



Specifications Document

Certified Clinical Transplant Coordinator (CCTC) Examination

A Program of the



American Board for
Transplant Certification

Specifications Documented by
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Introduction

Applied Measurement Professionals, Inc., a PSI business (PSI/AMP) staff facilitated a job analysis in 2013 while under contract with the American Board for Transplant Certification (ABTC). Details about study methods and results are described within a report from the study. Results from the job analysis impacted the content of examinations that are assembled. Related details affecting each form of the examination are described within this specifications document.

Objective behind the Examination

Candidates who take the examination for Certified Clinical Transplant Coordinator (CCTC) will have prepared through work experience. Many candidates have already achieved the RN license and some candidates have achieved graduate degrees in nursing. However, these designations are not required to be eligible for the CCTC credential. An eligible candidate must have completed 12 months of work experience as a transplant coordinator by the date the candidate submits an application to become certified. The types of transplants coordinated by such personnel involve solid organs.

Solid organs (e.g., kidney, liver, heart) are distinct from other kinds of tissue (e.g., bone marrow) that can be transplanted. This distinction is made because the sources for a large volume of transplanted solid organs are persons who have recently expired.

It is legal and generally consistent with policies within hospitals for a coordinator to care for transplant recipients without a specialty credential beyond the RN. The objective behind the examination is to assess whether individuals who provide such care are sufficiently competent to protect recipients while facilitating optimal care during the months and years after transplantation. The CCTC program recognizes the minimal competence of persons who voluntarily seek the certification from ABTC.

Plan to Approve and Score Examination Items

The Examination will be assembled from items that are of the multiple-choice type. The ABTC has decided to deploy four options within each item. A typical item will have one option designated as the key, which will be worth one point when selected by a candidate. The remaining options will be worth zero points.

Persons who work as transplant coordinators produce each new item. The procedure by which each new or revised item will be approved will involve an examination committee of about ten clinical transplant coordinators. Unanimous agreement must be observed about each of the following points for an item to be designated as approved within the item banking system:

- The item assesses a competency that is consequential to the program
- Content of the item links strongly to the competency described by a task classification within the detailed content outline
- The mental process by which a typical, competent candidate will arrive at the key is consistent with the cognitive level to which the item is classified
- The stem contains text that is clearly worded while efficiently presenting information that a competent candidate will need to select the key

- The best option of the four that are presented within the item is designated as the key
- Each distractor will be plausible to at least some from the candidate population

The intent behind the multi-step procedure is to promote protection of the public, encourage fairness to candidates, and minimize sources of measurement error that could negatively affect the first two goals.

Validation of the key of each new item that is subsequently implemented occurs without affecting candidates' test scores. One set of 25 items is added to each new test form and designated as pretest items. Each pretest item is associated with a point value of zero, even when the key that had been approved by the examination committee is selected by a candidate. After a sufficient number of responses from candidates have accumulated, the key of each pretest item will be validated by members of the examination committee. Such validation is informed by a p and r_{pb} value along with information about the frequency and percentage of respondents who selected each option plus the average score of each option group. Several items from a set are typically approved for inclusion on the scored-portion of a subsequent test form. A small subset of items are typically returned to the examination committee for revision.

Because of the pretesting system, items that are assembled into the scored portion of each test form must have had their keys validated by the process described above. Doing so permits delivery of results from each administration to each candidate as soon as he or she finishes the examination.

Plan to Assess the Accuracy of Test Scores and Decisions

Because items will be dichotomously scored (1=correct, 0=incorrect), we use the Kuder-Richardson formula number 20 (KR 20) to produce an indicator of test score accuracy. KR 20 values indicate the proportion of variability in examination scores that can be attributed to variability in competence within the clinical transplant coordination care domain. The degree to which observed scores are influenced by sources of measurement error will cause the value to fall below 1.00.

Estimates of the consistency of decisions about groups of candidates who pass and fail the examination are provided by indices that have been developed by Livingston¹ and Subkoviak². Both indices estimate the proportion of a group taking a test form who would experience the same pass or fail outcome after a second attempt. Only those candidates who have scores near the cut score are associated with a detectable probability of experiencing the opposite outcome on a second attempt. The larger the measurement error, the larger is the subset of candidates who could experience an inconsistent set of decisions across two attempts. The further removed a decision consistency value falls below 1.00, the larger is the candidate subset who could experience inconsistent decisions.

