knowledge characterizing each individual. The exam is a Level A battery of tests (American Psychological Association category) in that it can be administered and interpreted with the aids provided by the authors. Items on this exam cover five primary areas, 1) academic aptitude which includes verbal, nonverbal, and numerical; 2) spelling; 3) reading comprehension; 4) information in the natural sciences; and 5) vocational adjustment. The exam has proven to be both a valid and reliable instrument (Psychological Services Bureau, 1995).

The Academic Aptitude section of the exam is an instrument for appraising the combination of native and acquired abilities that are needed for school work; likelihood of success in mastering academic work, as estimated from measures of the necessary abilities. It measures the three kinds of school-related abilities which are most important in the greatest

number of educational endeavors: verbal, quantitative and nonverbal. It yields information which allows an estimate of present capabilities. The Academic Aptitude Test emphasizes concepts and experiences familiar to every examinee, while still requiring careful reasoning and the ability to comprehend and draw conclusions. The inclusion of computational and nonverbal items gives consideration to the individual with good reasoning ability but who lacks skill in reading and has poor verbal development (Psychological Services Bureau, 1995).

The verbal aspect consists of 30 vocabulary-related items. Empirical evidence has shown this type of test item to be highly related to academic success. As one of the most efficient measures of verbal ability it is a valid aid in estimating the general capacity of an examinee to undertake academic work of a higher level of schooling. The numerical aspect consists of 30 items drawing largely from basic arithmetic information. To some degree it involves skill with arithmetic concepts along with computational speed. The element of speed seems to be a more significant factor in the numerical subtest than in the Verbal subtest, although it does not seem to be excessively important. In the initial research studies 87 percent of the examinees completed three-fourths of the items in the numerical subtest. The apparent greater aspect of speediness with numerical materials in the PSB exam is consistent with the findings from other tests. A probable explanation is that examinees give up more readily on what are perceived to be difficult arithmetic problems than on difficult verbal problems. The nonverbal aspect consists of 30 items calling for comprehension of form relationships. The measurement here is in terms of the ability to manipulate things mentally. The test items measure ability to reason out differences in pictured objects. The nonverbal subtest serves as a measure of ability to deal with concrete materials through visualization. Recognition of form relationships and of differences in pictured

objects has been shown by research to be basic to learning aptitude. Reading skill is not a factor in nonverbal tests (Psychological Services Bureau, 1995). Directions are read to the examinees prior to the start of each section by the test administrator.

The Academic Aptitude section has three parts or subtest scores and a total score which is a sum of the three scores. Testing time is 30 minutes.

The Spelling section of the exam helps determine the ability to spell words relevant to the allied health occupations which is essential to written expression and communication. To some extent this test also reflects an individual's background of educational achievement. Sixty carefully selected sets of three words each are used. In PSB's initial studies, the addition of more than the two distractors to the sets of words was unproductive. The spelling test measures how well the examinee can recognize the correct spelling of certain words that might be expected to be found in the academic curriculum and subsequent work environment of the allied health professional. An additional feature of the words used is that certain rules of grammar are involved in determining the correct spelling (Psychological Services Bureau, 1995). Testing time is 15 minutes.

The Reading Comprehension sections measure ability to understand direct statements, to interpret passages, to see intent of authors, to observe organization of ideas, and to extract information from passages with respect to ideas and purposes. The test consists of three passages which the examinee reads sequentially and responds to questions associated with the material of each passage. There are forty questions for the three passages. The examinee is asked to recall sequences of ideas and facts, to identify ideas found in the passage when they are stated in language different from the selection, and to deduce by specific inference the meaning of

figurative, technical, and obscure words, phrases, and sentences. Passages were selected to represent the major types of material which students are called upon to read. Selection of passages was based upon the criteria that follows: 1. Passages content should be of some interest to examinee 2. Content of passage should have, at least, minimal value 3. Passages should be kinds likely to be read by students in school situations 4. Passages should be of appropriate difficulty 5. Passages should range from 325 to 450 words in length which is the typical length of most textbook passages (Psychological Services Bureau, 1995). Testing time is 15 minutes.

Information in The Natural Sciences section is a measurement test concerning the individual's accumulation of information in biology, microbiology, chemistry, physics, pharmacology, anatomy, physiology, and health and safety. The relationship of knowledge in the area of the natural sciences to the allied health fields is tested. Ninety items are included in this part of the battery of tests. Items were selected as indicated by an analysis of course of study and widely used textbooks in the curriculum for those preparing for allied health careers. For each of the ninety items there is one correct answer and four distractors. The distractors, in general, are somewhat removed from the correct response since the purpose of the test is to determine whether the examinee has sufficient knowledge to select the correct response as opposed to the depth of knowledge required to make very fine discriminations. The items representing the different disciplines named above appear in such an order in the test as to provide equal opportunity for all examinees regardless of which one of the sciences represents their area of strength or weakness (Psychological Services Bureau, 1995). Testing time is 30 minutes.

The Vocational Adjustment Index demonstrates how an individual's characteristic life style

is reflected in their personal, educational, and occupational adjustment. Knowledge of some of the significant personality characteristics of the prospective allied health professional would thus seem to be important. Feelings, attitudes, and opinions frequently determine success or failure. The index yields a composite estimate of factors - is the individual usually cheerful, objective, dependable, self-reliant, helpful, conscientious, insightful, mature in their approach to adult problems, not overly anxious, and free from psychosomatic complaints - felt to be significant to the adjustment of the allied health professional as a student and as a practitioner. The Vocational Adjustment Index is designed for use, if needed, in subsequent scholastic and personal counseling, rather than just in the selection process. The Vocational Adjustment Index consists of 105 statements with which the examinee is asked to agree or disagree. Program administrators and instructors were asked to list those personality traits, factors, or characteristics they felt to be desirable and important for the allied health professional to possess during the training period and, subsequently, in the working situation. From the lists submitted, those behavior categories were selected for use in the index which appeared most often on the lists and which were regarded as most essential. This knowledge of some of the significant personality characteristics of the prospective allied health professional would thus seem to be an important variable in assessing the needed qualities to complete successfully the program of studies and to function adequately in the profession (Psychological Services Bureau, 1995). Testing time is 30 minutes.

The PSB exam emphasizes both strength and speed. Since in the education for allied health careers, the student is expected to assimilate a very substantial body of knowledge in a rather limited length of time, speed or facility in absorbing and reacting is of importance (Mills,

1992). Excessive time limits therefore may be, under these circumstances, not only undesirable but adverse to the purpose of the testing.

The examinee is warned, in the test booklet and on the answer sheet, that they will probably not have sufficient time to complete all of the test items. Consequently, the morale and anxiety factors are minimized (Psychological Services Bureau, 1995). Total testing time for the PSB exam is two hours.

National Board for Respiratory Care's Certification Exam

On November 13, 1960 in Minneapolis, Minnesota, a dedicated group of professionals gathered to conduct the first meeting of the Board of Trustees of the American Registry of Inhalation Therapists (ARIT), the organization that is now the National Board for Respiratory Care (NBRC). The nine original members of the Board were appointed by three sponsoring organizations which included the American College of Chest Physicians, American Society of Anesthesiologists and American Association of Inhalation Therapists. Each of the sponsors contributed $ 500 donations to start the organization; then, the Board of Trustees began making plans that still provide the framework of the respiratory care credentialing system today (Bryant, 1990).

Since that initial meeting, over 30 years have passed, the respiratory care profession has grown, and the NBRC has issued more than 140,000 credentials. On July 1, 1974, the organization which began as the American Registry of Inhalation Therapists (ARIT) became the National Board for Respiratory Therapy (NBRT) and opened its first full-time business office in

Kansas City (Banning, 1995).

