

**Review of ABC and BOC Prosthetics, Orthotics, Orthotic Fitter and Pedorthics**

**Job Task Analyses and Certification Tests for the Commonwealth of Kentucky**

**Michael R. Cunningham, Ph.D.**

***Confidential report prepared for the Kentucky Board of Prosthetics, Orthotics & Pedorthics.***

***Not for distribution. ABC data redacted per their request.***

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**Executive Summary**

- In the fall of 2013, the Kentucky Board of Prosthetics, Orthotics & Pedorthics (hereafter referred to as the KY Board) undertook a review and evaluation of reports from two companies that provide professional certification tests.
- Both the American Board for Certification (ABC) and the Board of Certification (BOC) contracted with qualified outside organizations to conduct a series of Job Task Analyses for the practice of Prosthetics, Orthotics, Orthotic Fitter and Pedorthics. Both groups solicited the input of a respectable sample of currently practicing professionals. Both sets of analyses appear to be competently executed, although some customary procedural information and results data were not located in the reports of both organizations.
- ABC used the same six content Domains to characterize all four professions, whereas BOC used seven to nine Content Areas. In addition, ABC divided professional performance into Tasks and statements of Knowledge and Skills, whereas BOC used the term Task to describe all aspects of professional performance. Across the four professions, there was modest correspondence between the number of Tasks, Knowledge and Skill statements specified by ABC, and the number of Tasks specified by BOC,  $r = .35$ , *ns*. There was no evidence presented that demonstrated that either the ABC or BOC approach to defining the professional domains was more accurate or preferable.
- ABC's Job Task Analysis assessed perceptions of the percent of time spent on various tasks, and the "criticality" of those tasks. BOC's Job Task Analysis assessed only perceptions of the "significance" of the tasks. The present author conducted additional analyses using the data presented in the ABC and BOC tables. At the level of their 6 equivalent Domains, the correlation between ABC's criticality ratings and BOC' significance ratings was  $r = .95$ ,  $p < .001$ , indicating that the two organizations were tapping similar constructs.
- There was moderate correspondence between the total number of Multiple Choice items specified by ABC, and the number of Multiple Choice items specified by BOC, for the four professional tests,  $r = .58$ , *ns*, indicating roughly comparable assessments.
- Within the tests, there was high correspondence between ABC and BOC with respect to the number of Multiple Choice items allocated to the six equivalent Domains for Prosthetists and Orthotists,  $r = .96$ ,  $p < .02$ . There was moderate correspondence between ABC and BOC for the allocation of items to domains for Orthotic Fitter,  $r = .62$ . Item allocations to Domains were not located for BOC Pedorthist.
- There was no evidence presented that demonstrated that either the ABC or BOC approach to the Multiple Choice examinations was more accurate or preferable. In the context of the information available, both the ABC and BOC Multiple Choice examinations seem appropriate to evaluate knowledge of the profession of Prosthetics, Orthotics, Orthotic Fitter and Pedorthics (see Tables 1 & 2).

- Neither ABC nor BOC provided a clear report of precisely how the content of their Written Simulation examinations for the profession of Prosthetics and Orthotics were derived from the results of the Job Task Analyses. The fact that both sets of examinations had the input of test professionals and practice professionals suggests that some degree of confidence is warranted, but that is not a substitute for full psychometric documentation.
- The BOC Written Simulation examinations had much lower pass rates than the ABC Written Simulations (BOC avg. 45%; BOC Prosthetics 58%, BOC Orthotics 32%; [REDACTED]). The BOC data were based, however, on a shorter sampling period, and may change over time. The BOC pass rates also could be justified by high reliability data.
- There was no evidence presented that demonstrated that either the ABC or BOC approach to the Written Simulation examinations was more accurate or preferable. In the context of the information available, both the ABC and BOC Written Simulation examinations seem appropriate to evaluate knowledge of the profession of Prosthetics and Orthotics.(see Tables 1 &2).
- Neither ABC nor BOC provided clear reports of precisely how the content of their Practical Examinations were derived from the results of their Job Task Analyses. The fact that both sets of examinations benefitted from the input of testing professionals and practice professionals suggests that some degree of confidence is warranted, but, again, that is not a substitute for full psychometric documentation.
- ABC uses a commendable but costly Practical Examination procedure that requires candidates to travel to Texas and be observed by professionals while performing six procedures. BOC requires candidates to have themselves videotaped while performing one procedure. It is possible that BOC candidates could practice their performance until they were able to submit one good take, making it more of a demonstration than a test. That taped performance is reviewed by BOC professionals, but it is not clear that they are capable of judging the “freshness” vs. rehearsed nature of the performance.
- The BOC Practical Examination had a higher pass rates than the ABC Written Simulations (BOC avg. 87.5%; BOC Prosthetics 91%, BOC Orthotics 84%; [REDACTED]). Unfortunately, BOC was able to offer only small samples of data, and weak correlations with performance on their written examinations, to support the validity of their Practical Examination.
- There are four points in favor of BOC’s current approach to Practical Examinations:
  - The BOC Practical Examination imposes minimal costs on professional applicants who have demonstrated their competence on their Multiple Choice and Written Simulation examinations.
  - BOC professionals’ reviews of the videotaped performance have high reliability, suggesting that the judges may be effectively measuring the competence portrayed in the candidate’s performance.

- While the pass rate of the BOC Practical Examination is high, the pass rate of other BOC examinations is lower, so it is likely that very few truly incompetent candidates are certified by BOC.
- Steve Nettles, a member of the Applied Measurement Professionals, Inc. (AMP) testing firm under contract to BOC argued (see Appendix): “to the best of BOC's recollection, no one has ever challenged the competence of a practitioner who has passed the VPE and the other two assessments, i.e., credentialed by BOC.” While Nettles conclusion speaks to the overall validity of the BOC certification process rather than the differential validity of the BOC Video Practical Examination, it argues for acceptance of the BOC testing procedure as is.
- There are three grounds to be concerned about BOC’s current approach to Practical Examinations
  - BOC Video Practical Examination procedure covers only one procedure, about which candidates are informed in advance and have an opportunity to rehearse. This may make their performance unrepresentative of their actual ability.
  - The pass rates for the BOC Video Practical Examination are rather high, and, in the report BOC provided, eliminated only one candidates who passed their Multiple Choice and Written Simulation examination
  - The data offered in support of the BOC’s Video Practical Examination are scant. Steve Nettles conceded the latter point, stating: “To draw any conclusions, positively or negatively, about the VPE exams with these limited data is premature at best.”
- This independent review concurs that inadequate data have been provided by BOC at this time to justify a determination that the VPE, considered alone, is valid. Given the stringency of the other BOC tests, however, this independent review concludes that candidates for certification and licensure in the disciplines of Prosthetics and Orthotics who have passed all three BOC examinations are likely to possess the preparation and skills for professional practice in those disciplines. The BOC examinations for Orthotic Fitter and Pedorthics, although limited to one multiple choice examination each, also meet current professional standards.
- If insufficient support for the validity of the BOC Video Practical Examination is perceived by the KY Board, three alternatives might be considered:
  - The KY Board could delay approval of the BOC Video Practical Examination results until more dispositive data are presented by BOC on the current examination. In the meantime, the KY Board could require all candidates to take the ABC Practical Examination. This could represent a financial burden for some candidates. This also would require ABC’s cooperation in accepting candidates who took the BOC Multiple Choice and Written Simulation examinations, rather than their own.
  - Alternately, the KY Board could ask for enhancements of the BOC Video Practical Examination. To prevent the undermining of the BOC assessment due to rehearsal and retakes, the KY Board could require BOC to add a second performance requirement that was not announced in advance on the web. The nature of the second procedure would be transmitted to registered candidates only on the day that they plan to tape their other performance. The second presentation would be less of a demonstration

**and more of a test of the candidate's skills. This approach would require pilot testing on the part of BOC, entailing some delay.**

- **Alternately, to prevent the undermining of the assessment due to rehearsal and retakes, the KY Board could require BOC to instruct the candidates to perform one or more procedures live, before a camera connected to the internet video program Skype, or a comparable program. The performance would be videotaped, but a BOC proctor could also ask questions of the candidate, or request small modifications in the procedure. This approach would require pilot testing on the part of BOC, entailing some delay.**

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**Background:** In the fall of 2013, the Kentucky Board of Prosthetics, Orthotics & Pedorthics (hereafter referred to as the KY Board) sought external professional input for reviewing and evaluating the presentations from two companies that provide certification tests, in order to determine the best test formats to utilize at the state level.

The American Board for Certification (ABC) furnished information dated July 30, 2013 about their Prosthetics, Orthotics, Orthotic Fitter and Pedorthics examinations in three documents ranging from 76 to 102 pages in length. On September 13, 2013, the Board of Certification (BOC) circulated a one-page outline describing their intended oral presentation of information concerning their job task analyses and tests for the Orthotist, Prosthetist, Orthotic Fitter, and Pedorthist certifications.

