GUEST EDITORIAL

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A Report on the CCNA 2007 Professional Practice Analysis

The purpose of this column is to present the results of the 2007 Professional Practice Analysis (PPA) of the field of nurse anesthesia, conducted by the Council on Certification of Nurse Anesthetists. The PPA used survey and rating scale methodologies to collect data regarding the relative emphasis of various aspects of the nurse anesthesia knowledge domain and competencies. A total of 3,805 survey responses were analyzed using the Rasch rating scale model, which aggregates and transforms ordinal (rating scale) responses into linear measures of relative importance and frequency.

Summaries of respondent demographics and educational and professional background are provided, as well as descriptions of how the survey results are used to develop test specifications. The results of this analysis provide evidence for the content outline and test specifications (content percentages) and thus serve as a basis of content validation for the National Certification Examination.

Keywords: Certification examination, Professional Practice Analysis.

The purpose of this column is to present the results of the 2007 Professional Practice Analysis (PPA) of the field of nurse anesthesia, conducted by the Council on Certification of Nurse Anesthetists (CCNA). The CCNA is charged with protecting and serving the public by assuring that individuals credentialed as Certified Registered Nurse Anesthetists (CRNAs) have met predetermined qualifications or standards for providing nurse anesthesia services.[1] In partial fulfillment of this mission, the CCNA develops, maintains, and administers a certification examination that assesses whether nurse anesthesia practitioners have attained competencies necessary for safe and effective entry-level practice in the United States.

One of the key features of the examination development is content validation, a process that helps to ensure that test content and specifications are formulated on the basis of current clinical practice. Professional Practice Analysis plays a considerable role in content validation. Administration of a PPA usually involves the development of a survey in which the items reflect various aspects, concepts, topics, techniques, and procedures commonly encountered in the profession. Survey respondents are typically asked to indicate the importance, frequency, or criticality of each survey element, using a rating scale. According to national testing standards, credentialing agencies should repeat their validation studies every 3 to 5 years.[2] For test construction purposes, the PPA orders the survey items so they can be placed on a continuum that reflects the relative importance of the item. The results of the PPA are then used to evaluate whether any changes need to be made to the examination content outline or test specifications. The CCNA has previously performed content validation studies in 1987, 1992, 1996,[2] and 2001.[3]

Professional Practice Survey Development

In order to ensure a degree of comparability with the previous PPA, the survey for the 2007 PPA was developed using the 2001 PPA as a base document. The 2001 survey instrument was reviewed by members of the CCNA in early 2006 and updated to reflect current practice. The survey began with questions relating to demographics, including age, ethnicity, practice settings, education, and experiential background. The main portion of the survey consisted of specific areas of knowledge of anesthesia practice, and the survey respondents were asked to rate how often that knowledge was encountered or required in their current position.

Professional Practice Sampling Plan and Survey Administration

The final survey instrument was approved at the March 2006 meeting

of the CCNA and assembled in an Internet-based survey delivery system by September 2006. To increase response rates, the entire survey was divided into 3 smaller overlapping surveys, featuring a single section in common (specific areas: equipment, instrumentation and technology). Table 1 summarizes the specific sections contained in the 3 overlapping surveys. The single overlapping equipment, instrumentation and technology section allowed all of the survey items under specific areas to be calibrated on a single scale while decreasing the total number of questions each individual respondent had to answer. Once the surveys were constructed they were reviewed for accuracy 1 last time by members of the CCNA.

A sample of 23,153 potential respondents (all active CRNAs with an email address recorded in the registry database of the American Association of Nurse Anesthetists (AANA)) was selected for the survey administration. This sample was then randomly divided into 3 groups, with each group assigned 1 of the 3 surveys. An email invitation was sent to each member of the sample to complete the survey to which they had been randomly assigned. Responses were collected electronically through October 2006 and analyzed by the psychometric staff at Pearson VUE (Chicago, Illinois), the test delivery agency for the National Certification Examination.

Description of respondents

The first section of the survey contained 15 questions designed to determine the demographic, educational, and experiential makeup of the survey sample. The first 10 questions dealt with general demographic and educational areas. Table 2 summarizes the responses to these questions. In this table, the numbers in the third column represent results from the 2001 PPA survey. When interpreting the 2001 comparative results, it is essential to note the fundamental difference in the 2001 and 2006 samples. The 2006 sample included a portion of the entire population of CRNAs, while the 2001 group included a subset of the entire population. Namely, the 2001 sample consisted only of CRNAs who had been practicing no more than 2 years.