The ARIT gave its first written examination for respiratory therapists on April 1, 1961. Upon successfully passing the two part exam one became a Registered Respiratory Therapist. Expansion of the profession and professionalization of the ARIT began in 1969. Because the Registry Examination was very difficult, and because the few registered therapists were recognized as the most qualified of individuals practicing, the Board of Directors of the AAIT saw a need for an examination to measure the qualifications of other individuals practicing, below the level of the registered therapist. The AAIT proceeded to form the Technician Certification Board (TCB) and the first certification examination for respiratory therapy technicians was given in November, 1969. By 1974, the TCB has credentialed about 7,500 respiratory therapy technicians. The ARIT has credentialed more than 2,700 registered therapists (Bryant 1990).

Numerous conflicts had occurred between the ARIT and the newly formed Technician Certification Board (TCB) and confusion has abounded as to the meaning of the respective credentials. To resolve the difficulties, the ARIT and the AART formed a special joint committee comprised of experienced professional leaders. This special committee worked out an arrangement whereby the TCB would be dissolved and the Certification Examination for Respiratory Therapy Technicians transferred to the ARIT, which was renamed the National Board for Respiratory Therapy (NBRT). The American Thoracic Society was added as a sponsor, and the composition of the Board was fifty percent physicians and fifty percent respiratory therapists or technicians appointed by the AART (Banning, 1995).

The NBRT Board of Trustees recognized that the examinations must be based on job analysis research and supported by validity evidence. In 1982 they restructured the NBRT and

renamed the corporation the NBRC. The NBRC now owns a 44,000 square-foot facility in Lenexa, Kansas, that house both the credentialing board and its wholly owned subsidiary, Applied Measurement Professionals, Inc. (AMP), formed in 1982. AMP has evolved as a national testing agency, performing test development and administration activities for the NBRC as well as other clients (Banning, 1995). As a part of the test development, job analysis is crucial.

Job analysis can be defined as a systemic process of collecting data and making judgements about the nature of a specific job. Job analysis serves as the starting point for many human resource decisions specific to an organization. These include job design, job description, recruitment and selection, training and development, performance appraisal, and compensation. (Milkovich & Boudreau, 1991) Three basic categories of job information is collected for the typical job analysis. Categories include task data, behavioral data, and abilities data. Task data involves the development of task statements, whose objective is to identify and record a set of tasks that both includes all of the job's major tasks and excludes non relevant tasks. Behavioral data uses verbs describing the behaviors that occur on the job. Similarities and differences among jobs are often evaluated using factors such as information input, mental processes, work output, and relationships with other persons. Abilities data assess the knowledge or skill that a worker must possess for satisfactory job performance. Abilities may include psychomotor, physical, and cognitive. The conventional method of job analysis involves collection of job information involving an analyst using a questionnaire to interview job holders and supervisors. The approach requires involvement by both employees and supervisors which provides them with the opportunity to clarify their work expectations, and increases the

likelihood that they will accept the results. Quantitative job analysis uses job inventories as its core. An inventory is a structured questionnaire in which the task and behavior attributes relevant for the job to be analyzed are listed. Cost is a major consideration of this method since the characteristics tend to be extensive and require significant work by the analyst. Job analysis information is typically judged by a number of different standards. The most common are reliability and validity. Reliability is a measure of the consistency of the results obtained while validity is a measure of the results obtained (Milkovich, 1991). In conducting a national job analysis, the NBRC distributes a survey instrument containing a huge listing of possible job responsibilities. The idea is that this listing should include anything that might remotely be considered part of the entry level practitioner's job, or scope of practice. By the survey responses, the most important job duties are identified and become the basis for the entry level credentialing exam. The examination only reflects a small sample of the entire content domain of the entry level practitioner's job. The national job analysis survey instrument contained over 700 possible job duties and the survey responses indicate that most of these duties are clearly being performed. The examination which samples this content domain and attempts to separate the competent practitioners from others only includes 200 or so of the most important job responsibilities. The NBRC's survey demonstrated that 98% of the respondents indicated that the testing instrument adequately or completely covered the job of a Respiratory Care Practitioner. Respondents included employers, educators, medical directors, and practitioners themselves. The reliability of the ratings was over .99 (Bryant, 1990).

Validation studies typically are of two types, criterion-related and content validation. A third type of validation study, known as construct validation, involves components of reliability,

criterion-related validation, and content validation (Heneman, 1994). The process of criterion-related validation begins with job analysis. Results of the job analysis are then fed into criterion and predictor measures. Scores on the predictor and criterion are obtained for a sample of individuals and the relationship between the scores are then examined to make a judgement about the predictor's validity. Criterion measures represent performance measures while the predictor measure is the measure whose criterion-related validity is being investigated (Heneman, 1994). Content validation differs from criterion-related validity in one important respect: there is no criterion measure used in content validation. Therefore, predictor scores cannot be correlated with criterion scores as a way of gathering evidence about a predictor's validity. Instead, a judgement is made about the probable correlation, had there been a criterion measure (Heneman, 1994).

The job analysis research is the foundation for the legal defensibility of the examination. To comply with current measurement guidelines and governmental standards used by the courts, the job analysis must reflect what is actually being done in an occupation, not what may be done in the future, or what a segment of an occupation would like to see done. Thus, credentialing examination content, in any profession, not just respiratory care, should always follow actual job practice. Individuals will start performing new tasks, before these tasks are identified as important enough and widely performed enough to be included on a credentialing examination. The NBRC will perform a job analysis every five years (Traband, 1994). The NBRC's most recently completed analysis was in 1994 with resulting test matrix changes (Appendix A). The NBRC's current exam consists of 140 questions. Examinees are given a maximum of 3 hours to complete the test. The tests are given in March, July, and November. The average pass rate for

one year graduates varies between 65 to 72% for first time attempts (Ellis, 1989).

The examination has been validated on a criterion-related and content-related basis and is predictive of job performance. Validation of the examination was accomplished in accordance with standards put forth by the American Psychological Association and in compliance with the Uniform Guidelines on Employee Selection Procedures (NBRC, 1994).

Rationale and Purpose

This study was designed to identify the relationship of the Psychological Services Bureau (PSB) Health Occupations Aptitude Examination as used for an entry exam for nontraditional respiratory care students, to the predictability of students academic success (as measured by the National Board for Respiratory Care certification exam).

By successfully identifying those candidates who are likely to succeed the hospital will be able to have a successfully practicing Respiratory Care Practitioner (RCP) employed by the Respiratory Care Department once the student graduates and successfully passes the certification exam. The cost of placing a student in a nontraditional hospital based program approaches $20,000.00 per year per student. If a student fails to continue in the program due to poor academic performance the graduating class size decreases and the cost per student increases.

Nontraditional students enrolled in a hospital based respiratory care program are able to obtain their education in respiratory care without relocating or leaving their jobs. The need for determining an applicant's potential for success in the nontraditional program needs to be addressed. Hendrick Medical Center's nontraditional respiratory care program requires all applicants to sit for the Health Occupations Aptitude Examination which is constructed and

distributed by the Psychological Services Bureau. The aptitude exam covers five primary areas; 1) academic aptitude 2) spelling 3) reading 4) natural sciences and 5) vocational adjustment. Total testing time for the exam is two hours. Once the applicant is selected and satisfactorily completes the twelve month program they become eligible to take the National Board for Respiratory Care's certification entry level exam. The exam is administered by the National Board for Respiratory Care. Upon successfully passing the National Board's exam with a score of seventy-five percent or greater they achieve the credentials of a Certified Respiratory Therapy Technician (CRTT).

The National Board for Respiratory Care's exam consists of 140 questions and attempts to separate the competent practitioners from others. A national job analysis is conducted every five years by the National Board for Respiratory Care in order to identify the most important job duties which become the basis for the exam. The National Board for Respiratory Care assumes the validity and reliability of the exam. Every effort is made to assure that the job analysis reflects what is actually being done by the entry level respiratory care practitioner. The average pass rate for graduates varies between 65 to 72% for first time attempts.

Hypothesis

It is expected that of the 5 sections of the PSB exam, that the academic aptitude section will have the greatest correlation with academic success as measured by the NBRC certification exam.