In advance of their intended presentation, BOC was asked for a complete description of the procedures used to determine the content that is covered by each examination and the criteria used to establish the validity and reliability of each test, including statistics supporting such validity and reliability. Sixteen PDF documents were sent by BOC via drop box service one week before the meeting, on Oct. 15, 2013, including four documents on their Job Task Analyses for their Prosthetics, Orthotics, Orthotic Fitter and Pedorthics examinations, which ranged from 27 to 103 pages long. Ultimately, the data available to support the BOC tests was more extensive than that available for the ABC tests.

The KY Board's Special Meeting was held on October 23, 2013. The first presentation was at 9:00am by ABC. The second presentation was BOC at 1:00pm. The presentation and ensuing discussion consumed most of the day. Questions were raised about the job task analysis, and the reliability and validity of the Multiple Choice, Written Simulation and Practical Examination sections of the two examinations.

Many issues were addressed to the satisfaction of those in attendance, but other questions required additional information or data from the presenting companies. Additional information about the Practical Examination was obtained after several exchanges of emails. Some desired data on the reliability and validity of the Multiple Choice and Written Simulation examinations were not obtained, as noted in the relevant sections below. Such information probably would be furnished by the two companies if time were available to pursue these requests with the same level of persistence required for obtaining information about the Practical Examinations.

### **I. Job Task Analyses**

A Job Task Analysis is conducted to determine the essential tasks or activities involved in a job, including their frequency of performance and their importance. That information is then used as the basis for the creation of assessments of a candidate's knowledge, skills and abilities to perform the job.

#### **I.A. ABC Job Task Analyses Overview**

ABC contracted with Professional Examination Service (ProExam) to develop and implement their practice analysis and validation studies. ABC reported that it conducted "practice analysis and validation studies" for the disciplines of Prosthetics and Orthotics in 1990, 1999, and 2006. Data for those two disciplines are presented together, because that was the approach taken in the original ABC report, which did not consistently separate information pertaining to Prosthetics and Orthotics. Practice

analysis studies for the Orthotic Fitter profession were conducted in 2004, 2006 and 2010, and for the Pedorthic profession in 2001 and 2008, and are presented in that order.

### **I.B. BOC Job Task Analyses Overview**

BOC contracted with Applied Measurement Professionals (AMP) to develop and implement their Job Task Analyses. The Prosthetics and Orthotics Job Task Analysis data were derived from the same 2011 sample, but were presented in separate reports. The reviews of the BOC Job Task Analyses are presented in order of methodological refinement. The Prosthetist Job Task Analysis is presented first because it is the most complex and sophisticated. The Orthotics analysis used a subset of items from the Prosthetist Job Task Analysis. The Orthotic Fitter Job Task Analysis was conducted separately in 2010, with some variation in methods. The Pedorthist Job Task Analysis was conducted in 2007 with simpler methods. Comments and concerns expressed about the Prosthetist Job Task Analysis are intended to apply to the other Job Task Analyses when they use comparable methods and procedures.

#### **I.A.1/2 ABC Prosthetist and Orthotist Job Task Analyses**

ABC sought responses from 2578 Certified Practitioners, and received completed responses from 718, for an overall return rate of 32%, which is adequate. Demographics on the responding Prosthetists and Orthotists suggested a fairly diverse sample. The work was overseen by an eight member task force of certified practitioners; their home states were not reported.

ABC described the procedures and results for their Prosthetist and Orthotist Job Task Analyses in the same Practice Analysis report. The same six Domains were used for both disciplines, and 57 tasks were allocated to those domains. The designation of Domains and the allocation of tasks to Domains was apparently done on an *a priori* basis, rather than with input from the survey respondents.

The six domains are: 1. Patient Assessment; 2. Formulation of the Treatment Plan; 3. Implementation of the Treatment Plan; 4. Follow Up to the Treatment Plan; 5. Practice Management; 6. Promotion of the Competency and Enhancement of Professional Practice. Respondents were asked to report the percentage of time that they spent at each task during the past year, and how critical was each task for optimizing outcomes, on a 1 to 4 scale.

There are grounds to question whether these six Domains are sufficient to define the Prosthetist and Orthotist Domain. Because neither a review of the literature nor factor analysis results were presented to justify the six Content Areas, it cannot be determined whether six is the optimal number of Prosthetist Content Areas, rather than, for example, the ten Content Areas used by BOC for Prosthetists, the nine used by BOC for Orthotist, or some larger number of Domains.

The number of domains employed in the Job Task Analysis is consequential, because it may influence the number of Multiple Choice, Written Simulation and Practical Examination items that are allocated. The number of items in a domain influences the depth of testing on that competency, and therefore the qualifications of the professionals recommended for certification. Some indeterminacy on this issue may be overlooked, however, if the rest of the examination process seems sound.

Results of the ABC Prosthetics and Orthotics Job Task Analysis indicated that forty-three of those 47 tasks associated with direct patient care were performed frequently to routinely. All of the 57 tasks were rated as moderately to very critical. On only four of the 57 tasks did the frequency ratings of



Prosthetists and Orthotists differ by more than .3 of a rating scale point, and on only one task was there a difference in criticality rating.

It is interesting to note that, in a series of meta-analysis analyses conducted by the author for the KY Board, there was only a small and insignificant correlation between “% of time spent” and “Criticality” ratings at the level of the six domains ( $r = .32, p < .54$ ), suggesting little relation between the importance of a task and the amount of time that it consumed. Unfortunately, the reliability coefficients for those time spent and Criticality ratings were not located, so the quality of the data cannot be evaluated.

It should be noted that ABC’s number of domains, and the number of tasks, were noticeably fewer than that used by BOC, described below. Yet ABC also assessed respondent’s perception of 47 Knowledge and 27 Skill statements in terms of their criticality and their acquisition, the latter defined as “at what point should this knowledge or skill be acquired by a Certified Practitioner”. Some of the Knowledge and Skill statements were excessively broad, such as “Loss control (e.g., risk management, inventory control)” and “Research methodology and literature” and might have been subdivided into tighter categories.

Seventy-one of 74 Knowledge and Skill statements were regarded as moderately to highly critical and 61 of 74 statements were supported for acquisition before passing the ABC Prosthetics and Orthotics Examinations. ABC’s practice analysis also asked Prosthetists about their performance of tasks involving 39 prosthetic devices, and asked Orthotists about their performance of tasks involving 31 orthotic devices. It is not clear how, or if, this became an explicit part of the ABC Certification examination.

### **I.B.1 BOC Prosthetist Job Task Analysis**

A Job Analysis Committee was appointed by BOC to oversee this 2010 study. A Job Analysis Advisory Committee with 12 professional representatives from 11 states was listed in Appendix A of the BOC Prosthetist Job Analysis report. This group created a survey to ask about 165 tasks, which would be used to develop test content.

Web invitations were circulated to 1,016 individuals, and 237 responses were received. Of these, 126 performed Prosthetist duties. Based on the numbers, education and demographics, this sample of Subject Matter Experts (SMEs) is adequate to provide significance ratings for the Job Task Analysis.

In many job analyses (such as ABC’s described above), separate assessments are made of the percent of time or frequency of performance of a task, and the importance or criticality of the task. Some tasks may be performed infrequently, yet may be highly important, such as making an ethical choice in planning a course of patient care. The present BOC Job Task analysis used only the single assessment of “significance”, which ranged from “not performed/not within scope of practice” to “minimally”, “somewhat”, “quite” and “extremely significant”. Respondents were not given definitions of the terms, or what to do with a task that falls in what appears to be a qualitatively wide gap between “somewhat significant” and “quite significant”.

There are grounds to believe that the BOC ratings of “significant” were comparable to the ABC ratings of “criticality”. At the level of their 6 equivalent Domains, the correlation between ABC’s criticality ratings and BOC’ significance ratings was  $r = .95, p < .001$ , indicating that the two companies were tapping similar constructs. As will be described below, ABC used Criticality as their primary determinant of Multiple Choice item allocations. As a consequence, BOC’s use of just one rating dimension in their Job Task Analysis should not be regarded as a deficiency.

Inter-rater reliability statistics suggest that BOC respondents handled the ambiguities inherent in rating each task's "Significance" fairly well. The interrater reliability for SMEs' ratings of the significance of the 165 tasks ranged from .86 to .97, across the ten Content Areas (defined below), indicating very good consistency across raters. There also was good internal consistency of significance ratings within Content Areas, ranging from  $\alpha=.73$  to .98.

The ratings of 97.4% of the respondents indicated that the job task inventory completely (38.46%) or adequately (58.97%) described the job of the Prosthetist. The SME ratings supported the retention of 160 of the 165 tasks, and added 1 additional task. The 5 tasks dropped were based on 4 decision rules, especially low frequency of performance.

Ten Prosthetist Content Areas were specified *a priori* by the JAC. That is, the nature, number and content of the Content Areas, and the 161 tasks linked to the 10 Content Areas, appear to have been decided by the JAC, rather than by the respondents. The ten Content Areas are: I. Facilities Management; II. Perform Professional Practice/Ethics; III. Patient Assessment/Evaluation; IV. Communication/Patient Education; V. Device Delivery and Application; VI. Patient Preparation/Measurement; VII. Patient Preparation/Assessment; VIII. Design Selection; IX. Fabrication; X. Application and Evaluation.