Survey 1
Background information
Fundamental knowledge
Specific areas: equipment, instrumentation, and technology
Specific areas: patient conditions
Survey 2
Background information
Fundamental knowledge
Specific areas: equipment, instrumentation, and technology
Specific areas: procedures
Survey 3
Background information
Fundamental knowledge
Specific areas: equipment, instrumentation, and technology
Specific areas: anesthesia process: agents and techniques

Table 1. 2007 Professional Practice Analysis Survey Design

The first question asked respondents to indicate their primary anesthesia practice setting. The majority (63.3%) of the sample were associated with either a physician group or a hospital. A smaller proportion of the 2006 sample (28.7%) reported they were employed in a physician group, compared to what was reported in 2001 (44.9%). Also the 2006 sample contained a higher percentage of self-employed CRNAs (10.0%) when compared to 2001 (3.1%). Question 2 requested the number of anesthetics administered during an average week by the 2 groups. About half of the sample (53.3%) reported that they administer at least 20 anesthetics per week. Compared to the 2001 survey, the 2006 group tends to perform slightly more anesthetics per week (only 34.5% administered 20 or more anesthetics per week in 2001). The number of years as a CRNA (question 3) was generally evenly distributed, with a median of 14 years. On question 4, about 75.9% of the sample reported an age of 40 or more. Questions 5 and 6 asked the respondents to indicate their highest nursing degree preanesthesia and their highest anesthesia degree, respectively. The majority of respondents (55.6%) had a bachelor's in nursing as their highest degree before entering an anesthesia program, and roughly 59% of respondents' highest degree in the topic of anesthesia was a master's degree. This percentage is somewhat smaller than the percentage on 2001 (74.3%). Roughly half of the 2006 respondents were male, representing a slight increase from 2001, and an overwhelming majority (91.0%) of the 2006 respondents was white, again representing a slight increase from 2001. The next question asked about the community size in which the respondents practiced. The largest contingent in the 2006 sample consisted of respondents who work in an urban setting. There has been a slight migration from the urban setting when compared to the 2001 data. (Question 10 asked survey respondents to report their zip code. This information is not summarized here.)

Questions 11 to 15 asked the respondents to indicate either the percentage of time or percentage of

Question	% (2007)	% (2001)
1. Indicate your *primary* anesthesia practice setting.		
Employee of hospital	34.6	34.5
Employee of office/clinic	1.0	0.3
Employee of freestanding surgicenter	2.5	0.9
Employee of university/college	3.9	2.7
Employee of physician group	28.7	44.9
Employee of CRNA-only group	4.0	2.8
Federal Service	2.8	4.6
Independent contractor/locum tenens agency	2.9	2.9
Independent contractor for various arrangements	6.7	3.3
Solo contractor/self-employed	10.0	3.1
Other	2.4	NA
No response	0.3	NA
2. How many anesthetics do you administer during an average week?		
Between 0 and 5	2.5	11.6
Between 5 and 10	14.7	13.8
Between 10 and 15	11.7	22.4
Between 15 and 20	17.8	30.8
Between 20 and 25	26.0	22.5
Between 25 and 30	15.7	12.0
Between 30 and 35	8.8	NA
Between 35 and 40	1.9	NA
40+	7.4	NA
No response	3.5	NA
3. How many years have you been a Certified Registered Nurse Anesthetist?		
Between 0 and 5	22.6	NA
Between 5 and 10	13.2	NA
Between 10 and 15	14.9	NA
Between 15 and 20	9.8	NA
Between 20 and 25	12.5	NA
Between 25 and 30	12.8	NA
30 or more	13.6	NA
No Response	0.7	NA
4. What is your age?		
Under 30	2.9	NA
30-39	20.6	NA
40-49	30.0	NA
50-59	35.6	NA
60-65	10.3	NA
No response	0.6	NA
5. What is the highest degree you obtained preanesthesia?		
Diploma	12.6	0.1
Associate	6.6	0.2
Bachelor's – nursing	55.6	85.4
Master's – nursing	13.3	4.1
Doctoral – EdD	0.1	NA
Doctoral – PhD	0.6	0.1
Doctoral – DNSc	0.2	NA
Other	10.2	9.9
No response	0.8	NA
6. What is the highest degree you obtained in anesthesia?		
Certificate	32.2	22.8
Bachelor's	7.2	2.1
Master's	58.8	74.3
Doctoral – EdD	0.1	NA
Doctoral – PhD	0.2	0.1
Doctoral – DNSc	0.2	NA
Other	0.6	0.5
No response	0.7	NA
7. What is your gender?		
Male	48.6	45.5
Female	50.0	54.5
No response	1.4	NA
8. Please indicate your race-ethnicity.		
Asian American	1.8	3.2
African American	1.6	1.5
Caucasian	91.0	89.3
Hispanic	1.6	2.6
Native American	0.6	0.3
Other	2.2	1.8
No response	1.3	NA
9. Which of the following best describes the community in which you primarily practice?		
Rural/small town	27.2	20.1
Suburban	31.8	29.6
Urban	39.6	49.6
No response	1.4	NA