Method

Subjects

The study sample was composed of 100 graduates from a nontraditional respiratory care program administered as an outreach program of Southwest Texas State University operated at Hendrick Medical Center in Abilene, Texas. There were 22 males and 77 females included in the study. The students were enrolled in the 12 month program between 1985 and 1995. The ethnic background consisted of 94 Caucasian students, 3 Black students, and 2 Hispanic students. The age ranged from 18 to 44 years with a mean age of 27.08 years. Educational background varied from no college hours to 167 college hours. The number of years that had passed since the students last attended formal education ranged from 0 years to 18 years.

No graduate was notified or asked for their participation in this study. All data was collected from the files which are available to the school administrators for research purposes.

Measures

Data was collected from student files. This data included gender, race, age, educational background, scores from the PSB exam which was used as an entrance exam, and information about postgraduate performance on the NBRC credentialing exam. Data from the PSB exam included scores from the five sections, 1) academic aptitude; 2) spelling; 3) reading

comprehension; 4) information in the natural sciences; and 5) vocational adjustment. The student's right to privacy was protected by reporting data anonymously on report forms that were then coded for data entry.

Students' were coded 1 through 99. Gender was coded 1= female and 2 = male. Ethnic origin was reflected as B = Black, C = Caucasian, and H = Hispanic. Age was numerically expressed in years. Educational background was expressed in years of total school completed. PSB scores were numerically expressed for each of the five sections.

Instruments

PSB Health Occupations Aptitude Examination.

The selection process for acceptance into the respiratory care program required all applicants to sit for the Health Occupations Aptitude Examination. This standardized examination is constructed and distributed by the Psychological Services Bureau. The examination is a specialized aptitude exam consisting of a battery of tests that attempt to determine each individual's ability on the covered areas. Items on the exam cover five primary areas, 1) academic aptitude (verbal, nonverbal, and numerical; 2) spelling; 3) reading comprehension; 4) information in the natural sciences; and 5) vocational adjustment (See appendix C). The exam is administered by a school administrator and collected and mailed to Psychological Services Bureau for grading. Grades are returned to the school administration.

The academic aptitude area consists of three subparts. The verbal part consist of 30 vocabulary-related items. The nonverbal part consists of 30 items calling for comprehension of

spacial relationships. The numerical part consists of 30 items drawing largely from arithmetic. Total time allowed for completion of the academic aptitude area of the examination is 30 minutes. Scores ranges for the academic aptitude area range from 0 to 100%.

The spelling area of the examination helps determine one's ability to spell words relevant to the allied health occupations. The area consists of 60 selected sets of three words each. Each set includes two distractors. The spelling test measures how well the examinee can recognize the correct spelling of specified words. Total time allowed for completion of the spelling area of the examination is 15 minutes. Score ranges for the spelling area range from 0 to 100%.

The reading comprehension area of the examination measures one's ability to understand direct statements, to interpret passages, to see intent of authors, to observe organization of ideas, and to extract information from passages with respect to ideas and purposes. The area consists of three passages which the examinee reads and responds to forty questions covering the three passages. Total time allowed for completion of the reading comprehension area is 15 minutes. Score ranges for the reading comprehension area range from 0 to 100%.

The natural sciences area of the examination measures the individual's knowledge in biology, microbiology, chemistry, physics, pharmacology, anatomy, physiology, and health and safety. There are 90 questions within this section, each with one correct answer and 4 distractors. Total time allowed for completion of the natural sciences area is 30 minutes. Score ranges for the natural sciences area range from 0 to 100%.

The vocational adjustment area is expected to demonstrate how an individual's characteristic life style is reflected in their personal, educational, and occupational adjustment. The vocational adjustment index consists of 105 statements with which one either agrees or

disagrees. Total time allowed for completion of the vocational adjustment area is 30 minutes. Score ranges for the vocational adjustment index range from 0 to 100%.

NBRC.

The National Board for Respiratory Care's certification exam is taken once the student successfully graduates from the respiratory care program. The exam consist of 140 multiple-choice questions (see appendix B). Total time allotted for the test is 3 hours. The test is administered by proctors trained by the NBRC. The test is given in March, July, and November of each year at various locations throughout the United States. Exam content is based upon a job analysis conducted every 5 years. Content is related to the respiratory care practitioner's expected job duties. The test specifications for the examination are based on the results of a national job analysis study which delineated the knowledge, skills, and abilities required of respiratory therapy practitioners at beginning practice. The examination content areas include clinical data, equipment and therapeutic procedures . Test scores are reported as raw scores and scaled scores. A raw score is the number of correctly answered questions. A scaled score is statistically derived from the raw score. The total reported scaled score is used to determine whether the examinee passes or fails, and is reported as a scaled score ranging from between 1 and 99. The minimum scaled score needed to pass the CRTT examination has been set by the NBRC at 75 scaled units.

The NBRC reports scaled scores due to the different versions of the test which may vary in difficulty. As new versions of the test are introduced each year, a certain number of questions in each content area are replaced with new questions,. These changes have the potential to cause

one version of the test to be more difficult than another version. To adjust for these differences in difficulty, a procedure called "equating" is used. The goal of equating is to ensure fairness to all candidates. In the equating process, the minimum raw score required to equal the passing score of 75, is statistically adjusted or equated. Results of the test are received by school administrators and included in each student's file.

The NBRC is a member of the National Organization for Competency Assurance and its examination programs are accredited by the National Commission for Certifying Agencies (NCCA). Accreditation by the NCCA is a recognition signifying unconditional compliance with stringent testing and measurement standards among national health testing organizations. Applied Measurement Professional, Inc. is the wholly-owned subsidiary of the NBRC engaged in the test development and test administration.

Procedure

All data was collected from student files located at Hendrick Medical Center. Each student's file contained the original admissions application form, high school transcript, college transcripts, reference letters, PSB scores, and NBRC score.

All research and data collection was performed by the researcher. A report form was created which allowed the information to be recorded and coded for data entry thereby protecting the students' right to privacy. Student files remained in the custody of the school at all times. A total of 99 files were searched dating from 1985 to 1995. No file was incomplete.

Data Analysis

Each student's PSB scores, consisting of a score representing each of the five areas of the PSB, along with academic achievement scores, as represented by the post graduation score of the NBRC's certification exam, was used to formulate correlations. Each of the 5 sections of the PSB were correlated and regressed to academic success as defined by the NBRC certification exam score.

Results

The sample consisted of 22 males and 77 females. No significant differences were detected for NBRC ($t = 1.17$; $p = 0.25$), years of education ($t = 0.58$, $p = 0.57$), age ($t = 0.88$, $p = 0.43$), academic aptitude ($t = 1.20$, $p = 0.24$), spelling capabilities ($t = 0.49$, $p = 0.63$), reading comprehension ($t = 0.15$, $p = 0.88$), natural science ($t = 0.53$, $p = 0.60$), and vocational adjustment ($t = 1.72$, $p = 0.09$). Thus, for predictive models, males and females were combined. The description of these samples is displayed in Table 1.

Correlation analyses (Pearson's Product Moment) displayed in Table 2, revealed the following:

1) NBRC was not significantly correlated with a subject's years of education ($r = 0.019$, $p = 0.85$), nor vocational adjustment ($r = 0.164$, $p = 0.11$).

2) NBRC was mildly correlated with a subject's age ($r = 0.175$, $p = 0.08$).

3) NBRC was significantly associated with the score a subject achieved on academic aptitude ($r = 0.383$, $p < 0.01$), spelling ($r = 0.327$, $p < 0.01$); reading comprehension ($r = 0.302$, $p < 0.01$), and natural science ($r = 0.387$, $p < 0.01$).