We document a standard error value representing the average amount of error observed within candidates' scores plus a conditional standard error value that was observed at the cut score.

¹ Livingston, S.A. (1972). Criterion referenced applications of classical test theory. **Journal of Educational Measurement**, 9, 13-26.

² Subkoviak, M. (1976). Estimating reliability from a single administration of a criterion-referenced test. **Journal of Educational Measurement**, 13(4), 7-10.

The latter value particularly illuminates the amount of accuracy that was associated with test scores equal to the cut score.

Plan to Develop Examination Content over Time

Two test forms were released in 2015 to start the current cycle of test form assembly and release. We recommend that ABTC plan to conduct a job analysis as early as 2018 and no later than 2021. Anticipating that ABTC will continue to transition between testing cycles while perpetuating instant scoring for candidates, expect to start the next testing cycle two years after the year in which the job analysis is done. The intervening year will provide the opportunity to pretest items that will permit fulfillment of new test specifications after the keys of those items have been validated.

Once the current testing cycle is underway, ABTC releases one new test form each year and retires the oldest form. Hence, two test forms are maintained in the assessment center network. Examinations are solely administered by computer.

The creation of a new batch of items begins each year by comparing item frequencies in the bank to the test specifications. Assignments for new items are distributed among members of the CCTC examination committee as coordinated between the PSI/AMP test development specialist and the chairperson of the committee.

Critical to the development of quality examination content over time will be the influence of the approval procedure. Bullet points associated with item approval were described above in the section describing the [Plan to Develop and Score Examination Items](#).

Specifications for Test Form Assembly

A job analysis study yielded a set of task statements that were observed to be critical for transplant coordinators in 2013. Refer to the study report for a description of each task and the methods by which tasks were labeled as critical.

The outline for organizing tasks that were observed to be critical by the job analysis is shown in Table 1. The first two characteristics associated with each item are as follows:

- Content domain – one of 8 domains
- Cognitive level – one of 3 levels

An item on an examination must link to a task organized under a content domain from the detailed content outline while being written to one of the three levels of cognition described in Table 1. Each form of the examination includes a set of 25 pretest items in addition to 150 scored items.

Each group of recipients presents with unique issues depending on the organ that was transplanted. Following the specifications and targets described in Table 2 helps to ensure standardized content among test forms when it comes to the types of cases that are described among the items on any given form.

In summary, examination content is controlled among test forms based on the following item characteristics:

- content domain
- cognitive complexity
- organ group

Table 1. Specifications by Content Domains and Cognitive Complexities

ABTC Clinical Transplant Coordinator	Items			Totals
	Cognitive Level			
Content Area	Recall	Application	Analysis	
I. EVALUATION AND PREPARATION FOR TRANSPLANT	25	43	8	76
A. Education	11	16	0	27
B. Data Collection and Evaluation, and Recommendations	4	6	1	11
C. Suitability Assessment and Determination of the Potential Transplant Candidate and Live Donor	4	6	2	12
D. Wait List Management	4	6	2	12
E. Candidate/Deceased Donor Selection Criteria	1	4	3	8
F. Donor and Candidate Preoperative Care	1	5	0	6
II. POST-TRANSPLANT CARE	18	33	23	74
A. Education	8	20	0	28
B. Postoperative Monitoring, Evaluation, and Reporting	10	13	23	46
TOTAL	43	76	31	150

Table 2. Specifications by Transplanted Solid Organs

	# items
Kidney	28
Liver	19
Lung	9
Heart	10
Kidney-pancreas	4
Pancreas	2
Intestine	2
Heart-lung	1
Organ-Specific Subtotal	75
General Subtotal	75
Total	150

Examination Administrations

Candidates have 180 minutes to take the examination. Test administration times are enforced by the computer system that presents items from a test form to candidates. The only exception to the testing time specifications is one that is consistent with the Americans with Disabilities Act in response to a request from a candidate who has documented the presence of a medically-recognized disability. The intent behind an accommodation is to equalize the opportunity to pass an examination for a person with a documented disability. Hence, no special notations are documented with results achieved by an accommodated candidate.