The 161 tasks surveyed by BOC also compares favorably with ABC's survey of 170 tasks, knowledge & skill statements and prosthetic devices. It also should be noted that BOC's ten Content Areas are more numerous and detailed than ABC's six Domains. Nonetheless, as was the case with ABC's Domains, there are grounds to question whether these ten Content Areas are necessary and sufficient to define the Prosthetist domain.

Because neither a review of the literature nor factor analysis results were presented to justify the ten Content Areas, it cannot be determined whether ten is the optimal number of Prosthetist Content Areas, rather than, for example, the six Domains used by ABC, or, to take an arbitrary figure, 15 Content Areas. The Content Area of "VIII. Design Selection" included 73 tasks, which seems like a rather large number. That Content Area might have been reasonably broken up into a number of smaller categories. Similarly, several Content Area seem to combine domains, such as "II. Perform Professional Practice/Ethics", which could have been sub-divided to create two Content Areas.

The number and labelling of Content Areas is consequential, because it has a direct influence on the allocation of Multiple Choice questions. For example, "VIII. Design Selection" with 73 tasks was allocated only 20 items. More items might have been allocated to this domain if it was represented by, for example, by five rather than one Content Areas.

BOC presented the significance rating of each individual task on their Job Task Analysis (their Appendix D,E,F), and the number of tasks within each of their ten content categories (their Table 9). BOC did not present the mean significance ratings of the tasks within the Content Areas.

### **I.B.2 BOC Orthotist Job Task Analysis**

For the Orthotist Job Task analysis, 16 Orthotists (two of whom were on the Prosthetist JAAC) from 12 states served on the Job Analysis Advisory Committee. The same methodology and sample that were used in the Prosthetist Job Task Analysis were used for Orthotists. A total of 1,016 invitations to participate in the web survey were circulated in 2010, which netted 237 useable returns, which is adequate. Of the usable responses,  $n=207$  indicated that they performed Orthotist duties. Their

significance ratings were used in the Orthotist analysis. Given the totals, many of the same respondents contributed to both the Prosthetist and Orthotist results. Nonetheless, based on the data presented, the sample seems adequate to provide ratings on the significance of the various tasks within professional practice. For the Orthotist, the significance ratings and comments indicated that 74 of the original 79 tasks should be retained and one additional task should be added.

Eight Orthotist Content Areas were specified *a priori*. (I. Facilities Management; II. Perform Professional Practice/Ethics; III. Patient Assessment/Evaluation; IV. Communication/Patient Education; V. Device Delivery and Application; VI. Patient Preparation/ Measurement; VII. Evaluation/Selection of Product/Type of Device. VIII. Fabrication). Once again, there was no demonstration that eight is the necessary and sufficient number of Orthotist Content Areas, although the specified domains seem reasonable.

The interrater reliability for SMEs' ratings of the significance of the 74 tasks ranged from .81 to .98, within the eight Content Area, indicating very good consistency across raters. There also was good internal consistency of significance ratings within Content Areas, ranging from alpha=.71 to .95.

Once again, BOC did not present the mean Significance ratings of the tasks within the Content Areas, or appear to use those metrics for item allocations. The Job Analysis questionnaire did not employ a separate question asking about item allocations for Orthotists, but appeared to use the same ten-category Question #31 used for Prosthetists. The number of tasks allocated to Content Areas I to VI was identical for Prosthetists and Orthotists. Presumably, the information pertaining to the Prosthetist categories VII. Patient Preparation/Assessment and X. Application were dropped. It was not specified how data were derived for Orthotist Content Area VII. Evaluation/Selection of Product/Type of Device, since that Content Area was not included in Question #31, but it is likely that Prosthetist Content Area VIII. Design Selection was used.

### **I.A.3. ABC Orthotic Fitter Job Task Analysis**

The ABC Orthotic Fitter job task analysis was based on a panel of 5 practitioners from unspecified locations who surveyed 1,540 ABC Certified orthotic Fitters via email, and received 245 responses (17%).

The survey covered 32 tasks, 36 knowledge statements and 18 skill statements grouped into six domains. Identical to the other ABC analyses, the six domains were: 1. Patient Assessment; 2. Formulation of the Treatment Plan; 3. Implementation of the Treatment Plan; 4. Follow Up to the Treatment Plan; 5. Practice Management; 6. Promotion of the Competency and Enhancement of Professional Practice. Once again, the domains were plausible, but there was no evidence to support that they were necessary and sufficient. The percent of time spent in five areas of practice and activities performed in connection with 58 orthotic devices also were surveyed.

All tasks were rated as being critical to optimizing outcomes (only one task was rated below 3.0 and no task was rated below 2.5). At the level of the domain, the ratings of criticality were exceptionally highly correlated with percent of time spent,  $r = .94$ ,  $p < .005$ . This correlation differs from that for ABC Prosthetists and Orthotists, and suggests either that Orthotic Fitters are in the enviable position of allocating their time to the most important tasks, or the Orthotic Fitters used one estimate (such as criticality) to derive their response on the other variable (% time spent) without actually making an independent estimate. Unfortunately, the reliability of the percent of time and criticality scores were not located, although it is likely that they were acceptable, based on the sample size.

For the knowledge and skill statements, evaluations were obtained on criticality and on the point of acquisition for the knowledge or skill. Unfortunately, those data were not presented in the ABC orthotic Fitter report. It was stated that 50 of 54 knowledge and skills were expected to have been acquired before attaining the Orthotic Fitter credential, and those percentages were reported in the Orthotic Fitter Test Specifications document, but it was not clear how such findings were utilized.

### **I.B.3. BOC Orthotic Fitter Job Task Analysis**

For the Orthotic Fitter Job Task analysis, 9 Orthotic Fitters (three of whom were on the Prosthetist and two of whom were on the Orthotist JAAC) from 9 states served on the Job Analysis Advisory Committee. The Orthotist Fitter report was based on 1,192 invitations and 309 returns in 2010. The returned surveys included 114 respondents who identified themselves as Orthotic Fitters. Based on the data presented, the sample seems adequate to provide ratings on the significance of the various tasks within professional practice.

For the Orthotic Fitter, the significance ratings and comments indicated that 67 of the original 71 tasks should be retained. Seven Orthotic Fitter Content Areas were set *a priori*. (I. Facilities Management; II. Perform Professional Practice/Ethics; III. Patient Assessment/Evaluation; IV. Communication/Patient Education; V. Device Delivery and Application; VI. Patient Preparation/ Measurement; VII. Evaluation/Selection of Product/Type of Device). Once again, there was no demonstration that seven is the necessary and sufficient number of Orthotic Fitter Content Areas, although the specified domains seem reasonable.

Inexplicably, the interrater reliability for SMEs' ratings of the significance of the 71 Orthotic Fitter tasks within the seven Content Area, and the internal consistency statistics for significance ratings within Content Areas were not located.

Once again, BOC did not present the mean significance ratings of the tasks within the Content Areas, or appear to use those metrics for item allocations. The number of tasks allocated to Content Areas I to VI was the same for Prosthetic Fitters as it was for Prosthetists and Orthotists.

### **I.A.4 ABC Pedorthist Job Task Analysis**

The ABC Pedorthist job task analysis was based on a panel of 10 practitioners from unspecified locations who surveyed "approximately 2000 Certified Pedorthists" via email, and received 699 responses (36%).

The survey covered 56 tasks grouped into six domains and 59 knowledge and 28 skill statements. Identical to the other ABC analyses, the six domains were: 1. Patient Assessment; 2. Formulation of the Treatment Plan; 3. Implementation of the Treatment Plan; 4. Follow Up to the Treatment Plan; 5. Practice Management; 6. Promotion of the Competency and Enhancement of Professional Practice. Once again, the domains were plausible, but there was no evidence to support that they were necessary and sufficient. All tasks were rated in terms of their criticality (1 to 4) and the frequency with which they are performed (1 to 4). Activities performed in connection with 26 pedorthic devices also were surveyed.

All but six of the 41 patient care tasks were rated as being performed frequently to very frequently. All tasks were rated as being moderately to very critical to optimizing outcomes. In an analysis conducted by the present author, the ratings of criticality were marginally correlated with percent of time spent at the level of the domain,  $r = .87$ ,  $p < .07$ , akin to the Orthotic Fitters. Unfortunately, the reliability of the percent of time and criticality scores were not located, although it is likely that they were acceptable, based on the sample size.

For the knowledge and skill statements, evaluations were obtained on the point of acquisition and the criticality for the knowledge or skill. Unfortunately, the acquisition ratings, but not the criticality ratings were presented in the ABC Pedorthic Test Specification. It was stated and 75 of 87 knowledge and skills were expected before attaining the Pedorthist credential, and those percentages were reported in the Pedorthist Test Specifications document, but it was not clear how such findings were utilized.

#### **I.B.4 BOC Pedorthist Job Task Analysis**

For the Pedorthist Job Task, 5 Pedorthists, whose residency was not specified, served on the Advisory Committee (AC). Rather than conduct a survey of practicing professionals, the AC made its own judgments about the suitability of the tasks, and about the item allocations. This small board is not as good as a large sample of practitioners, but is minimally adequate to provide ratings on the significance of the various tasks within professional practice.

