

# OKAP<sup>®</sup> User's Guide



AMERICAN ACADEMY™  
OF OPHTHALMOLOGY

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## BACKGROUND ON THE OKAP®:

The American Academy of Ophthalmology (AAO) is a voluntary organization whose membership currently comprises 93% of US ophthalmologists and is open to ophthalmology residents. The Academy provides advocacy, assistance with practice management, and clinical-education programs for the benefit of its members. The Ophthalmic Knowledge Assessment Program (OKAP) examination is one of the Academy's clinical-education programs. The OKAP is a 260-item multiple choice test that is administered to ophthalmology residents in each year of training. It is designed to measure the ophthalmic knowledge of residents, relative to their peers, in order to facilitate the ongoing assessment of resident progress and program effectiveness. ExamRoom.AI provides assistance in the administration of the exam, and National Measurement and Testing (NMT) provides the psychometric analysis of item performance.

The American Board of Ophthalmology (ABO) is a separate organization whose mission it is to serve the public by improving the quality of ophthalmic practice through a certification process that fosters excellence and encourages continuous learning. The Board's Written Qualifying Examination (WQE) is a 250-item test in the field of ophthalmology and is given to physicians who have completed a residency training program in ophthalmology and who are candidates for Board certification. The intent of the certification process is to provide assurance to the public and to the medical profession that a certified physician has successfully completed an accredited course of education in ophthalmology. The WQE is part 1 of the Board's certification process. Upon successful completion of the WQE, a candidate takes part 2, which is the Board's oral examination.

From 1980 to 1992 the Academy and the Board administered the same exam as both the OKAP and the WQE. But because the Academy and the Board are two separate organizations and their respective exams actually perform two different functions, the OKAP and WQE became two separate exams in 1993. The OKAP and WQE are comprised of entirely different test questions with different psychometric properties and emphasize different aspects of ophthalmic knowledge. (For example, the OKAP gives greater emphasis to basic science questions.) Although the two exams are now separate, they both assess the knowledge, experience, and skills necessary to deliver high standards of quality patient care in ophthalmology. Accordingly, all items for both exams are still written and reviewed jointly by the Academy and the Board. This joint process of item development ensures continuity of assessment, from the first year of training to Board certification, and ensures that the OKAP will continue to be an excellent way to prepare for the WQE.

OKAP items are developed from a Content Outline that is almost identical to the same topical areas as the Academy's Basic and Clinical Science Course (BCSC). The BCSC is a highly recommended curriculum of basic knowledge and new developments in ophthalmology, but it is not meant to be an exhaustive survey of the entire field. Therefore, preparation for the OKAP should also include other authoritative sources such as textbooks and scientific journals.

## INTERPRETATION OF OKAP RESULTS

Guidelines for understanding and interpreting OKAP results are provided in this section. Recommendations for using OKAP results to further resident education are given in the section following this one, called UTILIZATION OF OKAP RESULTS.

Each annual OKAP examination is carefully constructed to be a valid and reliable measure of ophthalmic knowledge. An OKAP score carries information about how well a resident has done relative to the other residents who have taken the exam. Such scores are "norm-referenced" in the sense that they refer to the norm of performance established by the other examinees—the same as being graded "on the curve".

**Scores Are Confidential:** The Academy releases OKAP results only to residents and their program coordinators and directors, but scores also may be disseminated to other program faculty in support of their intended educational purpose. Residents should be given the names of faculty members who have knowledge of their performance on the exam. Residency programs must maintain and keep copies of all score reports.

**Resident Score Report:** Performance on the 260-item test, and on the 13 individual subtests, is reported as Scaled Scores and Percentile Ranks. These are simply two alternate ways of indicating how well one examinee performs relative to others. Developers of the OKAP have decided to use scaled scores to represent a resident's performance relative to all others taking the exam—regardless of training level—and to use percentile ranks to represent a resident's performance relative only to those at one's own level of training. Scaled scores and percentile ranks are both derived directly from the "number-correct" or "raw" scores, which is simply equal to the number of items answered correctly.

## Scaled Scores

The Scaled Scores transform a resident's raw scores on the OKAP exam, and all of its subtests, to a scale that indicates how many standard deviations the score falls above or below the average of all residents regardless of training level. To establish this common scale, common values are substituted for the means and standard deviations of the various raw-score distributions. Scaled scores computed for the test as a whole substitute 500 for the mean and 100 for the standard deviation. Scaled scores computed for the subtests substitute 50 for each subtest mean and 10 for each subtest standard deviation.