Each examination will be administered under standard procedures that are monitored by a proctor. The procedures are intended to keep the content of the examination secure, ensure that each administration occurs in an environment that is substantially similar to other administrations, and each person who takes the examination is the person who applied to take the examination. Each proctor verifies the identity of each candidate before admission to the testing center. Each candidate will capture a digital image of his or her face, which is printed on the score report that the candidate receives.

The sequence of items is scrambled within the group of candidates who take a test form. The ABTC has chosen to fix the sequence of options within each item.

Establishing the Cut Score

The ABTC compares a cut score to the total examination score achieved by each candidate. The total examination score is the sum of each correct response to each scored item.

Although Table 1 illustrates that the examination will assess competencies across several domains, the cut score is of the compensatory type. The term *compensatory* acknowledges that it is possible for a candidate to compensate for scoring low in one content domain by scoring high in another domain. Passing will require a sufficiently high total score regardless of a candidate's score in each subdomain. The intent behind the CCTC credential is to document a sufficiently high level of competence across several subdomains, so a compensatory type of cut score is consistent with the program intent.

Methods associated with the criterion-referenced cut score study, including a description of the qualifications of the panel members and details about their deliberations were documented in a separate report that was produced in 2015. Form 17 and Form 18 began this cycle of test form assembly.

Maintaining an Equivalent Challenge for Candidates across Test Forms

Confidence in Item Information

Each scored item on each new test form has had its key validated and the measurement properties of each item are known at the point when assembly occurs because of the pretesting system. Confidence in the observed measurement properties for an item is linked to having included a sufficient number of cases when calculating statistics (p , r_{pb}) based on classic test theory. Between 100 and 150 candidates make their first attempts at the examination each year.

Two test forms are maintained in the administration network, each of which has one set of pretest items. A typical new pretest item is expected to accumulate at least 130 responses from the population of first-time candidates because most forms are administered over a two-year period.

When each candidate becomes known to the system through the application process, the system randomly assigns a test form to the candidate from the list of available test forms. Because of the random assignment and adequate number of candidates responding to items on each test form, confidence in observed p and r_{pb} statistics is sufficiently high. When those statistics are transferred into a spreadsheet to extrapolate test score characteristics (mean standard deviation, standard error of measurement, reliability, decision consistency), confidence in the extrapolated values is high as well.

We do not plan to aggregate candidate cases by the point in the year when the examination is taken because we expect that test administrations will occur on-demand the year around. Because the sequence of items will be scrambled when administered to different candidates, we do not plan to subsequently place an item at or near its “home” position relative to the beginning, middle, or end of the test form.

Test Form Assembly Steps

The test form assembly plan involves satisfying the specifications without variation from what is displayed in Table 1 and Table 2. When coupled with a plan to emulate the scale produced by the base form, we assert an intent to assemble psychometrically parallel test forms that deserve the same cut score or a similar cut score as compared to the cut score that was used on the base form.

Verification of the cut score occurs by observing a linear equating result, which compares the scale characteristics and cut score from the base test form to the projected scale characteristics and cut score associated with the new test form. Form 17 was selected as the base form. Calculations built into an equating spreadsheet produce projections for the mean, standard deviation, standard error of measurement, reliability, and decision consistency that are expected to be associated with test scores from the new form. These projections are based on observed p and r_{pb} values that are produced from accumulations of response information from all administrations of each item to candidates taking the examination for the first time. Such modeling within the spreadsheet assumes that candidates’ abilities remain constant. The sufficient number of responses to each new item and the random assignment of test forms to candidates supports this assumption.