Eight Pedorthist Content Areas were set *a priori*. (I. Facilities Management; II. Perform Professional Practice/Ethics; III. Patient/Customer Assessment/Evaluation; IV. Communication/Patient Education; V. Footwear, Orthosis or Foot Prosthesis Application and Delivery; VI. Patient/ Customer Follow-up; VII. Patient/ Customer Preparation/Measurements; VIII. Evaluation/Selection of Product/Model/Type of Orthoses/Footwear/Modifications). Once again, there was no demonstration that eight is the necessary and sufficient number of Pedorthist Content Areas, although the specified domains seem reasonable.

While the input of 5 Pedorthists is certainly better than a smaller number, there was no presentation of the interrater reliability for AC members' allocation of 89 tasks to the eight Content Areas, or for the allocation of 100 items to the eight Content Areas. The BOC Pedorthist Job Task Analysis is less persuasive than the BOC reports concerning Prosthetist, Orthotist, and Orthotic Fitter.

## **II. Multiple Choice Examinations**

Some statistical information on the Multiple Choice exams was presented in the Oct. 23 meeting, and other data were provided in follow-up emails.

### **II.A.1/2 ABC Prosthetist and Orthotist Multiple Choice Examinations**

All of the data on 131 tasks, knowledge & skill statements for Prosthetists and Orthotists were presented in table form. But, there was no report of precisely how the data on criticality, percent of time, and acquisition time were used to create test specifications for the 150 Multiple Choice items. As a consequence, the degree of alignment of the results of the job task analysis to the ABC Multiple Choice test, is unknown because it is unstated (although good professional practice suggests that it is likely to be appropriately aligned).

In an effort to reverse-engineer the ABC Prosthetist and Orthotist Multiple Choice item allocation process, correlations were computed by the present author between the % of Time data and Criticality data in the Practice Analysis report, and # of items at the domain level in the ABC Orthotics Test Specification document. One of the six ABC Domains, Promotion of the Competency and Enhancement of Professional Practice, was excluded from the test specifications, presumably because it was not relevant to new practitioners. These calculations indicate that criticality ratings played a significant role ( $r = .88, p < .05$ ) in the number of items allocated to an Orthotics domain, whereas % of time ratings had a negligible influence ( $r = .37, p < .54$ ) on item allocation decisions. Comparable data were unavailable

for the Prosthetics discipline. Multiple Choice items also were allocated to 47 Knowledge and 27 Skill statements but the criteria used for these allocations were not specified.

Unfortunately, no data were located in the ABC reports on the reliability of the Prosthetist or Orthotist Multiple Choice Examination as a whole, or the reliability of the five domains, or the correlations among the five domains. Chances are that such data could be provided by ABC, but it would have been more helpful had they been included in the written reports submitted to the KY Board. Similarly, ABC described what sounds like an effective system for monitoring item statistics for their tests, but few details were provided. For example, what level of pass rate, item-total correlation, or discrimination index are used to retain vs. discard and replace an item on the test?

ABC reported that the 2012 pass rate for the Prosthetics Multiple Choice examination was 78% for first time test takers, 47% for repeat test takers, and 68% overall, making it a fairly stringent examination. The ABC Orthotics Multiple Choice examination had a pass rate of 85% for first time test takers, 66% for repeat test takers, and 79% overall, making the Orthotics Multiple Choice test 10% easier to pass than the ABC Prosthetics Multiple Choice test, although both seem acceptable.

Offering some support to the validity of the ABC examination process were significant correlations between the Multiple Choice examination scores, Written Simulation scores and Practical Examination scores (called Clinical Patient Management by ABC). [REDACTED]

### **II.B.1 BOC Prosthetist Multiple Choice Examination**

The mean Significance ratings of the tasks within the Content Areas were not located in the BOC reports. In addition, BOC did not appear to use those metrics, or the number of task within a Content Area, for their Multiple Choice item allocations. Rather than using the Job Task Analysis significance ratings to determine their item allocations, it appears that the BOC Job Task analysis relied on respondents' answers to a single question in survey section #31 (p. 45). That question asked respondent to report: "What percentage of a test would you allocate to each of the following areas?" and listed their ten Content Areas.

Although that is a legitimate approach to obtaining item allocation information from respondents, three limitations should be noted with that approach: (1) Respondents were not given explicit definitions of what tasks and competencies were included in the Content Areas (although that could have been deduced from the layout of the survey). (2) Respondents were not reminded that some Content Areas consist of 3, 5 or 6 tasks and some consist of 18, 20 or 73 tasks. Presenting ten categories in a simple column could have led respondents to largely treat them as equally important. As it happened, there was relatively little variance in item allocations across categories. The lowest number of items recommended for a Content Area was 6.76% for I. Facilities Management and the highest recommendation was 13.06% for III. Patient Evaluation, which amounts to a range of 10 +/- 3%. This might be appropriate if the mean significance ratings of the tasks within Content Area varied by only the same degree. But, because mean significance ratings were not presented for the Content Areas, the

correlation between the mean significance ratings of the tasks within a Content Area could not be correlated with item allocations.

There was a third problem with asking respondents how they would allocate items to the ten Content Areas. (3) Respondents were given no opportunity to recommend item allocations within the relatively broad, compound Content Areas. In allocating items to “II. Perform Professional Practice/Ethics”, for example, the question is not asked of respondents about what percentage of questions should be about performance and what percentage should be about ethics. The task significance data could have provided guidance here, but it does not appear to have been consulted in item allocation decisions.

In an analysis conducted by the present author, the mean number of items recommended by the SMEs (Table 8) was significantly related to the Content Area allocation ( $r = .88, p = .001$ ). It should be noted that the present use of a priori Content Area categories and molar recommendations of item allocations by professionals is a defensible approach to item allocation. A methodology for item allocation that explicitly included the number of tasks, and the mean task significance ratings of the tasks within Content Areas, however, might have made better use of the full Job Task analysis data.

The BOC’s Prosthetist Final Reported stated that “The EC discussed each task in each section and considered the typical complexity of task performance” (p. 19) in terms whether it required Recall, Application or Analysis/Evaluation. The formation of the EC was not described, nor were data presented on the reliability of their judgments. Across Content Areas, 47 items were supposed to be Recall, 68 Application and 35 Analysis. Apparently, this information was intended to guide the item writers and Job Analysis Committee, and did not appear to directly influence scoring of the test.

The internal consistency of the BOC 150 item Prosthetics Multiple Choice exam was reported to be .91-.95, which is commendable. The internal consistency of the Content Categories reported for PROBF06 ( $n=35$ ; percent passing =85.71) were lower, ranging from KR20= “near zero” for Perform Professional Practice/Ethics to .68, with an average of KR20=.47. This is rather low; a score of .70 is conventionally regarded as acceptable. The authors endeavored to enhance the scores using the controversial Spearman-Brown Prophecy Formula adjusting for a 150 item test. Because the KR20 for the test as a whole was .91 and the test as a whole is used for selection, these low scores are not seen as a major problem, especially since comparable data are unavailable for ABC.

The cut-point for passing scores were determined by the Anghoff method, in which subject matter experts specify whether or not each question on the test should be answered correctly by a minimally qualified applicant. This approach is commendable, and serves as partial compensation for the questionable decision not to use the significance ratings of the tasks during the Job Task Analysis and item allocation process.

The five judges’ ratings were fairly reliable, with an intraclass correlation of .96. The mean rating across items was 71.32. This rating suggests a passing point of 107 correct answers ( $150 \text{ items} * .7132 = 106.98$ ). The cut score actually used was adjusted downward to 102. The pass rate of 46 candidates was 71%. This indicates that the BOC Prosthetist Multiple Choice examination was fairly stringent

The correlation of the BOC Multiple Choice exam with the BOC Prosthetics Written Clinical Simulation exam was a modest  $r = .35, p < .001$ , based on  $n=79$  candidates. That indicates that 12% of the variation in scores was jointly assessed by the Multiple Choice and the Clinical simulation exams, and 88% of the variance was non-overlapping, due to tapping separate domains, or error. The Written Simulation exam

was divided into Information Gathering and Decision Making and the correlation with the Multiple Choice exam was  $r = .45$ ,  $p < .001$ ,  $n = 79$ , and  $r = .19$ ,  $p < .09$ ,  $n = 79$ , respectively. The correlation of the Multiple Choice exam with binary pass/fail scores on the Video Practical Examination was  $r = .30$ , ns., based on 12 candidates. This correlation indicates a 9% overlap in the variance in skills assessed by the Multiple Choice and Practical Exam, indicating substantial divergence in the two assessments.

To fully examine the Prosthetist Multiple Choice examination from both BOC and ABC, and ensure that all components are functioning appropriately, it would help to have (a) the inter-correlations of scores for the 10 Content Areas and (b) the correlation of scores for the 10 Content Areas with scores for the Written Clinical Simulation exam and the Video practical Exam. Such data were not located for ABC, so this should not be regarded as a major problem.