Table 2. Summary of Demographics, Education, and Professional Background

patients and conditions that constituted their practices. Table 3 summarizes the responses to these questions.

Question 11 asked the respondents to indicate what percentage of their work fell within various areas of responsibility. For the 2006 sample, the majority of their work was in direct clinical patient care. This result was comparable to the 2001 sample. Question 12 asked the respondents to indicate the percentage of their patients that fell within certain age levels. About half of time spent was with non–elderly adults, ages 18-65. Again, the results from 2001 are similar.

Next, the respondents were asked to indicate the percentage of their patients that fell within the physical status categories, as defined by the American Society of Anesthesiologists. The largest proportion of work performed (38.3%) was with class II patients. Nearly 90% of work performed fell under class I, class II, and

Question	%
11. Indicate what percentage of your work falls within the following responsibilities.	
Education	6.4
Management, supervision, or administration	2.3
Research	0.3
Consultation with others	1.9
Biomedical equipment maintenance/repair	0.4
Direct clinical patient care	85.2
12. Please estimate the percentage of time you spend with patients in each of the age categories listed.	
Birth-2 years	4.3
3-12	7.4
13-17	8.1
18-65	48.6
65+	28.4
13. Please indicate the percentage of your patients who fall into the following [ASA physical status] categories.	
Class I	16.7
Class II	36.9
Class III	31.5
Class IV	11.1
Class V	1.4
Class VI	NA
14. Please estimate your percentage of elective and emergency procedures.	
Elective	81.5
Emergency	15.6
15. Please estimate your percentage of inpatients and outpatients.	
Inpatient	38.8
Outpatient/ambulatory	58.6

Table 3. Summary of Distribution of Work

class III. Again, the results from 2001 features little change. Question 14 asked the respondents to indicate the percentage of their patients that fell within elective vs emergency procedures. The responses for question 14 show that the majority of work was performed in elective procedures. Question 15 asked the respondents to record the percentage of time they spent on inpatient and outpatient cases. On average, respondents spent 66.4% of their time working on outpatient procedures. This represents an increase of 7.8% from 2001, which could reflect recent increases in medical procedures being performed on an outpatient basis.

Summary

Although not as high as past PPA studies, the response rate for the 2006 survey was adequate, providing a sound foundation for the examination blueprint. The demographic material has highlighted some interesting similarities and differences between the 2001 and 2006 samples.

Any differences can be primarily attributed to the fundamental difference in sampling strategies between the 2001 and 2006 samples. The 2001 sample consisted primarily of practitioners within the first 5 years of beginning practice as a CRNA. The 2001 sampling strategy was used in order to ascertain a picture of entry-level practice. (For comparative purposes, a separate, "select" group, consisting of members of the AANA Board of Directors, Council representatives, and others was also sampled in 2001 but did not factor into the final results). In 2006, a picture of the CRNA practice as a whole was desired; thus, a broader sampling plan, tapping a wider array of experience, was used for the current analysis. Also, 2006 was the first year featuring an electronic surveying method for the practice analysis. Electronic and web-based survey administrations typically feature lower response rates. Therefore, a larger pool of respondents was asked to respond to the survey in order to gather as many responses as possible. Despite these differences in the 2 samples, the overall similarity between the current results and the results from 2001 indicates a good deal of continuity between the 2 survey samples.