The total scaled score uses a process called equating that enables comparison of scaled scores from year to year. An advantage of the scaled score is that it makes it immediately clear where the group mean is located (500 for total test and 50 for subtests) as well as how far away from the mean the score is, expressed in standard deviation units (100 and 10 points represent a standard deviation on the total test and subtest respectively). The utility of transforming raw scores to scaled scores is two-fold: Unlike raw scores, scaled scores carry information about how one has performed relative to one's peers, and allows comparison across subtests of varying length and difficulty.

As an example, if a resident's raw score for the whole 260-item test is 170, the actual mean of the raw scores is 150, and the actual standard deviation is 25, then that resident's raw score exceeds the mean by 20 items or  $20/25 = 0.80$  standard deviation units. This raw score can be expressed in terms of the mean and standard deviation as follows:  $150 + 0.80(25) = 170$ . The corresponding scaled score is computed by substituting 500 for the mean and 100 for the standard deviation in this expression:  $500 + 0.80(100) = 580$ . Or if a resident's raw score on a particular subtest is 16, the actual mean is 19, and the actual standard deviation is 5, then that resident's score is 3 points or  $3/5 = 0.60$  standard deviation units below the mean and the corresponding scaled score is  $50 - 0.60(10) = 44$ .

In general, about two-thirds of all residents will score within one standard deviation of the mean, so that their scaled scores will be between 400 and 600 for the test as a whole and between 40 and 60 on the subtests. Residents scoring within that range are part of the large, average group of residents who perform in a roughly equivalent manner. Residents scoring above or below this range are noteworthy because they differ from this overall average group.

A scaled score for the entire 260-item OKAP exam is a very reliable assessment of one's ophthalmic knowledge, relative to the other residents who also took the OKAP in that year. Therefore, scaled scores from repeated administrations of the OKAP can be used to track one's progress over the entire term of residency.

## Exam Equating

In 2006, OKAP scoring began using equating to enable score comparisons from year to year. Previous to 2006, inferences could only be based on a single year's results. Exam equating is a statistical method whereby a set of common items are included in each exam. Each new exam is linked back to an earlier exam, which in turn is linked with other exams by a chain of items extending back to the exam anchor. In this way, scores for OKAP examinees can be compared irrespective of the year in which the exam was taken. In 2017, the exam scoring was reset using the 2017 exam as the new anchor exam for equating. Because of this, scores prior to 2017 cannot be compared directly to scores after.

## Reference Group for OKAP Exam Scores

As indicated above, the mean for the OKAP exam is expressed as a scaled score of 500. To ensure comparability and continuity of scores, the OKAP exam uses the 2017 anchor exam and examinee pool as a *fixed reference group*. After 2017, all OKAP exam scores are expressed in terms of the mean and standard deviation of the 1,649 examinees who took the exam in 2017. The 2017 candidates constitute the fixed reference group for all subsequent forms of the exam. Thus, a score of 500 on any OKAP exam administered after 2017 corresponds to the mean of the 2017 sample, a score of 600 falls 1 standard deviation above the 2017 mean, 400 falls 1 standard deviation below the 2017 mean, and so forth.