Given the limitations of the Job Task Analysis and the data provided, however, the BOC Prosthetics Multiple Choice Examination appears to be an appropriate certification examination.

### II.B.2 BOC Orthotist Multiple Choice Examination

Although there were only half the tasks in the BOC Orthotist ( $n = 74$ ) compared to the Prosthetist ( $n = 161$ ) Job Task analysis, BOC again chose to have 150 Multiple Choice items in the Orthotist exam. This allowed heavier content saturation. Analyses conducted by the present author revealed that the number of tasks in the Orthotist Content Area was significantly correlated with the number of Multiple Choice items allocated to that Content Area ( $r = .73$ ,  $p = .04$ ). There were some discrepancies, such as two tasks under Fabrication, but 20 items allocated, despite the Job Task analysis respondents recommending only 14 items (9.29% of 150). Nonetheless, the mean number of items recommended by the SMEs on question # 31 (if properly interpreted, see above) was significantly related to the number of items allocated to the Content Areas ( $r = .82$ ,  $p = .01$ ).

The internal consistency of the BOC 150 item Orthotist Multiple Choice exam was reported to be .87-.93, which is commendable. The internal consistency of the Content Categories reported for a sample of candidates who took the ORTOF06 ( $n = 82$ ; percent passing = 70.73) were lower, ranging from KR20 = .30 to .68, with an average of KR20 = .50. This is rather low, although the authors endeavored to enhance the scores using the controversial Spearman-Brown Prophecy Formula. Because the KR20 for the test as a whole was .90 for this sample, and the test as a whole is used for selection, these low Content Category scores are not seen as a major problem, especially since comparable data are unavailable for ABC.

The cut-point for a passing scores was again determined by the Anghoff method. The judges' ratings were reliable, with an intraclass correlation of .92. The mean rating across items was 76.31. This rating suggests a passing point of 114 correct answers (150 items \* .7631 = 114.47. The BOC Passing Point Studies report suggested a raw passing score of 136, which appears to be incorrect). The cut score that was actually used was adjusted downward to 91. The pass rate of 85 candidates was 74%, as reported in the October meeting PowerPoint, and the pass rate of 203 candidates was 69.95% as reported in BOC ORT Additional analyses. This indicates that the BOC Orthotist Multiple Choice examination was fairly stringent [REDACTED]

The correlation of the BOC Multiple Choice exam with the Orthotist Written Clinical Simulation exam was moderately high,  $r = .64$ ,  $p < .0001$ , based on  $n = 137$  candidates. The Written Simulation exam was divided into Information Gathering (IG) and Decision Making (DM); the correlation with the Multiple Choice exam with IG was  $r = .55$ ,  $p < .0001$ ,  $n = 137$ , and with DM was  $r = .65$ ,  $p < .0001$ ,  $n = 137$ . The correlation of the Multiple Choice exam with binary pass/fail scores on the Video Practical Examination



was lower,  $r=.37$ ,  $p < .07$ , based on 25 candidates. This correlation indicates a 14% overlap in the variance in skills assessed by the Multiple Choice and Practical Exam, indicating substantial divergence between the two assessments.

Again, to fully examine the BOC Orthotist Multiple Choice examination, and ensure that all components are functioning appropriately, it would help to have (a) the inter-correlations of scores for the 9 Content Areas and (b) the correlation of scores for the 9 Content Areas with scores for the Written Clinical Simulation exam and the Video practical Exam. Such data were not located for ABC, so this should not be regarded as a major problem.

Given the limitations of the Job Task Analysis and the data provided, however, the BOC Orthotist Multiple Choice Examination appears to an appropriate certification examination.

### **II.A.3 ABC Orthotic Fitter Multiple Choice Examination**

The ABC Orthotic Fitter exam consists of 150 items. The ABC Job Task Analysis results appear to be directly related to the test specifications. Independent analyses indicated that percent of time that was reportedly devoted to tasks in the Job Task Analysis was strongly correlated with percent of items allocated to a domain ( $r = .998$ ,  $p < .0001$ ) and criticality ratings were strongly correlated with the number of items allocated to a domain ( $r = .938$ ,  $p < .02$ ).

Unfortunately, internal consistency scores for the exam as a whole, and within each of the five domains tested, were not located in the documents provided by ABC.

The Orthotic Fitter Test Specification document reported the percent of respondents who thought that each of 54 knowledge and skills should be acquired prior to credentialing. The linkage of those results to the item allocations, however, are not clear. For example, knowledge of hand and power tools is listed in a category called Materials/Equipment/Tools. Such knowledge was expected by 56% of the sample participants to be possessed by candidates for certification, but it is not clear if any Multiple Choice items are devoted to the topic.

Additional Knowledge and Skill categories, including Anatomy/Physiology, Pathologies, and Biomechanics contained Knowledge and Skill items that were strongly endorsed as necessary before certification, but it is not clear how that content was tested in the ABC examinations. If such information formed the basis for the Written Simulation or Practical Examination content, that should be so stated.

ABC used their SME team to examine each item, although the precise criteria that they used in some of their evaluations was not reported. To establish the passing point, ABC used the Anghoff criterion-referenced method, in which the SMEs indicate whether a minimally competent candidate should be able to correctly answer the item. Ratings were made on a 10 point scale. The passing point was equivalent to the average rating competency rating across all items. The passing point score was not located in the documents provided.

### **II.B.3 BOC Orthotic Fitter Multiple Choice Analysis**

Although there were a similar number of tasks identified in the BOC Orthotist ( $n=74$ ) and Orthotic Fitter ( $n=67$ ) Job Task Analysis, BOC chose to have 100 (rather than 150) Multiple Choice items in the Orthotic Fitter exam. Analyses revealed that the number of tasks in the Orthotist Fitter domain was positively (but not significantly) correlated with the number of Multiple Choice items allocated to that Content

Area ( $r = .50$ ,  $p = .25$ ). Again, there were discrepancies between the Job Task Analyses and the Multiple Choice item allocations. For example, there were three tasks under the Patient Preparation/Measurement category, but 16 Multiple Choice items were allocated, despite the Job Task analysis respondents recommending only 14 items (14.38% of 100). Similarly, 16 items were allocated to "III. Patient Assessment/Evaluation" despite that Content Area having 18 tasks, and the respondent recommending 18 items (17.65% of 100). The mean number of items recommended by the SMEs was not significantly related to the number of items allocated to the Content Areas ( $r = .58$ ,  $p = .17$ ). That indicates that the Orthotic Fitter test was designed with only moderate correspondence to the recommendations of the Job Analysis Task respondents.

The internal consistency of the 100 item BOC Orthotic Fitter Multiple Choice exam was reported to be .79, which is commendable. Internal consistency scores for the seven content categories in Form COFBF06 ranged from KR20=.12 to .48, with an average of KR20 average .36, which is quite low. The authors endeavored to enhance the scores using the controversial Spearman-Brown Prophecy Formula adjusting for a 100 item test. Because the KR20 for the test as a whole was acceptable and the test as a whole is used for selection, these low scores are not seen as a major problem, especially since comparable data are unavailable for ABC.

The cut-point for a passing scores were again determined by the Anghoff method. The three judges' ratings were moderately reliable, with an intraclass correlation of .73. The mean rating across items was 74.50. This rating suggests a passing point of 75 correct answers ( $100 \text{ items} * .7450 = 74.50$ ). The cut score that was actually used was adjusted downward to 69, which seems like a low score (equivalent to a D+ in a college course). The BOC Orthotic Fitter Test Analysis Report stated that the pass rate of 280 candidates was 52.86%. This indicates that the BOC Orthotic Fitter Multiple Choice examination was quite challenging.

Comparable data from ABC were unavailable concerning the foregoing issues, so it is premature to regard them as a problem. Because there was no Written Clinical Simulation or Video Practical Examination for the Orthotic Fitter, there are no additional data on which to assess the validity of the Orthotic Fitter Multiple Choice examination.

#### **II.A.4 ABC Pedorthist Multiple Choice Examination**

The ABC Pedorthist exam consists of 165 items. The ABC Job Task Analysis results appear to be directly related to the test specifications. Independent analyses indicated that percent of time devoted to tasks was strongly correlated with percent of items allocated to a domain ( $r = .999$ ,  $p < .0001$ ) and criticality ratings were strongly correlated with the number of items allocated to a domain ( $r = .842$ ,  $p < .074$ ).

Unfortunately, internal consistency scores for the exam as a whole, and within each of the five domains tested, were not located in the documents provided by ABC.

The Pedorthist Test Specification document reported the percent of respondents who thought that each of 87 knowledge and skills should be acquired prior to credentialing. The linkage of those results to the item allocations, however, are not clear.

ABC used their SME team to examine each item, although the precise criteria that they used in some of their evaluations was not reported. To establish the passing point, ABC used the Anghoff criterion-referenced method, in which the SMEs indicate whether a minimally competent candidate should be able to correctly answer the item. Ratings were made on a 10 point scale. The passing point was

equivalent to the average rating competency rating across all items. The passing point score was not located in the documents provided, nor was the passing rate.