TABLE 1

Descriptive Statistics Summary

	NBRC	Ed level (years)	Age	Academic Aptitude	Spelling	Reading Comp	Natural Science	Vocational Adjustment
MALE	Mean 85	13.36	27.8	50.1	45.2	15.3	57.8	95.3
	SD 5.11	1.89	5.92	14.15	8.57	4.70	12	6.02
	Max 95	16	41	88	56	26	78	100
	Min 76	9	19	27	28	10	40	75
FEMALE	Mean 83.5	13.1	26.6	46.1	44.2	15.4	56.3	92.4
	SD 5.89	1.22	6.55	12.13	7.65	5.08	9.12	10.08
	Max 94	16	44	76	57	28	77	100
	Min 69	11	18	22	26	6	30	32
TOTAL	Mean 83.9	13.1	26.9	47	44.4	15.40	56.7	93.0
	SD 5.74	1.39	6.4	12.64	7.83	4.98	9.79	9.39
	Max 95	16	44	88	57	28	78	100
	Min 69	9	18	22	26	6	30	32

TABLE 2

Correlation Coefficient Summary for NBRC Test Score with Predictive Variables

	Ed level (years)	Age (years)	Academic Aptitude	Spelling	Reading Comp	Natural Science	Vocational Adjustment
r	0.019	0.175	0.383	0.327	0.302	0.387	0.164
p	0.850	0.082	0.005	0.001	.002	0.005	0.105

Based on the magnitude of the above correlation coefficients, it was summarized that both academic aptitude and natural science scores best predicted a subjects score on the NBRC. Spelling and reading scores were both significantly correlated, however to a less magnitude. To assess the relative importance of the variables, stepwise regression was performed using linear regression for the five subsections of testing. The following model was obtained:

$$\text{NBRC} = 60.6 + 0.0703\ (\text{Academic Aptitude}) + 0.0644(\text{Spelling}) + 0.088(\text{Reading Comp}) + 0.150(\text{Natural Science}) + 0.0782(\text{Vocational Adjustment})$$

In the model only the Natural Science test scores were significant ($t = 2.29$, $p = 0.024$) with a regression coefficient ($r = 0.150$) twice the magnitude of the remaining scores. These results are displayed in Table 3.

TABLE 3

Linear Regression Summary For the Prediction of NBRC Scores by PSB Subsection Scores

Predictor	Coefficient	Standard Deviation	t-Ratio	p-value
Constant	60.554	6.523	9.28	< 0.001
Academic	0.070	0.056	1.26	0.210
Spelling	0.064	0.083	0.77	0.442
Reading	0.088	0.128	0.69	0.490
Natural Science	0.150	0.066	2.29	0.024
Vocational Adj.	0.078	0.059	1.33	0.188

[s = 5.164 R2 = 23.1% R2(adj) = 19.0%]

Analysis of Variance Summary

SOURCE	DF	SS	MS	F ratio	p-value
Regression	5	746.71	149.34	5.60	< 0.001
Error	93	2479.84	26.66		
Total	98	3226.55			

Using forward stepwise linear regression with significant improvement in R^2 to be entered, the following model was derived:

NBRC= 69.18 + 0.16(Natural Science) + 0.12(Academic Aptitude)

The R^2 for this model was 20.67. When entering all variables under the same stepwise

constraints a similar model was obtained. This model was as follows:

NBRC = 73.62 + 0.168(Natural Science) + 0.121(Academic Aptitude) - 0.183(Age)

The R^2 for this model was 24.80.

Entered alone Natural Science scores produced the model:

NBRC = 71.02 + 0.227(Natural Sciences)

The R^2 for this model was 14.97.

Discussion

The purpose of this research was to investigate whether, in a nontraditional Respiratory Care Program, there was any relationship between sections of the PSB entrance exam and a student's academic success as measured by the National Board for Respiratory Care Certification exam. It was expected that of the 5 sections of the PSB exam, the academic aptitude section would have the greatest correlation with academic success as measured by the NBRC Certification exam.

Test results were taken for both the PSB exam and NBRC exam from 100 graduates of Hendrick Medical Center's nontraditional respiratory care program. Test data was then analyzed using Pearson Product Moment correlation. The most significant correlation found was between

the Natural Science portion of the PSB exam (r = .150, T = 2.29, p = .024) which predicted almost 15% of the variation in the NBRC scores. The importance of the PSB Natural Science scores was substantiated through stepwise regression as this score was loaded first.

The PSB Academic Aptitude subsection appeared the second strongest predictor (r = .070, t = 1.26, p = .210) of the NBRC success explaining 5.7% of the NBRC scores.

The addition of age allowed for the explanation of another 4.1% variation in NBRC scores.

Results of other subsections of the PSB exam included Spelling which appeared as the third strongest predictor (r = .064, t = .77, p = .442) while Reading Comprehension appeared as the fourth strongest predictor (r = .088, t = .69, p = .490). The Vocational Adjustment subsection of the PSB exam appeared as the subsection least likely to predict (r = .078, t = 1.33, p = .188) NBRC success.

Implications of the Findings

This study demonstrates that the PSB exam is a useful tool in the evaluation of applicants to a nontraditional hospital based Respiratory Care program. The greatest predictor subsection of the PSB exam were scores from the Natural Science section followed by the scores from the Academic Aptitude section in judging the potential for an applicant's success in the program as measured by the NBRC scores. As a result of these findings Hendrick Medical Center will use the Natural Science section of the PSB exam with greater significance than other sections of the

exam. This particular section will be used as a selection tool for applicants applying to the Respiratory Care program.

Limitations of the Study

When evaluating the results of this study one should be aware of the limitations of the study. The first group of students graduating from Hendrick's Respiratory Care Program did not take the PSB entrance exam and therefore could not be included in the study. The first graduating class consisted of 9 students. All of the results were obtained only from Hendrick's Respiratory Care Program. Finally, the sample size of this study, consisting of 100 graduates, should be considered low.

Suggestions for Further Research

Based on the limitations of this study, further research can be recommenced to corroborate the results. Ideally, several hospitals which operate nontraditional respiratory care programs could be included in the study thereby providing data from a more diversified sample as well as providing a larger sample size.

Conclusions

In summary this study suggest that the score a student achieves on the Natural Science portion of the PSB exam best predicts academic success as measured by the NBRC exam score. Students' Natural Science scores explained almost 15% of the variation in NBRC scores. The importance of the PSB Natural Science scores was substantiated through stepwise regression as this score was loaded first. Academic Aptitude appeared the second strongest predictor of NBRC scores explaining 5.7% of the NBRC variation. The addition of age allowed for the explanation of another 4.1% variation in NBRC scores.

Hendrick Medical Center is like other participants involved in the nation's healthcare system. Hendrick continually strives to reduce costs and improve productivity in order to remain a viable, competitive healthcare provider. The results of this study suggest that the nontraditional respiratory care program operated by Hendrick Medical Center can better identify applicants who are likely to succeed with their education, graduate and pass the NBRC Certification exam. This will be accomplished by analyzing all applicant's PSB results.

Any method to better identify an applicant's likelihood to succeed in the educational process helps Hendrick Medical Center to operate a more cost effective program while meeting their respiratory care manpower needs.

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APPENDIX A

Certification Examination For Entry Level Respiratory Therapy Practitioners (CRTT) Examination Matrix

Content Area	Complexity Level			
	Recall	Application	Analysis	Number of Items
I. Clinical Data				35
A. Review patient records; recommend diagnostic procedures	2	4	0	6
B. Collect and evaluate clinical information	3	7	2	12
C. Perform procedures and interpret results	3	7	2	12
D. Assess therapeutic plan	1	1	3	5
II. Equipment				35
A. Select, obtain, and assure cleanliness	5	7	0	12
B. Assemble, check, and correct malfunctions	9	14	0	23
III. Therapeutic Procedures				70
A. Educate patients; maintain records and communication; and infection control	2	5	1	8
B. Maintain airway; mobilize and remove secretions	3	5	0	8
C. Assure ventilation	2	6	2	10
D. Assure oxygenation	3	5	0	8
E. Assess patient response	2	6	2	10
F. Modify therapy/make recommendations based on patient's response	4	4	13	21
G. Emergency resuscitation	1	3	1	5
Totals	40	74	26	140

NBRC Entry Level CRTT Examination Content Outline

I. Select, Review, Obtain, and Interpret Data

SETTING: In any patient care setting, the respiratory care practitioner reviews existing clinical data and collects or recommends obtaining additional pertinent clinical data. The practitioner interprets all data to determine the appropriateness of the prescribed respiratory care plan, and participates in the development of the respiratory care plan.