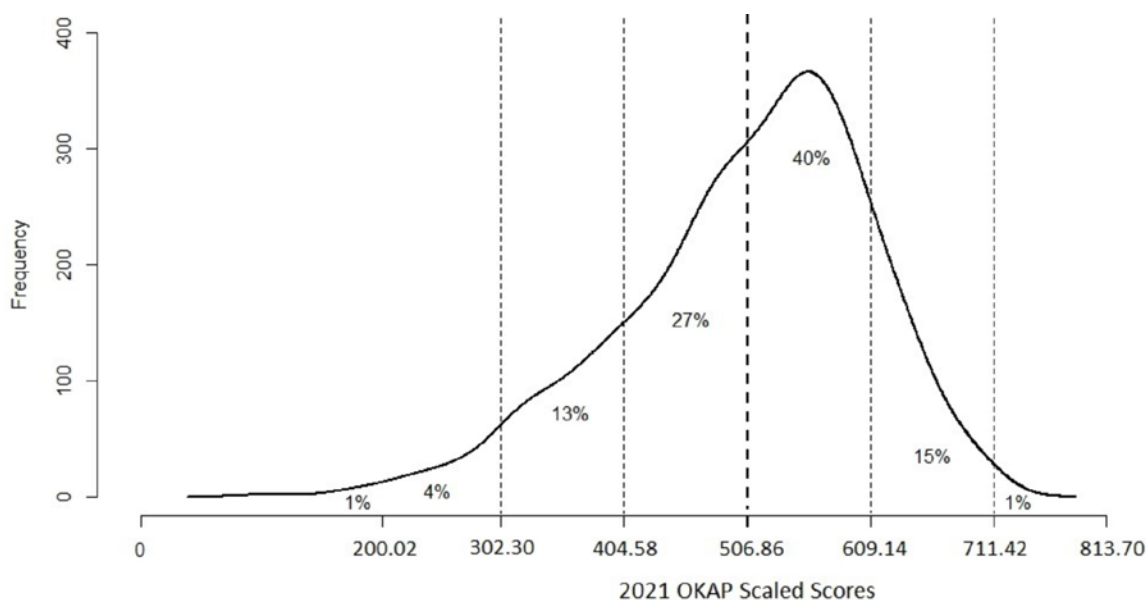
### Mean Scaled Scores

Mean scaled scores from the 2017 to 2021 exams are listed below, as well as the 2021 cognitive mean scaled scores. Note that the largest change in the scaled scores historically occurs between the first and second years of training, probably reflecting the fact that all of the content areas in the exam may not have been covered by the training-program curriculum until the second year.

Mean Scaled Scores					
	Yr 1	Yr 2	Yr 3	Yr 4	Total
2017	442.46	521.29	530.65	586.49	500
2018	450.76	534.05	547.42	600.63	512.53
2019	456.82	557.25	571.54	613.76	530.13
2020	445.67	520.30	549.12	579.50	506.05
2021	440.67	531.35	540.15	620.67	506.86

Cognitive Mean Scaled Scores			
		Recall	Decision Making/ Clinical Management
2021	Yr 1	44.54	42.58
	Yr 2	52.32	51.77
	Yr 3	52.36	54.90
	Yr 4	59.02	61.43
	Total	49.97	50.02

Below is a graphical depiction of the 2021 exam scores. The mean was 506.86 (with a standard deviation of 102.28):



### Percentile Ranks

The Percentile Ranks indicate the percentage of examinees, at a resident's own training level, who scored below that resident. If, for example, a second-year resident had a percentile rank of 60, it would mean that his or her raw score was higher than the raw scores of 60 percent of the second-year residents taking the exam in that year. Like scaled scores, percentile ranks are provided for the test as a whole and for all subtests. Prior to 2012 the cutoff percentile ranks were 1 to 99, but the statisticians are using 0 to 100 percentile ranks going forward. You may see a 0 or 100% as the percentile rank, because the computed percentile rank can be as low as 0.1 and as high as 99.99 and is rounded into an integer. This does not mean that you answered everything wrong or everything right. The 0 is essentially the same with 1 (indicates the lowest score and no one scores lower than these candidates) and 99 is essentially the same with 100 (indicates the highest score and no one scores higher than these candidates).

**Subtest Scores:** Reviewing subtest scores can be helpful in identifying specific learning needs. The OKAP subtests parallel the 13 volumes of the Academy's Basic and Clinical Science Course (BCSC). A subtest is comprised of the OKAP test items that pertain to that subspecialty area/BCSC book.

**Subtest Reliability:** The main core topics within the 13 subtests are assessed in every OKAP exam, but because each yearly exam is comprised of a different set of test items, not every clinical point can be covered in every year. For example, because of the sampling of content, the Optics and Refractive subtests may give more emphasis to spectacle lenses one year and to contact lenses the next. Thus, in addition to reflecting the level of one's ophthalmic knowledge, one's score also might reflect variations in the sequence of topics presented in different residency programs.

Because subtests necessarily must contain fewer items than the test as a whole, subtest scores are somewhat less reliable and must be interpreted with more caution than a score based on all 260 items—particularly if the score is extreme. For example, a resident who scores extremely well on a particular subtest when first taking the OKAP might show some decline on that subtest in a subsequent examination, simply as an artifact of lower subtest reliability. Though not as reliable as the score for all 260 items, subtest scores do indicate areas in which more study may be needed. Because scaled scores and percentiles are both derived from raw scores, they both have precisely the same reliability characteristics. If there are concerns about subtest performance, further evaluation is suggested in those areas. The 13 sections of the BCSC provide study questions to assist in this process.