Fundamental Knowledge Section

The fundamental knowledge questions were analyzed first. These questions represent the skeleton of the blueprint and replicate the major headings on the current examination outline. For the current analysis, respondents were asked to rate the relative importance of each area of fundamental knowledge on a 3-point scale: 1, low (little importance in my practice); 2, moderate (some importance to my practice); and 3, high (very important to my practice).

They were asked to apply this rating to 4 broad areas—basic sciences, equipment and technology, basic and advanced principles of anesthesia and professional issues—and then to progressively fine-tune each area. See Table 4 for the results of this progression.

Once the responses were collected, the Rasch rating scale model was used to analyze the ratings in order to place all of the survey items on a single interval scale of importance. A positive Rasch calibration indicates an item of relative high importance, while a negative Rasch calibration indicates an item of relative low importance. Tables 4 and 5 include a

Question	Rasch calibration	Rating mean	Rating SD
1. Consider the importance of the 4 components of your practice: (1) the professional issues you encounter in your practice, (2) the responsibilities in your clinical practice, (3) your knowledge of the basic sciences, and (4) your use of equipment, instrumentation and technology in your clinical practice. Please indicate the importance of each component relative to the other components.			
Professional Issues	–2.09	2.25	0.65
Anesthesia practice (basic and advanced combined)	3.02	2.94	0.25
Basic sciences	–0.97	2.46	0.59
Equipment, instrumentation, and technology	0.04	2.63	0.52
2. Within the category of Professional Issues, what is the relative importance of knowledge in each of the following?			
AANA standards of practice	–0.52	2.64	0.55
Legal	–0.86	2.58	0.57
Quality improvement	–1.53	2.43	0.61
Research	–3.97	1.83	0.68
Safety	1.19	2.87	0.38
3. Within the category of anesthesia practice, what is the relative importance to your practice of knowledge in each of the following?			
Basic principles	2.18	2.94	0.30
Advanced principles	0.24	2.76	0.48
4. Listed below are 3 general categories of basic sciences. Please indicate the relative importance that knowledge of the topics in each category has in your practice.			
Anatomy, physiology, and pathophysiology	0.58	2.81	0.44
Chemistry, biochemistry, physics	–1.71	2.39	0.60
Pharmacology	1.64	2.91	0.34
5. Within the category of equipment, instrumentation, and technology, what is the relative importance of the following categories?			
Anesthesia delivery systems	0.76	2.83	0.42
Airway devices	1.45	2.89	0.36
Monitoring devices	0.52	2.80	0.44

Table 4. Fundamental Knowledge Survey Results

mean rating score with a corresponding standard deviation and a Rasch calibration. The means reported in Table 4 are ordinal-level data taken directly from the raw score ratings. They give some idea of the relative importance of the various categories or subcategories. The Rasch calibrations are a log-linear transformation of this ordinal level data onto a linear, equal interval scale.[5] As such, they give a clearer picture of the importance of the relationship between the various categories or subcategories. They also provide the basis for mathematical operations, making possible a meaningful transformation to percentage of items on the test, as will be shown later.

The first question dealt with the broadest areas. The respondents were asked to rate the 4 areas: professional issues, basic sciences, anesthesia practice, and equipment. The respondents indicated that anesthesia practice was the most important, followed by equipment, instrumentation, and technology, and then basic sciences. Professional issues was rated the least important. The second set of questions dealt with the area of professional issues. It asked the respondents to indicate the relative importance of knowledge in the areas of standards of practice, legal, quality improvement, research, and safety. Safety had the highest importance rating, followed by standards of practice, legal, quality improvement and research, respectively. The third set of questions asked the respondents to distinguish the relative importance between knowledge of basic anesthesia principles and knowledge of advanced anesthesia principles. Knowledge of basic principles was rated as more important than knowl-