	RECALL	APPLICATION	ANALYSIS
A. Review existing data in patient record, and recommend diagnostic procedures based on all available patient information.	*2	4	0
1. Review existing data in patient record, namely:			
a. patient history, physical examination, and current vital signs		x**	x
b. admission and current respiratory care orders		x	x
c. patient progress notes		x	x
d. pulmonary function values and blood gas results			x
e. results of chest x-rays			x
f. results of respiratory monitoring:			
(1) respiratory rate, tidal volume, minute volume, I:E ratio, maximum inspiratory and expiratory pressure, vital capacity			x
(2) pulse oximetry			x
(3) lung compliance, airway resistance			x
g. results of cardiovascular monitoring – blood pressure, heart rate			x
2. Recommend procedures to obtain additional data, namely:			
a. chest x-ray			x
b. blood gas analysis			x
c. spirometry before and/or after bronchodilator			x
d. pulse oximetry			x

	RECALL	APPLICATION	ANALYSIS
B. Collect and evaluate additional pertinent clinical information.	3	7	2
1. Assess patient's overall cardiopulmonary status by inspection to determine:			
a. general appearance			x
b. peripheral edema			x
c. diaphoresis			x
d. digital clubbing			x
e. cyanosis			x
f. chest configuration			x
g. evidence of diaphragmatic movement			x
h. breathing pattern			x
i. accessory muscle activity			x
j. asymmetrical chest movement			x
k. intercostal and/or sternal retractions			x
l. nasal flaring			x
m. character of cough			x
n. amount and character of sputum			x
2. Assess patient's overall cardiopulmonary status by palpation to determine:			
a. heart rate, rhythm, force			x
b. asymmetrical chest movements			
c. secretions in the airway			x
d. endotracheal tube placement			
e. crepitus			x
3. Assess patient's overall cardiopulmonary status by auscultation to determine:			
a. bilateral, normal breath sounds			x
b. increased, decreased, absent, or unequal breath sounds			x
c. rhonchi or râles (crackles)			x
d. wheeze			x
e. stridor			x
f. blood pressure			x
4. Interview patient to determine:			
a. level of consciousness			
b. orientation to time, place, and person			x
c. emotional state			
d. ability to cooperate			x
e. presence of dyspnea and/or orthopnea			x
f. sputum production			x
g. work of breathing			

*The number in each column is the number of items in that content area and cognitive level contained in each examination. For example, in category I.A., 2 questions will be asked at the recall level, 4 questions at the application level, and none at the analysis level. The questions could be asked relative to any tasks listed (1-2) under category I.A.

** Note: An "x" denotes the examination does not contain items for the given task at the cognitive level indicated in the respective column (Recall, Application, Analysis).

	RECALL	APPLICATION	ANALYSIS
5. Inspect chest x-ray to determine position of endotracheal or tracheostomy tube.			x
C. Perform procedures and interpret results.	3	7	2
1. Perform and/or interpret results of bedside procedures to determine:			
a. pulse oximetry			x
b. tidal volume			x
c. minute volume			x
d. I:E ratio			x
e. maximum inspiratory pressure (MIP)			x
f. peak flow			x
g. forced vital capacity			x
h. timed forced expiratory volumes (FEV_1, etc.)			x
i. tracheal tube cuff pressure			x
j. lung mechanics (intubated patient)			
k. alveolar ventilation			x
l. blood gas analysis			
m. maximum expiratory pressure			x
2. Perform and interpret results of the following:			
a. pulse oximetry			x
b. spirometry before and/or after bronchodilator			x
c. blood gas analysis			x
3. Interpret co-oximetry results.			x
D. Determine the appropriateness of the prescribed respiratory care plan, recommend modifications where indicated, and participate in the development of the respiratory care plan.	1	1	3
1. Review planned therapy to establish therapeutic goals.			
2. Determine appropriateness of prescribed therapy and goals for identified pathophysiological state.			
3. Recommend changes in therapeutic plan (based on data) if indicated.			
4. Participate in development of respiratory care plan.			x

	RECALL	APPLICATION	ANALYSIS
II. Select, Assemble, and Check Equipment for Proper Function, Operation, and Cleanliness			
SETTING: In any patient care setting, the respiratory care practitioner selects, assembles, and assures cleanliness of all equipment used in providing respiratory care. The practitioner checks all equipment and corrects malfunctions.			
A. Select and obtain equipment, and assure cleanliness of equipment appropriate to the respiratory care plan.	5	7	0
1. Oxygen administration devices:			
a. nasal cannula, mask, reservoir mask (partial rebreathing, nonrebreathing) and face tents			x
b. tracheostomy collar and T-piece			x
c. air entrainment devices			x
d. CPAP devices (mask and nasal)			x
e. oxygen hoods and tents			x
2. Humidifiers:			
a. bubble, passover, cascade, wick			x
b. heat moisture exchangers			x
3. Aerosol generators:			
a. pneumatic nebulizers			x
b. ultrasonic nebulizers			x
4. Ventilators:			
a. pneumatic			x
b. electric			x
c. microprocessor			x
5. Artificial airways:			
a. oro- and nasopharyngeal airways			x
b. oral and nasal endotracheal tubes			x
c. tracheostomy tubes and buttons			x
d. intubation equipment – laryngoscope and blades			x
6. Suctioning devices:			
a. suction catheters			x
b. specimen collectors			x
c. oropharyngeal suction devices			x
7. Gas delivery, metering, and clinical analyzing devices:			
a. regulators, reducing valves, connectors, and flowmeters			x
b. air compressors			x
c. air/oxygen blenders			x

	RECALL	APPLICATION	ANALYSIS
d. gas cylinders, bulk systems, and manifolds			x
e. oxygen analyzers			x
f. blood gas analyzers and sampling devices			x
g. pulse oximeters			x
8. Manometers and gauges:			
a. manometers – water, mercury, and aneroid			x
b. inspiratory/expiratory pressure meters			x
c. cuff pressure manometers (ET/trach)			x
9. Resuscitation devices:			
a. manual resuscitators (bag-valve)			x
b. mouth-to-valve mask resuscitators			x
10. Incentive breathing devices			x
11. Patient breathing circuits:			
a. IPPB			x
b. continuous mechanical ventilation			x
c. CPAP			x
d. PEEP valve assembly			x
12. Percussors and vibrators			x
13. Environmental devices – aerosol (mist) tents			x
14. Metered dose inhalers (MDI) and spacers			x
15. Assure selected equipment cleanliness:			
a. select or determine appropriate agent and technique for disinfection and/or sterilization			x
b. perform procedures for disinfection and/or sterilization			x
c. monitor effectiveness of sterilization procedures		x	x
B. Assemble, check for proper function, identify malfunctions of equipment, and take action to correct malfunctions of equipment.	9	14	0
1. Oxygen administration devices:			
a. nasal cannula, mask, reservoir mask (partial rebreathing, nonrebreathing) and face tents			x
b. tracheostomy collar and T-piece			x
c. air entrainment devices			x
d. oxygen hoods and tents			x
e. CPAP devices (mask and nasal)			x
2. Humidifiers:			
a. bubble, passover, cascade, wick			x
b. heat moisture exchangers			x
3. Aerosol generators:			
a. pneumatic nebulizers			x
b. ultrasonic nebulizers			x
4. Resuscitation devices:			
a. manual resuscitators (bag-valve)			x
b. mouth-to-valve mask resuscitators			x
5. Ventilators:			
a. pneumatic			x
b. electric			x
c. microprocessor			x
6. Artificial airways:			
a. oro- and nasopharyngeal airways			x
b. oral and nasal endotracheal tubes			x
c. tracheostomy tubes and buttons			x
d. intubation equipment – laryngoscope and blades			x
7. Gas delivery, metering, and clinical analyzing devices:			
a. regulators, reducing valves, connectors, and flowmeters			x
b. air/oxygen blenders			x
c. gas cylinders, bulk systems, and manifolds			x
d. oxygen analyzers			x
e. air compressors			x
f. blood gas analyzers and sampling devices (excluding correction of malfunction)			x
g. pulse oximeters			x
8. Suctioning devices:			
a. suction catheters			x
b. specimen collectors			x
c. oropharyngeal suction devices			x
9. Patient breathing circuits:			
a. IPPB			x
b. continuous mechanical ventilation			x
c. CPAP			x
d. PEEP valve assembly			x
10. Incentive breathing devices			x
11. Environmental devices – aerosol (mist) tents			x
12. Percussors and vibrators			x
13. Metered dose inhalers (MDI) and spacers			x
14. Manometers and gauges:			
a. manometers – water, mercury, and aneroid (excluding correction of malfunction)			x
b. inspiratory/expiratory pressure meters			x
c. cuff pressure manometers (ET/trach)		x	x