#### **II.B.4 BOC Pedorthist Multiple Choice Examination**

The internal consistency of the BOC 100 item Pedorthist Multiple Choice exam was reported to be .84-.88, which is commendable. Internal consistency statistics for the 8 Content Categories ranged from KR20= .10 to .66 with an average KR20 = .46, which is quite a bit below the convention standard of .70. The authors endeavored to enhance the scores using the controversial Spearman-Brown Prophecy Formula adjusting for a 100 item test. Because the KR20 for the test as a whole was acceptable and the test as a whole is used for selection, these low scores are not seen as a major problem, especially since comparable data are unavailable for ABC.

The cut-point for a passing scores were again determined by the Anghoff method. The eight judges' ratings were moderately reliable, with an intraclass correlation of .90. The mean rating across items was 66.45. This rating suggests a passing point of 66 correct answers (100 items \* .6645= 66.45. The cut score that was actually used was adjusted upward to 68, which still seems like a low score (equivalent to a D+ in a college course). The BOC Pedorthist Test Analysis Report stated that the pass rate of 65 candidates was 56.92%. This indicates that the BOC Pedorthist Multiple Choice examination was highly challenging.

It would be inappropriate to draw negative conclusions about the BOC Multiple Choice examination based on any of the foregoing, because comparison data for ABC were not located for most points and might have been no better. Because there was no Written Clinical Simulation or Video Practical Examination for the Pedorthist exam, there are no additional data on which to assess the validity of the Orthotic Fitter Multiple Choice examination.

### **III. Written Clinical Simulation Examinations.**

Both ABC and BOC have Written Clinical Simulation Examinations that are intended to assess the candidates' information gathering, reasoning and decision-making when faced with a clinical problem. The Written Clinical Simulation Examinations have just as much impact of the candidates' prospects for certification as the Multiple Choice Examination or the Practical Examination; a failure on any component will require a successful retake.

The Written Clinical Simulation Examination results can be evaluated with traditional psychometric criteria for reliability; content, convergent and discriminant validity and pass rates but much of the information necessary to make such evaluations was not located in the ABC and BOC documents.

#### **III.A.1 ABC Prosthetist Written Clinical Simulation Examination.**

ABC created additional test questions for its Written Simulation examinations, which appears to focus on 6 domains. The Prosthetics simulation was described as possibly including management of the transradial and transhumeral upper extremity amputee, transfemoral, transtibial or partial foot amputee and immediate postoperative fitting procedures.

Unfortunately, the linkage of the Job Task Analysis to the Written Simulation, the precise number of responses scored, reliability of the Written Simulation examination items, and procedures for determining a passing score for the Written Simulation were not located in the available ABC documents. [REDACTED]

[REDACTED] This indicates moderate overlap of the Written Clinical Simulation with the other two components of the ABC Prosthetist certification test.

### **III.B.1. BOC Prosthetist Written Clinical Simulation Examination**

In addition to the Multiple Choice examination, the BOC Prosthetist exam includes 8 Written Clinical Simulation Exam (CSE) problems. The Prosthetist report (p. 98) specifies 8 types of amputations that could be on the examination: CSE (Transtibial, Transfemoral (traumatic), knee disarticulation, transradial and/or transhumeral, partial foot, symes, transfemoral, bilateral lower limb (traumatic). The BOC Prosthetist Simulation Matrix Form PROBS06 indicated the problems were focused on 8 domains: III. Patient Assessment/Evaluation; IV. Communication/Patient Education; V. Device Delivery and Application; VI. Patient Preparation/ Measurement; VII. Patient Preparation/Assessment; VIII. Design Selection; IX. Fabrication; X. Application and Evaluation. There were 18 items on Information Gathering and 34 items on Decision-Making. The linkage of this content to the Job Task analysis was not presented, although face validity was evident.

The Reliability of the BOC Prosthetist Clinical Simulation Exam was reported to be .79 based on n=58 candidates. The reliability for Information Gathering was .84 and for Decision-Making was a low .43. Because the test as a whole determines pass/fail decisions, the latter is not a serious problem. Feedback to candidates about their clinical decision-making skills, however, might be invalid.

The October 2013 BOC PowerPoint presentation did not present a pass rate, but a subsequent BOC Prosthetics Additional Analysis pdf reported a 58.02% pass rate based on n=58. The BOC Test Analysis Report for FORM PROBS06 reported a joint pass rate of 54% for n=54, with an Information Gathering pass rate =85% and a Decision-Making pass rate =61%, indicating a very difficult examination.

As noted above, the correlation of the Prosthetist Written Clinical Simulation exam with the Multiple Choice exam with was  $r = .35$ ,  $p < .001$ , based on n=79 candidates. Scores on the Written Simulation exam was divided into Information Gathering and Decision Making. The correlations of those two components with the Multiple Choice exam were  $r = .45$ ,  $p < .001$ ,  $n = 79$ , and  $r = .19$ ,  $p < .09$ ,  $n = 79$ , respectively.

The psychometric properties of the Information Gathering and Decision Making scores, and how they were derived or calculated was not evident in the reports examined.

The correlation of the Written Clinical Simulation exam with binary pass/fail scores on the Video Practical Examination was  $r = .48$ ,  $p < .04$ , based on 18 candidates. The correlation of the overall Written Clinical Simulation score with the subcomponents Information Gathering and Decision Making was  $r = .41$ ,  $p < .09$ ,  $n = 31$ , and  $r = .44$ ,  $p < .07$ ,  $n = 18$  respectively. Such data indicate appropriate convergent validity.

The data evaluated indicates that the BOC Prosthetist Written Clinical Simulation exam is a challenging test, but one that shows good reliability and good convergence with the Multiple Choice and Video Simulation examinations. Given the limitations of the Job Task Analysis and the data provided, the BOC

Prosthetist Written Clinical Simulation Examination appears to be an appropriate but difficult, certification examination components.

### **III.A.2 ABC Orthotist Written Clinical Simulation Examination.**

The ABC Orthotics Written Simulation was described as possibly including the scoliosis/kyphosis, spinal cord injuries, fractures, treatment of stroke, upper extremity management, hip and knee pathologies, cervical spine and neuromuscular diseases. The connection to the Job Task Analysis and rationale for those item allocations were not located.

Reliability statistics for the correlations among items on the ABC Orthotist Written Clinical Simulation Examination were not located.

Pass rates for the Orthotics Written Simulation examination was 84% for first time test takers, 72% for repeat test takers, and 82% overall. This was not highly stringent, but seems reasonable.

Such data indicate appropriate convergent validity.

### **III.B.2 BOC Orthotist Written Clinical Simulation Examination**

The BOC Orthotist report described the Clinical Simulation Examination in a footnote to the Orthotist Detailed Content Outline (p. 85): “Three of these problems will involve Spinal or Cervical cases and five problems will involve Upper or Lower Extremity cases.” The connections to the Job Task Analysis and rationale for those item allocations were not located.

The Reliability of the BOC Orthotist Written Clinical Simulation Exam was reported to be .88 based on n=142 candidates, which is very good. The reliability for Information Gathering was .76 and for Decision-Making .88, both of which exceed acceptable standards.

The October 2013 BOC PowerPoint presentation did not present a pass rate, but a subsequent BOC Orthotist Additional Analysis reported a 32.33% pass rate based on n=300. A BOC report on Form OROBO06 using n=139 reported an overall pass rate of 29%, including a pass rate of 76% for Information Gathering and 32% for Decision-Making. This is an extremely difficult test.

It was previously noted that the correlation of the Orthotist Written Clinical Simulation exam with the Multiple Choice exam was  $r = .64$ ,  $p < .0001$ , based on n=137 candidates. The Written Simulation exam was divided into Information Gathering and Decision Making and the correlation with the Multiple Choice exam was  $r = .55$ ,  $p < .0001$ , n=137, and  $r = .65$ ,  $p < .0001$ , n=137, respectively.

The correlation of the Written Clinical Simulation exam with binary pass/fail scores on the Video Practical Examination was  $r = -.04$ ,  $p < .85$ , based on 31 candidates. The correlation of the Written Clinical Simulation with Information Gathering was  $r = .06$ ,  $p < .74$ , n=31, and with Decision Making, and  $r = -.23$ ,  $p < .21$ , n=31. Thus, there is no evidence that the Written Clinical Simulation exam taps the same skills as the Video Practical Examination. That may be due to limitations in the Video Simulation Examination rather than in the Written Clinical Simulation exam. A correlation that is not statistically significant may be attributed to small sample size, but that putative cause is less persuasive when the correlation itself is small, such as less than .20. The combination of small sample size and restriction in range of the VSE, however, may attenuate the correlation.

The data evaluated indicates that the BOC Orthotist Written Clinical Simulation exam is a challenging test, but one that shows good reliability and good convergence with the Multiple Choice test, although not with the BOC Video Simulation Examinations. Given the limitations of the Job Task Analysis and the data provided, the BOC Orthotist Written Clinical Simulation Examination appears to be an appropriate, but quite difficult, certification examination.