**Institution Score Report:** Each program receives an institution report that indicates the mean scaled scores (total and subtest) for residents in their program. It is useful to apply the scaled score interpretation for individuals to this report. That is, it is reasonable to assume that all programs whose average falls within the range of one standard deviation above or below the mean are experiencing similar outcomes on the content being measured by that score.

Programs with an average score falling more than one standard deviation above or below the mean should examine their resident profiles to determine if performance is uniformly above or below average, and how it compares with results from the previous year. In some cases, the performance of a single unusual resident may skew your program average, especially in smaller programs. Under such circumstances, it would be a good idea to re-compute the program's average after excluding that "outlying" value.

**Keyword Reports:** Each resident receives a report that provides the keywords/topics from the exam subtests/BCSC books for each item that he or she missed on the exam. The purpose of these reports is to help residents identify areas for further study, develop specific learning objectives in those areas, and devise learning plans for meeting those objectives. Programs also receive an Institution Keyword Report which is designed to identify program gaps in knowledge and to let programs know the most frequently missed topics of their residents.

**Cognitive Levels:** Mastery of clinical and scientific knowledge is tremendously important in the practice of ophthalmology, but knowledge alone is not sufficient. Residents must also learn to use their knowledge to interpret the clinical facts in a particular case and to solve the clinical problems that arise. OKAP exam items are classified according to these three levels of cognitive functioning:

Level 1: Recall items measure an examinee's command of the facts, concepts, principles, and procedures on which the field of ophthalmology is based, but these items require more than rote recall (merely remembering a textbook definition). They also assess accuracy, depth, and comprehension; fine distinctions among subtly different concepts; and errors of commission and omission in route procedures.

Example of Level 1 item:

Which of the following medications is the treatment of choice of adult chlamydial conjunctivitis?

- > A. Systemic tetracycline
- B. Systemic ciprofloxacin
- C. Systemic sulfisoxazole
- D. Topical erythromycin

Level 2: Interpretation items likewise require recall of facts, but also require examinees to abstract meaning from those facts, recognize their implications, make inferences or extrapolations, explain or predict findings, or identify abnormalities in lab results and diagnostic images.

Example of Level 2 item:

Which of the following choices is the correct spherocylindrical notation for combining the cylinders  $+2.00 \times 120^\circ$  and  $-2.25 \times 30^\circ$ ?

- > A.  $+2.00$  with  $-4.25 \times 30^\circ$
- B.  $-0.25$  with  $-2.25 \times 120^\circ$
- C.  $+2.00$  with  $-0.50 \times 120^\circ$
- D.  $-4.25$  with  $+2.00 \times 30^\circ$

An examinee probably has not seen this particular situation and so cannot use recall alone to determine the correct response.

Level 3: Decision Making & Clinical Management items require examinees to apply their ability to recall relevant knowledge and draw correct conclusions to the complex process of making decisions about differential diagnosis in unusual circumstances and setting priorities among competing clinical considerations in case management and treatment.

Example of Level 3 item:

A 60-year-old woman has a meibomian gland carcinoma of the left lower eyelid which extends through the orbital septum into the anterior orbit. What is the appropriate management?

- A. Radiation to the orbit
- B. Systemic chemotherapy
- > C. Orbital exenteration
- D. Cryotherapy

Unless an examinee has received explicit instruction about a patient in this particular circumstance, a problem-solving process is necessary to respond correctly.

## UTILIZATION OF OKAP RESULTS

The primary purpose of the OKAP exam is to support the clinical and basic-science education of residents by providing them a way to assess their ophthalmic knowledge relative to their peers and to identify individual learning objectives. The OKAP exam is also designed to provide program directors with information that is useful in the formative evaluation of resident progress and program effectiveness. OKAP exam results may be used as a measure of competency in ophthalmic knowledge in comparison with all residents and within a residency year peer group. However, OKAP exam results should never be used as the sole gauge of a resident's overall ophthalmic proficiency. Consideration of other relevant factors such as clinical acumen, surgical skill, patient rapport, and case-management ability always must enter the process of resident evaluation.

To make best use of OKAP results, residents are encouraged to follow the six steps set forth below. Those in their second year of training, or beyond, should process their results in this way for every OKAP exam they take and evaluate their progress from one year to the next.