Least frequent (in order of increasing frequency)	Rasch	Mean	SD
Patient conditions			
Malignant hyperthermia	−1.53	1.50	0.55
Insulinoma	−1.45	1.54	0.55
Acromegaly	−1.41	1.56	0.52
Thymus	−1.37	1.57	0.53
Huntington's chorea	−1.34	1.59	0.54
Pheochromocytoma	−1.31	1.61	0.52
Porphyria	−1.27	1.63	0.55
Hypo/hyperaldosteronism	−1.26	1.63	0.54
Epiglottitis	−1.24	1.65	0.54
Burns	−1.05	1.76	0.82
Coma	−0.97	1.81	0.79
Autonomic hyperreflexia	−0.92	1.85	0.59
Pyloric stenosis	−0.89	1.88	0.76
Disseminated intravascular coagulation	−0.86	1.89	0.63
Demyelinating disease	−0.85	1.90	0.57
Hemophilia	−0.85	1.90	0.53
Procedures			
Radiation therapy	−1.96	1.38	0.81
Intracranial: transorbital approach	−1.91	1.39	0.67
Organ transplants	−1.86	1.41	0.84
Hemipelvectomy	−1.78	1.44	0.71
Organ harvest living donor	−1.73	1.46	0.76
Organ harvest cadaver	−1.67	1.48	0.74
Thymus	−1.63	1.50	0.65
Burns	−1.59	1.52	0.78
Intracranial: transsphenoidal hypophysectomy	−1.48	1.57	0.81
Surgical sympathectomy	−1.36	1.63	0.83
Electroconvulsive therapy	−1.31	1.66	1.14
Renal artery	−1.26	1.69	0.83
Extracranial: rhizotomy	−1.24	1.70	0.91
Electrophysiology	−1.23	1.71	1.10
Diaphragm	−1.15	1.75	0.84
Anesthesia process: agents and techniques			
Halothane	−3.20	1.10	0.35
Hypnosis	−2.82	1.14	0.52
Etidocaine	−2.57	1.18	0.48
Difficult airway management: cricothyrotomy	−2.49	1.19	0.44
Paravertebral	−2.46	1.19	0.51
Psychopharmacologic therapy: Lithium	−2.45	1.20	0.51
Psychopharmacologic therapy: MAO Inhibitors	−2.35	1.21	0.55
Hyperthermia	−2.29	1.23	0.55
Dantrolene	−2.21	1.24	0.45
Barbiturates: methohexital	−2.04	1.29	0.63
Opioid agonist-antagonists: butorphanol	−2.01	1.29	0.61
Cocaine	−1.92	1.32	0.61
Chemotherapeutics	−1.90	1.33	0.72
Psychopharmacologic therapy: tricyclic antidepressants	−1.89	1.33	0.78
Procaine	−1.88	1.33	0.67
Equipment, instrumentation, and technology			
Combitube	−1.98	1.33	0.56
Jet ventilation	−1.36	1.58	0.66
CNS: intracranial pressure	−1.25	1.64	0.81
Computerized record-keeping devices	−1.21	1.66	1.39
CNS: electroencephalogram	−1.15	1.70	1.07
Lighted stylet	−1.11	1.72	0.84
Transesophageal echocardiography	−1.01	1.78	1.07
Computerized preoperative assessment	−0.76	1.96	1.60
CNS: Evoked potential	−0.74	1.98	1.09
Cardiac output	−0.65	2.05	1.07
Tube exchangers	−0.61	2.08	0.77
Pulmonary artery pressure monitoring	−0.55	2.14	1.07
Modified nonrebreathing	−0.46	2.22	1.38
Endobronchial tube	−0.28	2.39	1.10
Tracheostomy tubes	−0.23	2.44	0.93

Most frequent (in order of decreasing frequency)	Rasch	Mean	SD
Patient conditions			
Hypertension	3.01	4.82	0.53
Substance abuse: tobacco	2.44	4.69	0.65
Gastroesophageal reflux disorder (GERD)	2.22	4.62	0.63
Diabetes mellitus	2.11	4.57	0.66
Electrocardiogram	1.77	4.41	0.90
Morbid obesity	1.70	4.37	0.80
Asthma	1.55	4.28	0.65
Lab tests: blood glucose	1.51	4.26	0.82
Lab tests: hemoglobin/Hematocrit	1.37	4.15	0.94
COPD/emphysema	1.34	4.13	0.86
Dysrhythmias	1.24	4.04	0.83
Ischemic heart disease/angina	1.24	4.04	0.93
Substance abuse: alcohol	1.20	4.01	0.87
Peripheral vascular disease	1.19	4.01	0.89
Gallstones/gallbladder disease	1.15	3.97	0.92
Cancer	1.14	3.97	0.87
Procedures			
Positioning: supine	3.10	4.78	0.68
Positioning: lithotomy	1.67	4.25	1.03
Laparoscopy	1.58	4.20	1.12
Positioning: Trendelenburg	1.53	4.17	1.02
Positioning: reverse Trendelenburg	1.35	4.04	1.08
Extremities: lower	1.30	4.01	1.06
Abdominal/gynecology	1.24	3.96	1.10
Extremities: upper	1.20	3.93	1.06
Gallbladder	1.13	3.87	1.17
Herniorrhaphy	1.11	3.86	1.07
Positioning: lateral	1.11	3.85	1.05