#### **IV. Practical Examinations**

##### **IV.A. ABC Practical Examination (Clinical Patient Management Examination, CPM)**

ABC requires candidates for certification to travel to its designated testing facility (currently in Texas) at one of three specified times per year. Candidates then demonstrate their skills to professionals at six testing stations. Candidates are not informed of the questions in advance. A description of the linkage of the chosen CPM procedures to the ABC Job Task Analysis was not located.

##### **IV.B. BOC Video Practical Examination**

The BOC Practical Exam consists of the candidate filming a single designated procedure with a simulated patient, and mailing the videotape in to BOC for evaluation by a qualified professional rater. The procedure is described on the BOC website. The linkage of the chosen procedure to the BOC Job Task Analysis was not located.

A concern with a self-administered Practical Exam is that the student can practice and do multiple retakes. An instructor or sponsor can provide feedback until one good performance has been videotaped. If a videotaped practical exam sampled a candidate's rehearsed and best performance rather than his or her general skill level, it would be expected that the pass rate for such a Practical Exam would be high, and scores on such a Practical Exam would not significantly correlate with performance on the Multiple Choice and Written Simulation portions of the exam. Such information was sought from BOC.

Additional information on data pertaining to the BOC Video Practical Examination was requested during the October KY Board meeting. BOC reported the correlations of its Multiple Choice and Written Simulations test components on Nov. 1. Unfortunately, those correlations did not include the Video Practical exam. Additional information was submitted by BOC, via Applied Measurement Professionals, Inc. (AMP) on Nov. 20 and 21, 2013.

##### **IV.A.1. ABC Prosthetist CPM Examination**

[REDACTED]

ABC states that it calculates CPM scores using a formula that “weighs each response relative to how critical that item is judged to be” (Examination Policies and Information, p. 14). They also state that Clinical examiners evaluate a candidate’s performance on each task. The passing point is said to be referenced to “a criterion with clear, predetermined standards”. The criticality data and weighting procedures used for the calculation of the CPM scores were not located in the information provided. As a consequence, the appropriateness of that scoring approach cannot be fully evaluated.

#### **IV.B.1. BOC Prosthetist Video Practical Examination**

In the BOC Prosthetist Video Practical Examination, the candidate submits a tape involving the performance of a stipulated procedure, and that performance is evaluated by one to three examiners. It appears that the examiner does not provide scores for the performance of sub-tasks, but only reports the binary judgment of whether the candidate passed or failed.

The BOC examined the reliability of the Prosthetist Video Practical Examination in a study using 6 examiners who each evaluated 2 to 48 candidates. In this study, the pass rate was 94.12%. To evaluate the examiner agreement rate for the present report, it was necessary to weight the scores by the number of candidates that each examiner reviewed. Using that procedure, the percent agreement was 96.15%, the average Phi coefficient = .77 and the average Kappa coefficient = .78. While these statistics are acceptable, it is possible for examiners to attain high inter-rater reliability scores by being uncritical of the candidates and passing most of them.

In the Oct. 2013 meeting, the BOC pass rate for the Prosthetist Video Practical Exam was reported to be 91.09% based on n = 101. That is the least stringent of the BOC Prosthetist exam components (Multiple Choice pass rate = 73%, n=157; Clinical Simulation pass rate 58%, n = 131)

The BOC Prosthetist Video Practical Exam had no impact on the pass rates of candidates for whom scores on the other BOC tests were available. The rate of candidates who passed both the BOC Multiple Choice and Written Simulation but failed the Practical Examination = 0.00%. Thus, not a single candidate who passed the BOC Multiple Choice and Written Simulation tests was flagged for questionable practical skills. Unfortunately, joint pass rates and correlations were based only on a scant n=12. BOC/AMP reported *“The low n listed above is the result of candidates being able to take the exams in any order they choose. To be included in this category, a candidate would have needed to complete all three tests within the past two years.”*

The correlations between the Prosthetist Video Practical Examination scores and the Multiple Choice Examination scores and Written Clinical Simulation Examination scores were reported above, but additional points might be noted. For the BOC Prosthetist exam components, the correlations between the Multiple Choice and Written Simulation scores and the Video Practical Exam (VPE) scores were limited to binary Pass/Fail Practical Exam scores, which causes a restriction of range and violation of normality assumptions. The correlations averaged  $r = .41$ . Only the correlation between the Multiple Choice and Video Practical Exam Pass/Fail rate was statistically significant,  $r = .48$ ,  $p < .04$ . BOC

accurately notes “The low/ insignificant correlations indicate little overlap between the different exams’ measurements. However, these data should be interpreted cautiously because of the small N.”

Unfortunately, the combination of high pass rate and low correlation with other measures of Prosthetist Knowledge, Skills and Abilities offers scant evidence in support of the validity of the BOC Prosthetist Video Practical Examination.

#### **IV.A.2. ABC Orthotist Clinical Patient Management Examination**

[REDACTED]

[REDACTED]

[REDACTED]

#### **III.B.2. BOC Orthotist Video Practical Examination**

The BOC examined the reliability of the Orthotist Video Practical Examination in a study using 6 examiners who each evaluated 11 to 51 candidates. In this study, the pass rate was 83.05%. To evaluate the examiner agreement rate for the present report, it was again necessary to weight the scores by the number of candidates that each examiner reviewed. Using that procedure, the percent agreement was 90.18%, the average Phi coefficient = .77 and the average Kappa coefficient = .74.

The BOC pass rate for the Orthotist Practical Exam was 84.05% based on n=163 (Multiple Choice pass rate 69.95%, n=203. Written Simulation pass rate 32.33%, n=300). Joint pass rates and correlations were offered for only n=25 to n=31. With respect to the Orthotists who pass both the Multiple Choice and Written Simulation but fail Practical exam, that frequency was 4.00% Four percent of 25 candidates is just one person. Taken alone, the BOC Orthotist Video Practical Examination is much less stringent than the ABC Orthotist Clinical Patient Management Examinations.

The correlations between the BOC Orthotist Video Practical Examination scores and the Multiple Choice and Written Clinical Simulation Examination scores were reported above, but additional points might be noted. For the BOC Orthotist exam components, the correlations between the Multiple Choice and Written Simulation scores and the Video Practical Exam scores again were limited to binary Pass/Fail Practical Exam scores, which causes a restriction of range and violation of normality assumptions. The correlations averaged  $r = .04$ ; none of the correlations were statistically significant. The correlation between the Practical Exam and the Decision-Making component of the test was  $-.23$ ,  $p < .21$ , indicating that higher score on the Video Practical Examination were nonsignificantly related to poorer Decision-Making. Based on these negligible or inverse correlations, BOC seems inaccurate when it repeats a statement from its Prosthetist report that: “if these correlations hold with larger samples, the data



indicate that all parts of BOC's examination program are contributing to the evaluation of candidates' competency." Indeed, the  $r = .04$  and  $r = -.24$  indicates just the opposite conclusions, although the sample sizes are small and these statistics might be unrepresentative.

### **BOC Examination Conclusions.**

In response to these data, a concern was expressed to BOC and AMP on Nov. 22, 2013 that "of the candidates who passed both the BOC Multiple Choice and simulation, the Practical Exam failed only 1 of 37 or less than 3%. It might be argued that is a very weak contribution of unique variance. Comparable practical exams of which I am aware have unique failure rates of 10-15% or higher, as well as stronger correlations with the other test components." A request was made for "any additional data in support of the validity and reliability of the BOC Practical exam"

BOC responded on Nov. 22, 2013 by asking for additional information on the unique pass rates of other tests.

BOC was informed that *"I checked with certain test publishers, and they have declined my request to provide BOC with the pass/fail rate of their Practical Examinations...You may wish to provide a rationale for the unique failure rate of 2.7% on the BOC Practical Examination across the Prosthetist and Orthotist tests (i.e. failure rate on the practical exam of those who passed the multiple choice and simulation)."*

Steve Nettles of AMP, acting on behalf of BOC, provided an extensive response on Dec. 2, 2013 reported in Appendix A. The essence is: *"I feel it is unfair to judge the BOC VPE solely on these inter-correlations and "unique" pass rates... when considered in total with the simulation and MC exams, BOC exams have substantial evidence of validity, specifically in validity of content, and traditional reliability measures."*

- There are four points in favor of BOC's current approach to Practical Examinations.
  - The BOC Practical Examination imposes minimal costs on professional applicants who have demonstrated their competence on the Multiple Choice and Written Simulation examinations.
  - BOC professionals' reviews of the videotaped performance have high reliability, suggesting that the judges may be effectively measuring the competence portrayed in the candidate's performance.
  - While the pass rate of the BOC Practical Examination is high, the pass rate of other BOC examinations is lower, especially the Written Simulation Decision-Making, so it is likely that very few truly incompetent candidates are certified by BOC.
  - Steve Nettles, a member of the Applied Measurement Professionals, Inc. (AMP) testing firm under contract to BOC argued: *"to the best of BOC's recollection, no one has ever challenged the competence of a practitioner who has passed the VPE and the other two assessments, i.e., credentialed by BOC."* While Nettles conclusion speaks to the overall validity of the BOC certification process rather than the differential validity of the BOC Video Practical Examination, it argues for acceptance of the BOC testing procedure as is.