1. **Prioritize subspecialty areas for further study** (Note that all subspecialty areas will require further study throughout residency. The following suggestions are not meant to exclude any subspecialties from further study, merely to identify where to begin):
  - Rank order the OKAP subtest results, from low to high, by both scale score and percentile.
  - Group subtest scaled scores according to whether they are below 40, between 40 and 60, or above 60.
  - Group subtest percentile ranks according to whether they are below the 25<sup>th</sup>, between the 25<sup>th</sup> and 75<sup>th</sup>, or above the 75<sup>th</sup>.
  - Because scaled scores and percentiles have been used to represent two different comparison groups, the priorities established may not always be identical for both.

2. **Identify specific learning objectives:**
  - Review Keyword Report.
  - List specific topics of questions missed under each subtest.
  - Within each subspecialty, target as specific learning objectives the major headings in the BCSC books under which these topics are listed.
3. **Identify educational resources for meeting learning objectives:**
  - Use the Master Index, Section Indexes, and lists of educational resources in the BCSC to begin identifying medical textbooks, Academy resources, and references to the scientific literature for each area.
  - Continue this process with the bibliographies and reference sections in the resources identified from the BCSC.
4. **Structure a learning plan:**
  - Begin with the areas shown to need the most study in step 1.
  - Specify how and when the resources from step 3 will be used to meet the objectives specified in step 2.
5. **Review the learning plan with Program Director:**
  - Discuss the logic underlying the learning plan.
  - Make changes and additions to the learning plan recommended by Program Director.
  - Obtain Program Director's recommendation for the most appropriate faculty members to help carry out the learning plan.
6. **Work on the learning plan with appropriate faculty** (Divulging specific OKAP results to faculty is optional but not necessary):
  - Discuss the learning plan.
  - Identify additional related topics and materials to study.
  - Meet regularly to discuss progress.
  - Regularly inform the Program Director about progress made in accomplishing steps called for in the learning plan.

Clearly, one-on-one dialogue between residents and faculty is an indispensable part of clinical education and should not be limited to discussion of the OKAP. But regular faculty review of progress on OKAP learning plans could be useful as a starting point for a more comprehensive assessment of a resident's changing educational needs. In fact, assigning a faculty member to help a lower-scoring resident create and complete an OKAP learning plan is likely to provide a much more substantial benefit than the all-too-common practice of simply requiring that resident to take a review course.

In addition to the assessment of residents, the OKAP exam is also useful in supplying information about the residency program itself. Program Directors should examine the rank orderings among subtests for all of their residents, to see if any interesting patterns are present. Attempting to understand why certain subtests consistently rank well in the program may point up educational practices and techniques that would be worth discussing with the entire faculty.

### **Fellowship Applications:**

The Academy does not condone the use of or provide OKAP scores to fellowship programs. The OKAP examination is not designed as a tool for assessment of fellowship applicants. Fellowship programs that do wish to use the OKAP score in evaluating fellowship candidates should request the score directly from the candidate's residency program, who may provide the score at the option of the Program Director. Such requests must be accompanied by a signed statement from the candidate confirming his or her permission and expressly naming the fellowship program to which the score is to go. If an OKAP score is released to a fellowship program on a resident's behalf, the Program Director shall supply only the overall OKAP score, not topical area scores, to preserve statistical validity.

## FREQUENTLY ASKED QUESTIONS ABOUT THE OKAP EXAM

1. *Can I get a copy of my OKAP scores?*

Requests for scores must be addressed directly to the candidate's residency program, who must maintain these scores. If the candidate's residency program cannot supply an OKAP score, copies from the 2012 administration to present can be requested from the Academy for a \$25 fee per score year requested.

2. *How are OKAP exams scored and is the WQE scored the same way?*

The "number-correct" or "raw" score for the OKAP, from which scaled scores and percentiles are computed, is simply the number of test items answered correctly. Scores for the WQE are computed and reported in the same way as the OKAP, except that WQE score reports include the minimum total scaled score required to pass. Of course, no passing score exists for the OKAP.

3. *Does any of the information provided in the score report indicate the percentage of test items answered correctly?*

No. As with any exam of this type, slight variations in difficulty exist from year to year, and among subtests in the same year. Because percent-correct scores are confounded by these arbitrary differences in difficulty, they cannot really be compared over time or across subtests. For scaled scores and percentiles, however, differences in difficulty are removed by norming each test on its own level of performance. Because they reflect the one's rank among their peers, scaled scores and percentiles are ideal for making comparisons over time and across subtests. It is important to remember that percentiles indicate the percent of examinees with lower scores, not the percentage of items answered correctly.