III. Initiate, Conduct, and Modify Prescribed Therapeutic Procedures

SETTING: In any patient care setting, the respiratory care practitioner maintains patient records and communicates relevant information to members of the healthcare team, initiates, conducts, and modifies prescribed therapeutic procedures to achieve the desired objectives.

	RECALL	APPLICATION	ANALYSIS
A. Explain planned therapy and goals to patient; maintain records and communication; and protect patient from nosocomial infection.	2	5	1
1. Explain planned therapy and goals to patient in understandable terms to achieve optimal therapeutic outcome.			x
2. Maintain records and communication, namely:			
a. specify therapy administered, date, time, frequency of therapy, medication, and ventilatory data			x
b. note and interpret patient's response to therapy:			
(1) vital signs (heart rate and rhythm, respiratory rate, blood pressure)			x
(2) auscultatory findings			x
(3) cough and sputum production and characteristics			x
(4) adverse reactions			
(5) subjective and attitudinal response to therapy			x
c. verify computations and erroneous data			
d. communicate information regarding patient's clinical status to appropriate members of the healthcare team			x
e. communicate information relevant to coordinating patient care (e.g., scheduling, avoiding conflicts, sequencing of therapies)			x
3. Protect patient from nosocomial infection by adherence to infection control policies and procedures (universal precautions, blood and body fluid precautions, etc.).			x

	RECALL	APPLICATION	ANALYSIS
B. Conduct therapeutic procedures to achieve maintenance of a patent airway, including the care of artificial airways; and to achieve removal of bronchopulmonary secretions.	3	5	0
1. Achieve maintenance of a patent airway:			
a. position patient properly			x
b. maintain adequate humidification			x
c. insert oro- and nasopharyngeal airways			x
d. maintain proper cuff inflation and position of endotracheal or tracheostomy tube			x
2. Achieve removal of bronchopulmonary secretions:			
a. instruct and encourage proper coughing techniques			x
b. perform postural drainage			x
c. perform percussion and/or vibration			x
d. suction endotracheal and tracheostomy tubes			x
e. perform nasotracheal or orotracheal suctioning			x
f. administer aerosol therapy			x
g. administer prescribed agents (bronchodilators, saline, mucolytics, etc.)			x
C. Conduct therapeutic procedures to achieve adequate spontaneous and artificial ventilation.	2	6	2
1. Instruct in proper breathing techniques.			x
2. Encourage deep breathing.			x
3. Instruct and monitor techniques of incentive spirometry.			x
4. Administer prescribed bronchodilators.			x
5. Initiate and adjust IPPB therapy:			
a. adjust sensitivity, flow, volume, and/or pressure			x
b. adjust F_IO_2			x
c. change patient – machine interface (mouthpiece, mask, etc.)			x
6. Select appropriate ventilator.			
7. Select appropriate tidal volume, rate, and/or minute ventilation for mechanical ventilation.			
8. Institute and modify weaning procedures.			
9. Initiate and adjust continuous mechanical ventilation when settings are specified.			x
10. Initiate and adjust IMV, SIMV, pressure support ventilation (PSV).			

	RECALL	APPLICATION	ANALYSIS
D. Conduct therapeutic procedures to achieve adequate arterial and tissue oxygenation.	3	5	0
1. Position patient to minimize hypoxemia.			x
2. Administer oxygen (on or off ventilator).			x
3. Prevent procedure-associated hypoxemia (e.g., oxygenate before and after suctioning and equipment changes, etc.).			x
4. Initiate and adjust CPAP.			x
5. Initiate and adjust PEEP therapy.			x
E. Evaluate and monitor patient's response to respiratory care.	2	6	2
1. Measure and record vital signs.			x
2. Monitor cardiac rhythm.			x
3. Perform pulse oximetry.			x
4. Auscultate chest and record changes.			x
5. Observe changes in sputum production and consistency.			x
6. Note patient's subjective response to therapy.			x
7. Measure F_IO_2 and/or liter flow.			x
8. Perform spirometry/determine vital capacity.			x
9. Perform arterial puncture.			x
10. Interpret results of arterial blood gas analysis.			
11. Adjust and check alarm systems.			
12. Note patient's response to mechanical ventilation.			
13. Measure tidal volume, respiratory rate, airway pressures, I:E ratio, and maximum inspiratory pressure.			x
14. Monitor endotracheal or tracheostomy tube cuff pressure.			x
F. Make necessary modifications in therapeutic procedures, and recommend respiratory care plan modifications based on patient response.	4	4	13
1. Terminate treatment based on patient's adverse reaction to therapy being administered.			
2. Modify bronchial hygiene:			
a. alter duration of treatment			x
b. alter equipment used			x
c. alter techniques			x
d. coordinate sequence of therapies			x
e. alter position of patient			x
3. Modify management of artificial airways:			
a. change type of humidification equipment			x
b. initiate suctioning			
c. inflate and deflate the cuff			
d. alter endotracheal or tracheostomy tube position			
4. Modify incentive breathing devices:			
a. change type of equipment			x
b. increase or decrease incentive goals			x
5. Modify aerosol therapy:			
a. change type of equipment			x
b. change dilution of medication			x
c. adjust temperature of the aerosol			x
d. modify patient breathing patterns			x
e. change aerosol output			x
6. Modify oxygen therapy:			
a. change mode of administration			x
b. adjust flow			x
c. adjust F_IO_2			x
d. set up or change an O_2 blender			x
7. Modify suctioning:			
a. change size and type of catheter			x
b. alter negative pressure			x
c. instill irrigating solutions			x
d. alter frequency of suctioning			x
e. alter duration of suctioning			x
8. Modify mechanical ventilation:			
a. adjust ventilator settings (tidal volume, F_IO_2, etc.)			
b. change patient breathing circuitry			x
c. adjust alarm settings			
d. change mechanical dead space			x
e. change inspiratory plateau			
f. change PEEP level			
g. change CPAP level			
h. change weaning procedures			
i. change type of ventilator			
j. change pressure support level			
9. Recommend modifications in the respiratory care plan based on the patient's response:			
a. recommend discontinuation of any treatment based on the patient's response			
b. recommend change in duration of therapy			

	RECALL	APPLICATION	ANALYSIS
c. recommend changes in aerosol drug dosage or concentration			
d. recommend use of pharmacologic agents: bronchodilators, corticosteroids, cromolyn sodium			
e. recommend adjustment of inspiratory effort (sensitivity)			
f. recommend initiation of the following:			
(1) PEEP			
(2) CPAP			
(3) IMV			
(4) weaning			
(5) bronchopulmonary drainage procedures			
g. recommend change in oxygen:			
(1) F_IO_2			
(2) oxygen flow			
h. recommend change in position			
i. recommend change in weaning procedures			
j. recommend change in IMV rate			
k. recommend change of tidal volume			
l. recommend change of respiratory rate			
m. recommend change in CPAP level			
n. recommend change in PEEP level			
o. recommend change in inspiratory flow			
p. recommend change in flow pattern			
q. recommend change in pressure limit			
r. recommend change in ventilatory mode			
s. recommend change in I:E ratio			

	RECALL	APPLICATION	ANALYSIS
G. Initiate, conduct, or modify respiratory care techniques in an emergency setting.	1	3	1
1. Recognize the need for emergency resuscitation.			
2. Call for help.			x
3. Establish patent airway.			x
4. Use mouth-to-mouth, bag-mask ventilation, and/or mouth-to-valve mask ventilation.			x
5. Perform external cardiac compression.			x
6. Check pulse.			x
7. Provide supplemental oxygen.			x
8. Observe chest excursion.			x
9. Recommend obtaining arterial blood gas sample.			