The KY Board could remain concerned both that the BOC Video Practical Examination procedure covers only one rehearsed procedure, and the scant data offered in support of the BOC's Video Practical Examination are currently inadequate to demonstrate its validity. Steve Nettles implicitly conceded the latter point, stating: *"To draw any conclusions, positively or negatively, about the VPE exams with these limited data is premature at best."* This independent review concurs that inadequate data have been provided by BOC at this time to justify a determination that the VPE, considered alone, is valid.

Given the stringency of the other BOC tests, however, this independent review concludes that candidates for certification and licensure in the disciplines of Prosthetics and Orthotics who have passed all three BOC examinations are likely to possess the preparation and skills for professional practice in those disciplines. The BOC examinations for Orthotic Fitter and Pedorthics, although limited to one multiple choice examination each, meet current professional standards.

If the KY Board perceives that BOC has offered insufficient support for the validity of the Video Practical Examination, three alternatives might be considered:

- The KY Board could accept the results of the BOC Multiple Choice and Written Simulation Examinations. But, the KY Board could delay approval of the BOC Video Practical Examination until more supportive data are presented on the validity of the current Practical Examination, such as a sample of n=100. In the meantime, the KY Board could require all candidates to take the ABC Clinical patient Management examination. This could represent a financial burden for some candidates. This also would require ABC's cooperation in accepting candidates who took the BOC Multiple Choice and written stimulation examinations, rather than their own.
- Alternately, the KY Board could ask for enhancements of the BOC Video Practical Examination:
  - To prevent the undermining of the BOC assessment due to rehearsal and retakes, the KY Board could require BOC to add a second performance requirement to be taped that was not announced in advance on the web. The nature of the second procedure would be transmitted to registered candidates only on the day that they registered to tape their other performance. The second presentation would be less of a demonstration and more of a test of the candidate's skills. This approach would require pilot testing on the part of BOC, entailing some delay.
  - Alternately, to prevent the undermining of the assessment due to rehearsal and retakes, the KY Board could require BOC to instruct the candidates to perform one or more procedures live, before a camera connected to the internet video program Skype, or a comparable program. The performance would be videotaped, but a BOC proctor could also ask questions of the candidate, or request small modifications in the procedure. This approach would require pilot testing on the part of BOC, entailing some delay.

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**Table 1: Selected Statistics for ABC and BOC Prosthetics, Orthotics, Orthotic Fitter and Pedorthics Job Task Analyses and Certification Tests.**







	Dom.	Tasks	K&S	Total	Reliability	Pass Rate
ABC Prosthetist Job Task Analysis	6	57	74	131		
BOC Prosthetist Job Task Analysis	9	165		165	.86_ .97	
ABC Orthotist Job Task Analysis	6	57	74	131		
BOC Orthotist Job Task Analysis	8	74		74	.81_ .98	
ABC Orthotic Fitter Job Task Analysis	6	32	54	86		
BOC Orthotic Fitter Job Task Analysis	7	71		71		
ABC Pedorthist Job Task Analyses	6	56	87	143		
BOC Pedorthist Job Task Analyses	8	89		89		
ABC Prosthetist Multiple Choice	5			165		
BOC Prosthetist Multiple Choice	8			150	.91_ .95	71%
ABC Orthotist Multiple Choice	5			165		
BOC Orthotist Multiple Choice	7			150	.87_ .93	70%_ 74%
ABC Orthotic Fitter Multiple Choice	5			150		
BOC Orthotic Fitter Multiple Choice	5			100	0.79	79%
ABC Pedorthist Multiple Choice	5			165		
BOC Pedorthist Multiple Choice	8			100	.84_ .88	69%
ABC Prosthetist Written Clinical Simulation				6		
BOC Prosthetist Written Clinical Simulation				8	0.79	58%
ABC Orthotist Written Clinical Simulation				6		
BOC Orthotist Written Clinical Simulation				8	0.88	32%
ABC Prosthetist Clinical Patient Management				6		
BOC Prosthetist Video Practical Examination				1	.77_ .78	91%
ABC Orthotist Clinical Patient Management				6		
BOC Orthotist Video Practical Examination				1	.74_ .77	84%

Table 2: Correlation among ABC and BOC Test Components

Table 2	Correlation with Multiple Choice	Correlation with Written Simulation	Correlation with Practical
<b>ABC Prosthetist Multiple Choice</b>		■	■
<b>BOC Prosthetist Multiple Choice</b>		0.35	0.30
<b>ABC Orthotist Multiple Choice</b>		■	■
<b>BOC Orthotist Multiple Choice</b>		0.64	0.37
<b>ABC Prosthetist Written Clinical Simulation</b>	■		■
<b>BOC Prosthetist Written Clinical Simulation</b>	0.35		0.48
<b>ABC Orthotist Written Clinical Simulation</b>	■		■
<b>BOC Orthotist Written Clinical Simulation</b>	0.64		-0.04
<b>ABC Prosthetist Clinical Patient Management</b>	■	■	
<b>BOC Prosthetist Video Practical Examination</b>	0.30	0.48	
<b>ABC Orthotist Clinical Patient Management</b>	■	■	
<b>BOC Orthotist Video Practical Examination</b>	0.37	-0.04	

**Appendix: Statement of Steven Nettles, of AMP on behalf of BOC, Dec. 2, 2013.**

All competencies assessed are directly related to significant activities identified by the job analysis as required by NCAA standards. Therefore, validity of content is assured by this direct linking of significant job content to the required competencies.

The fact that the list of competencies is known beforehand is completely appropriate. BOC provides a Detailed Content Outline (DCO) for the MC and simulation examinations, providing candidates the competencies to be assessed for those formats. In similar fashion, this information is provided to candidates for the VPE. These competencies are the learning objectives to be assessed. It is good testing practice in the credentialing community to tell candidates the competencies to be assessed beforehand. Additionally, the Test Analysis Reports provided show that the MC and simulation tests display adequate reliability; the inter-rater reliability studies provided indicate adequate reliability for the VPE. In fact, one could argue that the ABC practical exam -- with only one judge per station, and the face-to-face exam administration with non-scripted interaction allowed between the examiner and the candidate -- is subject to serious potential flaws to standardization and ultimately the reliability of the practical exam.

You also indicated a concern that candidates make their own videotape of an orthotics or prosthetics procedure with the opportunity for retakes until the candidates (and perhaps the candidates' teachers and sponsors) are satisfied. The BOC Practical Exam pass rates are high but not excessive. BOC candidates, if unsuccessful, have two additional attempts to prove competence. One would expect a high pass rate given that unsuccessful candidates have the opportunity to resubmit to prove competence. The opportunity to "redo" or revisit questions on the multiple choice exam and problems on the simulation exam does not exist; therefore, their pass rates are lower. Additionally, my colleagues who work with Objectively Structured Clinical Examinations (OSCEs) currently, or have worked with practical exams in the past, indicate to me that their pass rates were generally in excess of sometimes close to 100%. And they were not concerned since "people would do pretty well on the practical exams and generally had a harder time with the written if they were going to have a problem" (personal communication). More recent information relates to the Standardized Patients (SP) exam for physicians. Although it is hard to obtain exact numbers, my understanding is that on the United States Medical Licensing Examination (USMLE) exam, almost everyone passes the SP portion (as distinct from the written).

Because of our candidate volume, we are unable to provide larger samples for the correlations you requested. Since the samples are small, only one correlation is significant ( $p < .05$ ) - VPE P/F rating with Simulation Total score for Prosthetist. You indicated that for other comparable practical exams of which you are aware that there are stronger correlations with the other test components. The VPE P/F rating when correlated with the MC total score and Simulation Total score were 0.304 and 0.48 for the Prosthetist, and 0.37 and -0.23 for Orthotist. And if these correlations are of similar magnitude with larger samples, I consider the positive correlations moderate and desirable. If these correlations were very high, and based on larger Ns, one could argue that the VPE was not contributing to the overall assessment of competencies. To draw any conclusions, positively or negatively, about the VPE exams with these limited data is premature at best.

Thus, I feel it is unfair to judge the BOC VPE solely on these inter-correlations and "unique" pass rates. In my opinion I believe it is important to review the data provided in their entirety. The overall VPE pass rates of 91% and 84% are based on candidate volumes of 101, or 163, respectively for the Prosthetist and Orthotist. As you indicated, the "unique" pass rate for the VPE is close to 97%. However, as

indicated above, these pass rates are consistent with similar (comparable) format practical/OSCE licensing exams. I agree that with the low Ns on the inter-correlations we were able to compute that the results may be interpreted in several ways. However, when considered in total with the simulation and MC exams, BOC exams have substantial evidence of validity, specifically in validity of content, and traditional reliability measures.

Consequently, BOC's video practical has to be seen as it is - a unique, reliable, and valid instrument to measure the practical knowledge of candidates. The goal of the VPE is for candidates to be able to demonstrate competency performing significant tasks, in a standardized manner, such that independent reviewers may evaluate the results. Finally, to the best of BOC's recollection, no one has ever challenged the competence of a practitioner who has passed the VPE and the other two assessments, i.e., credentialed by BOC.