Table 5. Specific Areas Survey Results: Least and Most Frequent Survey Items

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Most frequent (in order of decreasing frequency)	Rasch	Mean	SD
Intestine	0.89	3.66	1.17
Positioning: prone	0.85	3.62	1.10
Breast biopsy	0.80	3.58	1.12
Cystoscopy	0.76	3.53	1.22
Anesthesia process: agents and techniques			
Other sedative/hypnotics: propofol	4.46	4.95	0.32
Opioid agonists: fentanyl	4.31	4.94	0.34
Benzodiazepines: midazolam	3.49	4.87	0.53
Endotracheal Intubation: oral	2.88	4.76	0.64
Sevoflurane	2.13	4.52	0.88
Lidocaine	2.10	4.51	0.85
Neostigmine	1.99	4.45	0.95
Monitored anesthesia care	1.91	4.42	0.81
LMA maintenance	1.73	4.31	0.87
Anticholinergics	1.68	4.28	1.04
Rocuronium	1.40	4.08	1.31
Succinylcholine	1.34	4.03	1.11
Antimicrobials	1.16	3.87	1.58
Bupivacaine	1.08	3.79	1.10
Desflurane	1.03	3.75	1.51

Most frequent (in order of decreasing frequency)	Rasch	Mean	SD
Equipment, instrumentation, and technology			
Pulmonary/airway monitoring: pulse oximetry	5.24	4.97	0.22
Electrocardiogram	4.69	4.96	0.31
Noninvasive blood pressure monitoring	4.21	4.93	0.42
Flow meters, valves, floats	3.66	4.89	0.50
Temperature monitoring	3.43	4.86	0.55
Pulmonary/Airway monitoring: capnography	3.40	4.85	0.60
Pneumatic and electronic alarm devices	3.36	4.85	0.59
Carbon dioxide absorbent	3.22	4.83	0.63
Vaporizers	3.18	4.82	0.65
"Fail-safe" devices	3.17	4.82	0.66
Pulmonary/Airway monitoring: airway pressure	3.14	4.81	0.67
Pulmonary/Airway monitoring: airway gas analysis	3.11	4.81	0.70
Pressure failure safety devices	3.06	4.80	0.70
Endotracheal tube	2.97	4.78	0.65
Ventilator	2.94	4.78	0.71

Table 5. Specific Areas Survey Results: Least and Most Frequent Survey Items
MAO indicates monoamine oxidase; CNS, central nervous system; COPD, chronic obstructive pulmonary disease; LMA, laryngeal mask airway.

edge of advanced principles. The fourth question asked the respondents to distinguish the relative importance of knowledge in the topics of basic science. Knowledge of pharmacology was rated most important. Anatomy, physiology, and pathophysiology followed as the next most important topics. Chemistry, biochemistry, and physics were rated least important. The final set of questions asked the respondents to distinguish the relative importance of knowledge in the topics of equipment, instrumentation, and technology. Respondents rated airway devices as most important, followed by anesthesia delivery systems and monitoring devices.

Many of these fundamental knowledge survey items, with the exception of the final equipment section, were included on the 2001 survey. While the 2001 calibrations[4] featured some fluctuation compared to the 2006 calibrations, the ordering of the survey tasks by their Rasch calibrations was nearly identical between the 2001 and 2006 surveys. This consistency suggests overall stability in CRNA practice over the last 5 years.

Specific Areas Section

The remaining 4 sections of the survey were designed to obtain more detailed information on the current practice of nurse anesthetists. These 4 sections addressed the areas of patient conditions, procedures, anesthesia processes, and equipment. In these sections, the respondents were asked to indicate the frequency in which they encountered a preexisting condition or a surgical/diagnostic procedure, administered an anesthesia process, or used a piece of equipment. The respondents rated each of these specific areas of practice on a 5-point rating scale of frequency: 1, never; 2, rarely; 3, monthly; 4, weekly; 5, daily.