TEST DIRECTIONS

The following directions are taken from the test booklet for the Certification Examination for Entry Level Respiratory Therapy Practitioners. You will read these directions again before you begin the actual test, but it cannot be overemphasized that all directions must be followed exactly during the examination.

Certification Examination for
Entry Level Respiratory Therapy Practitioners

THE NATIONAL BOARD FOR RESPIRATORY CARE

Please note that the term "torr" is used to indicate units of pressure in this examination. Torr is defined as "a unit of pressure equivalent to 1 millimeter of mercury under standard conditions."

General Instructions

1. You will be given 3 hours to work on this test, which consists of 140 questions.
2. Your score is based on the number of questions you answer correctly. You are advised to use your time effectively and mark the best answer you can to every question, even if you are not sure of the answer you mark. However, do not spend too much time on questions that are too difficult for you. Go on to other questions and come back to the difficult ones later, if you can. In the final analysis, it is better to guess than to leave a question unanswered.
3. You may make any preliminary notes or calculations you wish in the test book.
4. YOU ARE TO INDICATE YOUR ANSWERS TO ALL QUESTIONS ON THE SEPARATE ANSWER SHEET ENCLOSED. **No credit will be given for anything written in this examination book.**

   The answer spaces are lettered to correspond with the letters of the suggested answers to the questions in this book. After you have decided which of the suggested answers is correct, blacken the corresponding space on the answer sheet. Give only one answer to each question. If you change an answer, be sure that the previous mark is erased completely. USE ONLY #2 PENCILS (SOFT LEAD) AND BE SURE THAT EACH MARK IS BLACK AND COMPLETELY FILLS THE ANSWER SPACE.

   Example:

   Which of the following is the capital of the United States?

   A. New York, NY
   B. Washington, DC
   C. Chicago, IL
   D. Los Angeles, CA

   Sample Answer:

   

5. It is VERY IMPORTANT that you carefully complete Sections A through G on Side 1 of your answer sheet. Sections B through G require you to first WRITE the requested information, then blacken the space in the column below each corresponding number or letter. Please note that the form number (Section F) is a six-digit number which appears on the top right-hand corner of the front cover of your test book.
6. You are invited to comment on the content of any examination question. To do so, blacken the item number of any question for which you have a concern in the area labeled **ITEMS** in the left-hand column of Side 2 on the answer sheet. Also, you should write your specific concern about the question in one of the large boxes on Side 2 of the answer sheet, using one box for each item.

Total time – 3 hours

DO NOT BREAK THE SEAL UNTIL YOU ARE TOLD TO DO SO.

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case, and blacken the corresponding space on the answer sheet.

1. The respiratory care practitioner is monitoring a patient with myasthenia gravis and finds that the maximum inspiratory pressure (MIP) has changed from −35 cm H_2O 4 hours ago to −10 cm H_2O. Based on this change, the practitioner should recommend which of the following?

   A. measuring maximum voluntary ventilation (MVV)
   B. administering oxygen via partial rebreathing mask
   C. administering oxygen via nasal cannula at 5 L/min
   D. obtaining an arterial blood gas analysis

2. Activity of the respiratory accessory muscles is most indicative of

   A. normal ventilation.
   B. increased pulmonary compliance.
   C. increased airway resistance.
   D. decreased work of breathing.

3. Expiratory grunting in a 32-week gestational age newborn who is in respiratory distress will do which of the following?

   A. Decrease apneic episodes.
   B. Prevent atelectasis.
   C. Increase the $PaCO_2$.
   D. Increase the blood flow to the vena cava.

4. If a patient has a tidal volume of 450 ml and her respiratory frequency is 15/min, what is the minute ventilation?

   A. 5.75 L/min
   B. 6.75 L/min
   C. 7.75 L/min
   D. 8.25 L/min

5. The respiratory care practitioner is participating in an emergency resuscitation. While the patient is being ventilated with a bag and mask, the valve system jams. The appropriate response would be to

   A. call for a mechanical ventilator.
   B. call for a replacement bag.
   C. begin mouth-to-mask resuscitation.
   D. wait for the patient to be intubated.

6. A dyspneic patient who is in the emergency department is coughing up copious amounts of frothy, pink sputum, and audible râles are noted. Which of the following would be the most appropriate treatment?

   A. performing repeated nasotracheal suctioning to clear the airways
   B. administering positive-pressure ventilation with air
   C. administering an F_IO_2 of 0.35 via venturi mask and then suctioning
   D. administering mask CPAP with an F_IO_2 of 1.0

7. The respiratory care practitioner is checking a volume-cycled, pressure-limited ventilator and observes low exhaled volumes. To determine if they are caused by an inaccurate volume control, the practitioner should measure the volume at the

   A. machine outlet.
   B. patient connector.
   C. exhalation valve.
   D. spirometer.

8. Reverse (protective) isolation is indicated for

   A. patients with tuberculosis who are receiving isoniazid therapy.
   B. patients with *Staphylococcus aureus* in an open wound.
   C. a *Pseudomonas* infection in a patient's sputum and urine.
   D. patients with cancer who are receiving immunosuppressive drugs.

9. The respiratory care practitioner is making routine equipment checks and hears the relief valve of a humidifier device operating. Possible causes of this problem include which of the following?

   I. an excessive oxygen flow setting
   II. a clogged filter
   III. an obstruction in the attached tubing

   A. III only
   B. I and II only
   C. I and III only
   D. I, II, and III

GO ON TO THE NEXT PAGE.

10. A patient with asthma is in acute respiratory distress and presents to the emergency department with markedly diminished breath sounds. Following bronchodilator therapy, auscultation of the chest reveals rhonchi and wheezing. This change suggests which of the following?

A. development of a pneumothorax
B. improvement of the air flow
C. onset of pneumonia
D. development of pulmonary edema

11. The pressure setting on a pressure-cycled ventilator will determine the pressure

A. at which inhalation ends.
B. gradient from the ventilator to the alveoli.
C. required to open the exhalation valve.
D. required to activate the pop-off mechanism.

12. Chest physiotherapy is ordered for a patient with atelectasis of the left upper lobe. The patient is most likely to become cyanotic during therapy when which of the following areas is being drained?

A. right anterior and right lateral basal segments
B. right and left posterior basal segments
C. superior segment, left lower lobe
D. apical segment, left upper lobe

13. To obtain the most effective ventilation, a patient with severe emphysema should be instructed to

A. inhale slowly.
B. exhale slowly.
C. breathe as rapidly as possible.
D. breathe as deeply as possible.

14. When administering an IPPB treatment with a properly set sensitivity level, which of the following pressures would be noted on the manometer at the beginning of inspiration?

A. 1 cm H_2O
B. 0 cm H_2O
C. −2 cm H_2O
D. −5 cm H_2O

15. A patient who is being mechanically ventilated with an F_IO_2 of 0.60 and 8 cm H_2O PEEP has the arterial blood gas results below.

pH	7.36
$PaCO_2$	44 torr
HCO_3^-	24 mEq/liter
PaO_2	48 torr

The most appropriate action would be to

A. decrease PEEP to 5 cm H_2O.
B. increase PEEP to 12 cm H_2O.
C. increase the F_IO_2 to 1.0.
D. maintain the present therapy.