4. *Will the percentile and scaled score computed for the entire test equal the average of the corresponding subtest values?*

Not usually. The specific numerical relationship between percentiles and raw scores, and between scaled scores and raw scores, can differ for every subtest. For example, correctly answering one more question might raise the percentile rank by 10 on one subtest, but only by 5 on another. Similarly, it is common for an identical change in the raw-scores for two subtests to result in different changes in the associated scaled scores. For percentiles, the change associated with a given raw score change can vary even within a single subtest, depending on where the raw score is located along the range from low to high. This occurs because scores tend to aggregate in a large group near the average. Adding one more item correct in that part of the range will raise the associated raw score above a greater percentage of examinees than would be the case nearer the ends of the range, resulting in a larger percentile increase, by definition. These scale inconsistencies means that neither the percentile nor the scaled score for the total test can be derived from the corresponding subtest values.

5. *Should I be concerned if my percentiles and scaled scores do not increase from year to year?*

More so if your scaled scores do not increase. The clear expectation is that a resident's ophthalmic knowledge will increase from year to year, and that OKAP scores will reflect that increase. Because percentiles are used to represent OKAP performance relative to one's own level of training, a percentile rank that stays the same over time simply means that your ophthalmic knowledge has increased at the same rate as the other OKAP examinees at your level of training. But because scaled scores represent performance relative to all residents regardless of training level, a scaled score that does not go up means that the OKAP did not detect the expected increase in ophthalmic knowledge.

6. *Does the WQE follow the same 13-section breakdown of subspecialties as the OKAP?*

No. Although the entire field of ophthalmology is covered in the WQE, the topics are organized into 8 major headings instead of 13.

7. *Can my OKAP scores validly be used in reaching decisions about my academic standing within my program?*

Yes, but only in conjunction with other information. The OKAP exam is a valid and reliable instrument for measuring the ophthalmic knowledge of residents, but it is unwise to decide such an important question on the basis of a single use of any measuring device. Furthermore, there are many other factors contributing to resident competence that a test of ophthalmic knowledge does not assess.

8. *Who makes up the questions for the OKAP? Is there training involved?*

Exam items for the OKAP are the responsibility of the Liaison Committees of the Academy and the Board. Content expert members of these committees write exam items and the OKAP Committee then decide which are suitable for the OKAP exam. Extensive item-writing training is required to generate valid and reliable test items that meet the committees' extremely high standards and is provided to all new members.



9. *What percentage of US ophthalmology residency programs participate in the OKAP exam? Is it only available for ACGME certified programs?*

The residents in all 117 US residency programs in ophthalmology, accredited by the Accreditation Council for Graduate Medical Education (ACGME), currently take the OKAP examination. In addition, the residents in several Canadian ophthalmology programs and American Osteopathic ophthalmology programs also take the OKAP exam.

10. *Why not administer each OKAP subtest separately upon completion of the curriculum unit for that topic?*

Presumably, an OKAP subtest would provide the most beneficial educational feedback if it could be taken when the topic material has just been completed. But because the validity of the OKAP exam depends on maintaining test security, the exam must be proctored under controlled conditions that cannot be offered cost effectively more than once a year.

11. *How does the Academy obtain information about the training level to which an examinee belongs?*

Each resident's training level is verified by his or her program through several emails sent during the year. One's training level is defined as one's year of ophthalmology residency (not PGY). If you are in your first year of ophthalmology residency, you are at training level 1, and so on.

12. *What can be done if I notice a discrepancy in my reports?*

Contact the Academy within 7 days of the scores being available noting the discrepancy. Reports will not be recalculated because of incorrect training level. It is the responsibility of each program to verify their residents' training levels during registration.

13. *Are any test items excluded from scoring due to aberrant item performance?*

Sometimes. Although all items have been extensively reviewed by content experts before administration, a few may not perform as expected. These items are sent to the Chair of the Academy's OKAP Committee, who determines (sometimes with the help of other content experts) whether the answer key needs to be changed or whether to remove an item from the exam.

Notice to Readers of the OKAP User's Guide

The OKAP Committee of the American Academy of Ophthalmology has developed this *Guide* as an aid to residents and program faculty. We are very interested in obtaining as much feedback as possible from all users and would greatly appreciate hearing your thoughts on how the *Guide* could be improved. Please communicate all comments and suggestions to:

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