Items are often replaced by the examination committee as a test form progresses through the approval process. When an item is replaced on a new examination form, the person who is responsible for assembling the form must document the cut score result that is projected by the simplified linear equating formula³. (We have observed that the more familiar linear equating formula⁴ produces the same result as the simplified formula.)

$$^3 \text{ Equated cut score} = \left(\frac{\text{Standard Deviation } Y}{\text{Standard Deviation } X} \right) (\text{Cut } X - \text{Mean } X) + \text{Mean } Y$$

Formula 20.1 in Crocker, L and Algina, J. (1986). Introduction to classical and modern test theory. Holt, Rinhart and Winston, Inc. Fort Worth, TX. p. 458-459.

$$^4 \text{ Equated cut score} = \left(\frac{\text{Standard Deviation } Y}{\text{Standard Deviation } X} \right) \text{Cut } X + [\text{Mean } Y - \left(\frac{\text{Standard Deviation } Y}{\text{Standard Deviation } X} \right) \text{Mean } X]$$

Formula 2.5 in Kolen, MJ and Brennan, RL (1995). Test equating methods and practices. Springer, New York, NY. p. 30.

The old set of statistics is replaced with the new set within the equating spreadsheet for each item that is replaced. The same cut score that was used on the base test form is the observed result of the equating for some test forms in which case the same cut score is used for the new test form. The equated cut score may vary up or down on other occasions in which case ABTC has agreed to use a cut score for the new test form that is higher or lower than used on the base form in a magnitude that is indicated by the equating result. For example, if the equated cut value for a new test form was 96.8 and the cut score used on the base form was 96, then the cut score for the new form becomes 97.

Summary

The purpose of this document is to describe details associated with the assembly and use of the examination linked to the CCTC credential. The objective behind the credential is to recognize minimally competent clinical transplant coordinators through a standardized examination that candidates voluntarily take. Examination forms are assembled from items of the multiple-choice type, which are dichotomously scored as correct or incorrect. A compensatory cut score is compared to each candidate's score to determine whether a candidate achieves the credential.

Each test form is assembled from items, some of which have a long legacy and other items that were recently validated. Each new item is approved while following a standard procedure, which is intended to promote public protection, encourage fairness to candidates, and minimize sources of measurement error.

Each test form is assembled according to specifications covering content domains, cognitive complexity, and organ group. When coupled with a plan to closely reproduce the measurement scale of the base form within each new form, we assert that candidates experience an equivalent level of challenge among test forms as decisions to certify and do-not-certify are made.

Index of Examination Features

	Feature	Detail
1.	Job analysis year for current testing cycle	2013
2.	Start of current testing cycle	2015
3.	Forms released at start of cycle	CLIAB17A, CLIAB18A
4.	Number of forms released each year	1
5.	Number of forms maintained in the network	2
6.	Recommended time frame for next job analysis	2018 to 2021
7.	Recommended time frame for start of the next testing cycle	2020 to 2023
8.	Candidate eligibility	12 months of work experience as a transplant coordinator
9.	Objective behind examination	assess whether individuals who provide transplant coordination care are sufficiently competent to protect recipients while facilitating optimal care during the months and years after transplantation
10.	Type of examination stimuli	multiple-choice items containing four options
11.	Examination content contributors	transplant coordinators
12.	Number of members appointed to the examination committee	9
13.	Time between final item response submission and results delivery	1 minute
14.	Minutes available to submit examination responses	180
15.	Number of scored test items	150
16.	Number of pretest items per set	25
17.	Number of pretest sets per form	1
18.	ADA accommodations	yes
19.	Examination administration tool	computer
20.	Item sequence scrambling for each candidate	yes
21.	Option sequence scrambling for each candidate	no
22.	Candidate response scoring scheme	dichotomous (0, 1)
23.	Reliability index	Kuder-Richardson Formula 20
24.	Decision consistency index	Livingston
		Subkoviak
25.	Standard error value	Standard error of measurement
		Conditional standard error of measurement

	Feature	Detail
26.	Test form assembly specifications	8 content domains
		3 cognitive levels
		9 organ groups
27.	On-site proctor	yes
28.	On-site candidate authentication	yes
29.	Number of cut scores	1
30.	Cut score type	compensatory, criterion-referenced
31.	Candidate population on which Classic Test Theory item statistics are calculated	first-time
32.	Number of responses from first-time candidates last year	141 between February 23, 2015 and February 22, 2016
33.	Number of responses from first-time candidates expected for each pretest item	at least 130
34.	Justification for releases of psychometrically-equivalent test forms	test form assembly specifications satisfied without variation
		scale equivalence comparison between new form and base form through linear equating when scales are based on Classic Test Theory



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