16. A 58-year-old male arrives in the emergency department complaining of severe chest pain. A myocardial infarction is suspected. Arterial blood gas values on room air reveal the following.

pH	7.32
$PaCO_2$	68 torr
HCO_3^-	34 mEq/liter
PaO_2	52 torr

The physician requests that oxygen therapy be initiated immediately. Which of the following should the respiratory care practitioner recommend?

A. simple oxygen mask at 10 L/min
B. 40% venturi mask at 8 L/min
C. partial rebreathing mask at 10 L/min
D. nasal cannula at 2 L/min

17. A 4-day-old, 35-week gestational age infant with symptoms of respiratory distress syndrome is receiving an F_IO_2 of 0.28 and nasal CPAP at 8 cm H_2O. His vital signs, appearance, and fluid output have been stable for 12 hours. The results of a blood gas analysis sample obtained from an umbilical artery catheter are below.

pH	7.43
$PaCO_2$	42 torr
HCO_3^-	27 mEq/liter
PaO_2	129 torr

Based on this information, the respiratory care practitioner should recommend which of the following?

A. Maintain the present therapy and monitor the infant.
B. Discontinue CPAP and increase the F_IO_2 to 0.40.
C. Decrease CPAP to 5 cm H_2O.
D. Decrease the F_IO_2 to 0.21.

GO ON TO THE NEXT PAGE.

PSB-HEALTH OCCUPATIONS APTITUDE EXAMINATION

TEST BOOKLET

do not open
this test booklet until you are told to do so

do not make any marks in this test booklet

DEVISED AND DEVELOPED
BY THE
STAFF OF THE PSYCHOLOGICAL SERVICES BUREAU
RESEARCH AND DEVELOPMENT DIVISION
WITH
CONSULTANT CONTRIBUTIONS
SUSAN ANNE STOUFFER, R.N., B.A., B.S.N., M.Ed.
COORDINATOR

CONFIDENTIAL

PSB TESTS Since 1959

PSYCHOLOGICAL SERVICES BUREAU
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GENERAL INSTRUCTIONS

This examination consists of five parts. Before you do each part, read and consider carefully the brief explanation of that part and the practice problem or problems which show you how to do those that follow.

As you begin each part, note the amount of time you will have for the problems in that section of the examination.

YOU ARE NOT EXPECTED TO BE ABLE TO ANSWER ALL THE QUESTIONS OR PROBLEMS. Do the best you can. Try to get as many correct as possible. Be careful not to go so fast that you make mistakes, but do not spend too much time on any one question or problem. If you change your mind about an answer, be sure to erase cleanly and completely.

You are to record your answers on a separate answer sheet rather than on the pages of the test booklet. Instead of writing down your answers, you will record each answer by blackening a circle.

EXAMPLE:

1. How many days are there in a week?
   (A) One (B) Two (C) Three (D) Five (E) Seven

1. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ

There are seven days in a week, so the circle with the E in the middle should be blackened.

1. Ⓐ Ⓑ Ⓒ Ⓓ ●

Your answer sheet will be scored accurately if you observe the following directions:

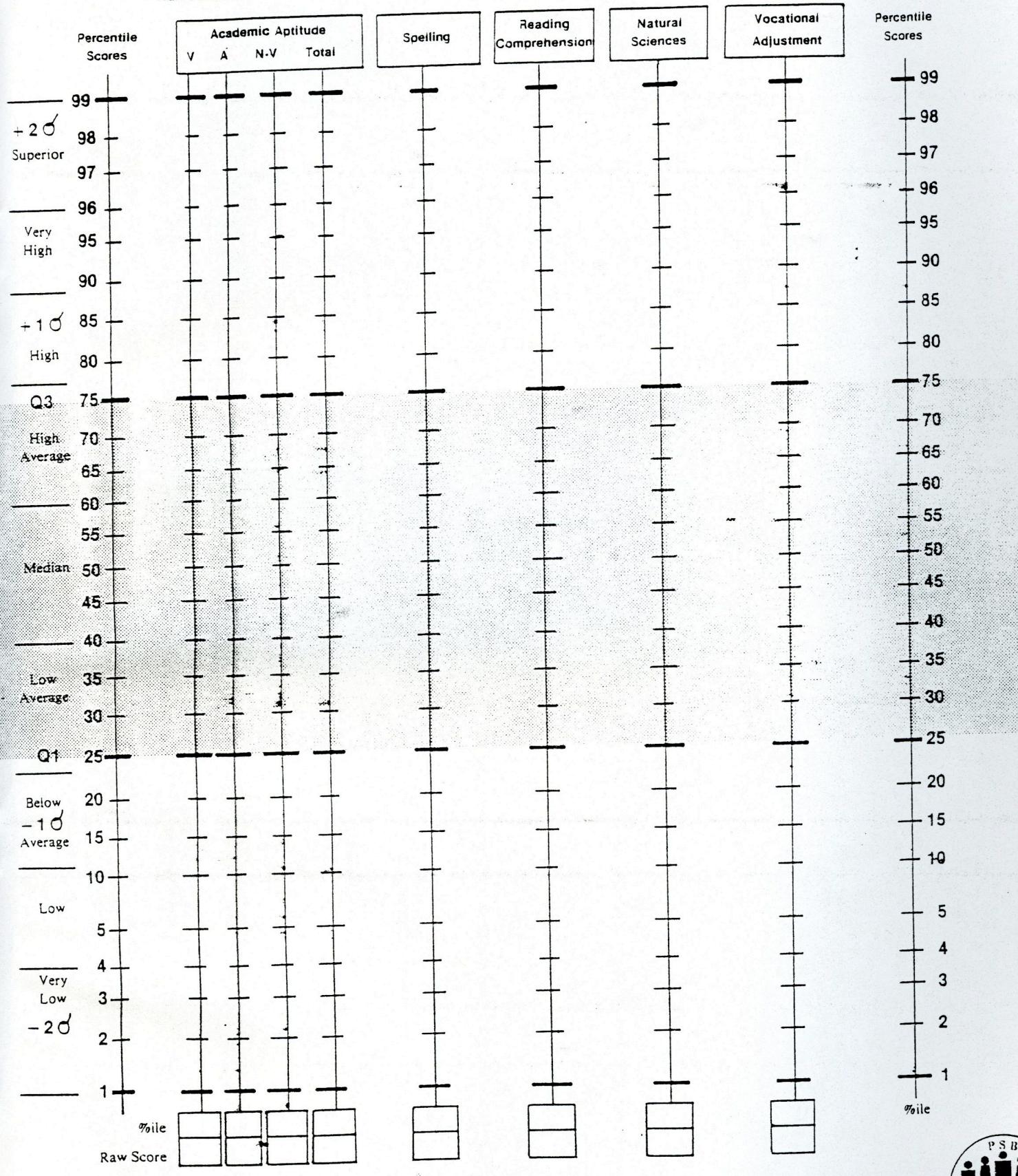
1. Be sure you are marking the correct section of the answer sheet for the part of the test you are taking at a particular time.
2. Always find the row of circles which is numbered the same as the question you are answering.
3. Then find the circle which corresponds to the answer you choose and blacken the circle.
4. Make heavy black marks that fill the circle completely.
5. Erase cleanly any answer you wish to change.
6. Blacken only one response circle for each question.
7. Make no unnecessary marks on the answer sheet.
8. Fold the pages of your test booklet so that only one page is visible. Place your test booklet close to the answer sheet so that the answer circles being blackened are as close as possible to the question being answered.

No questions about the examination will be answered by the examiner after the testing begins.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

PSYCHOLOGICAL SERVICES BUREAU'S
PSB-HEALTH OCCUPATIONS APTITUDE EXAMINATION
Student Test Record and Profile Chart

Name of Student _____ School _____ Test Date _____



Norm Group _____

Based on scores earned by students applying for admission to Schools throughout the United States.

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