Again, the Rasch rating scale model used the survey responses to calibrate each survey item onto a single logit scale of frequency. The survey items with the 15 highest and lowest frequency calibrations from each section are presented in Table 5. The aspects of CRNA practice with more positive frequency calibrations are frequently encountered, while the aspects with more negative frequency calibrations are rarely encountered.

Test Specification Development

The purpose of collecting job analysis data is to order the content items so that they can be placed on a continuum that reflects the relative importance of the item. All of the survey items are considered important to practice or they would not have been included on the survey. The key issue is the relative importance of the items. The observation of relative importance is the key factor in determining appropriate test specifications.

The Rasch rating scale model is used to bring the observations together in a single linear framework. The application of this model transforms the ordinal level ratings awarded to each item into a linear

measure of the item frequency or importance. The items that are rated as most frequently encountered or most critical by the practitioners should receive the most weight on the test (ie, a higher percentage of questions on the test). Conversely, those items weighted least critical to practitioners should receive little or no weight on the test. Those items with weights that fall between these extremes should be distributed proportionately.

The process of transforming job analysis data for use in designing test specifications involved several steps. First, the Rasch calibrations for each section of the blueprint are aggregated into a single value describing the relative ordering of that content area on a scale of importance. Because the Rasch calibrations feature negative and positive values, it is necessary to apply a simple linear transformation to place them on an emphasis scale from 1 to 5. The lowest Rasch calibration is scaled to 1 and the largest is scaled to 5, with the intermediate values being scaled proportionally between 1 and 5. Percentages for each content area are then calculated by dividing the emphasis value for each content area by the sum of all emphasis values.

These calculations were performed for both the fundamental knowledge and specific areas sections of the survey. The results for each of these sections, then both sections combined, are presented here.

Blueprint calculations based on the fundamental knowledge section of the survey are presented in Table 6. The calibrations for each primary content area were taken directly from those documented in the fundamental knowledge section of this column.

Blueprint calculations based on the specific areas section of the survey are also presented in Table 6. Calculations of the blueprint percentages based on the specific areas involved an additional step. The specific areas portion of the content outline was organized in a format somewhat different from the structure of the current content outline. Before the frequency calibrations from specific areas could be aggregated, each survey item in this section had to be mapped to 1 of the 5 content areas of the current outline. The specific area survey items were thus reorganized into the structure of the current outline, and the calculations proceeded as described earlier.

The percentages calculated on fundamental knowledge and specific areas are somewhat different, particularly in the basic science, equipment, and basic principles sections. In order to arrive at a single percentage for each area of the outline, it is possible to base the percentage calculations on a linear combination (sum) of the importance calibrations from the fundamental knowledge section and the frequency calibrations of the specific areas outline. The calculations based on the combined calibrations are presented in the bottom section of Table 6.

Results based on fundamental knowledge responses

Content area	Importance	Emphasis	%
Professional issues	–2.47	1.00	7.25
Basic science	–1.49	1.84	13.36
Equipment	–0.59	2.62	18.98
Basic principles	2.18	5.00	36.25
Advanced principles	0.24	3.33	24.15

Results based on specific areas responses

Content area	Frequency	Emphasis	%
Professional issues	–2.47	1.00	6.21
Basic science	–0.13	3.54	22.00
Equipment	1.22	5.00	31.00
Basic principles	–0.55	3.08	19.15
Advanced principles	–0.19	3.47	21.58

Combined results

Content area	Importance	Frequency	Emphasis	%
Professional issues	–2.47	–2.47	1.00	5.73
Basic science	–1.49	–0.13	3.02	17.32
Equipment	–0.59	1.22	4.39	25.15
Basic principles	2.18	–0.55	5.00	28.65
Advanced principles	0.24	–0.19	4.04	23.14

Table 6. Test Specification Percentages

Content area	Revised %	Previous %
Professional issues	5	4
Basic science	25	30
Equipment	10	5
Basic principles	30	31
Advanced principles	30	30

Table 7. Revised Test Specifications

In May 2007, after a period of review and discussion of the PPA analytical results, the CCNA approved the final percentages for the revised National Certification Examination blueprint. These percentages are presented in Table 7 and were reviewed and confirmed with the testing vendor in June 2007. The new blueprint was implemented on January 1, 2008.

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