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The next European Board of Ophthalmology  
Diploma Examination will take place on  
7 - 8 May 2010

*Venue: Le Palais des Congrès de Paris*



# Setting pass marks for examinations

CESMA meeting, Brussels, November 28th, 2009

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## Definition of pass mark

- Synonyms: standard, cutpoint
- A **pass mark** is a special score that serves as **boundary** between those who perform well enough and those who do not



- How to set pass marks? Reaching a **consensus** rather than obtaining a scientifically correct solution

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## Importance of pass marks

- The **purpose** of an examination is to select the group of candidates that perform well enough (**pass**) and to eliminate the group of candidates that do not perform well enough (**fail**)
- In order to achieve this goal, a (limited) number of **questions** are presented to the candidates
- The discriminative power of the examination will depend on the **validity** of the questions used



## Validity of questions

- Degree of **difficulty** of questions
  - Can be assessed by calculating the **P-value** (i.e. percentage of candidates answering correctly)

### Thumb rule:

Avoid questions with P-value above 0.90 or below 0.10

- Degree of **discriminative power** of questions
  - Objective measurement of the degree to which the question is able to discriminate strong from weak candidates
  - Can be assessed by calculating the **Rit/Rir value** (correlation of question score to total examination score)

### Thumb rule:

Avoid questions with Rit-value below 0.20



## Types of pass marks

- “**absolute**” pass mark (criterion-reference)
  - expressed as a **number** (e.g. 70 correct responses) of **test questions**
  - expressed as a **percentage** (e.g. 70 % correct responses) of **test questions**
    - how to determine reasonable criteria for candidates?
    - flexibility in case you are not familiar with the technique
- “**relative**” pass mark (norm-reference)
  - expressed as a **number** (e.g. 50 best performers) of **examinees**
  - expressed as a **percentage** (e.g. top 20 % performers) of **examinees**
    - number of candidates • 40
    - candidates have to take the test on an individual basis



## Types of pass marks

- “**absolute**” pass mark (criterion-reference)
  - No influence of the **caliber** of the **total candidate population**
  - It is possible that all candidates **pass with high distinction** / **fail**
  - A fair amount of **experience** is demanded to set the pass marks
- “**relative**” pass mark (norm-reference)
  - Very **easy to use** for examiners
  - Appropriate in **large candidate populations** (> 40) to be sure that the candidate population is representative

The grade of a candidate is determined by both **own achievement** and **achievements of all other candidates**

- Stimulation of **competition** between candidates



## Angoff method to set pass marks

- First proposed by Angoff in 1971
- Prior to the examination, the **probability** of the questions to be answered correctly by a **minimally competent candidate** (candidate whose knowledge, skills and abilities are just enough) is **estimated** by several judges
- Based on the **averaged estimates**, an arbitrary (**absolute**) pass mark is set prior to the examination



## Angoff method to set pass marks

- For a 250 test-item examination, a **minimal number of 10 judges** would be necessary in order to estimate the degree of difficulty of the test items with a minimal degree of error<sup>1</sup>
- However, no consensus on minimal number of judges:
  - 5-10 judges (Norcini and Shea, 1997)
  - 10-15 judges (Hurtz and Hertz, 1999)
  - 5-30 judges (Zieky and Livingston, 1977)
  - As many judges as possible (Cizek, 1996)

<sup>1</sup> Verhoeven B.H., van der Steeg A.F., Scherpbier A.J., Muijtjens A.M., Verwijnen G.M., van der Vleuten C.P. (1999). Reliability and credibility of an angoff standard setting procedure in progress testing using recent graduates as judges. *Med. Educ.* 33(11):832-837





## Angoff method to set pass marks

- The **concept** of a **borderline** or **minimally competent** candidate has been found difficult to accurately define and understand by judges
- Candidate whose **knowledge**, **skills** and **abilities** are just enough
- Candidate who has an exactly **50:50 probability** of **passing or failing** the examination

**The borderline candidate is the marginal student:  
one who on some days might just barely pass your  
assessment but on other days might fail...**



## Norm-reference method to set pass marks

- Standard-setting **norm-reference method** determines the pass mark to be equal to average test score minus one standard deviation (indicated by educationalists)
- Comparison to Angoff method
  - George S., Haque M.S., Oyebode F. (2006). Standard setting: comparison of two methods. BMC Med. Educ. 6, 46-51
- Angoff method: objective  
Norm-reference method: arbitrary



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## Norm-reference method to set pass marks

- Pass rate with Angoff method is significantly higher (100 percent in paper) than the pass rate with the Norm-reference method (85 percent in paper)  
(note: this was a 50 single-best answer item test with only 78 participants)
- Different standard setting methods result in different outcomes → **clear definitions should be made in order to assure credibility, acceptability and defensibility of the chosen method**

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## Some things to reflect on...

- What is the level of education? Is it possible that **every candidate** is able to **pass (fail)** the examination?  
(can be the case when using the Angoff method)
- Is an examination intended to **definitely fail** a certain percentage of candidates?  
(will be the case with the norm-reference method)
- In practice **combinations** of both techniques (absolute and relative) are often used

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- How to set pass marks? Reaching a **consensus** rather than obtaining a scientifically correct solution



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## Example: European Board of Ophthalmology

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## WELCOME TO THE EBO WEBSITE

The European Board of Ophthalmology (EBO) was founded in 1992 in London. It is a permanent working group of the Ophthalmology Subspecialty Section of the **European Union of Medical Specialists (UEMS)**.

The Board has specifically been given the task of overseeing the standard of ophthalmology training. The National Delegates of the Board include clinicians and academicians with specific ophthalmological skills, expertise and a broad geographic distribution. Two delegates are nominated from each country of the European Union, Norway and Switzerland by the National Ophthalmological Societies. One delegate represents academic ophthalmology and one represents the professional practitioners. The delegates are chosen for a four year term. One additional four-year term is permitted.

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## EBOD Examination: European standards

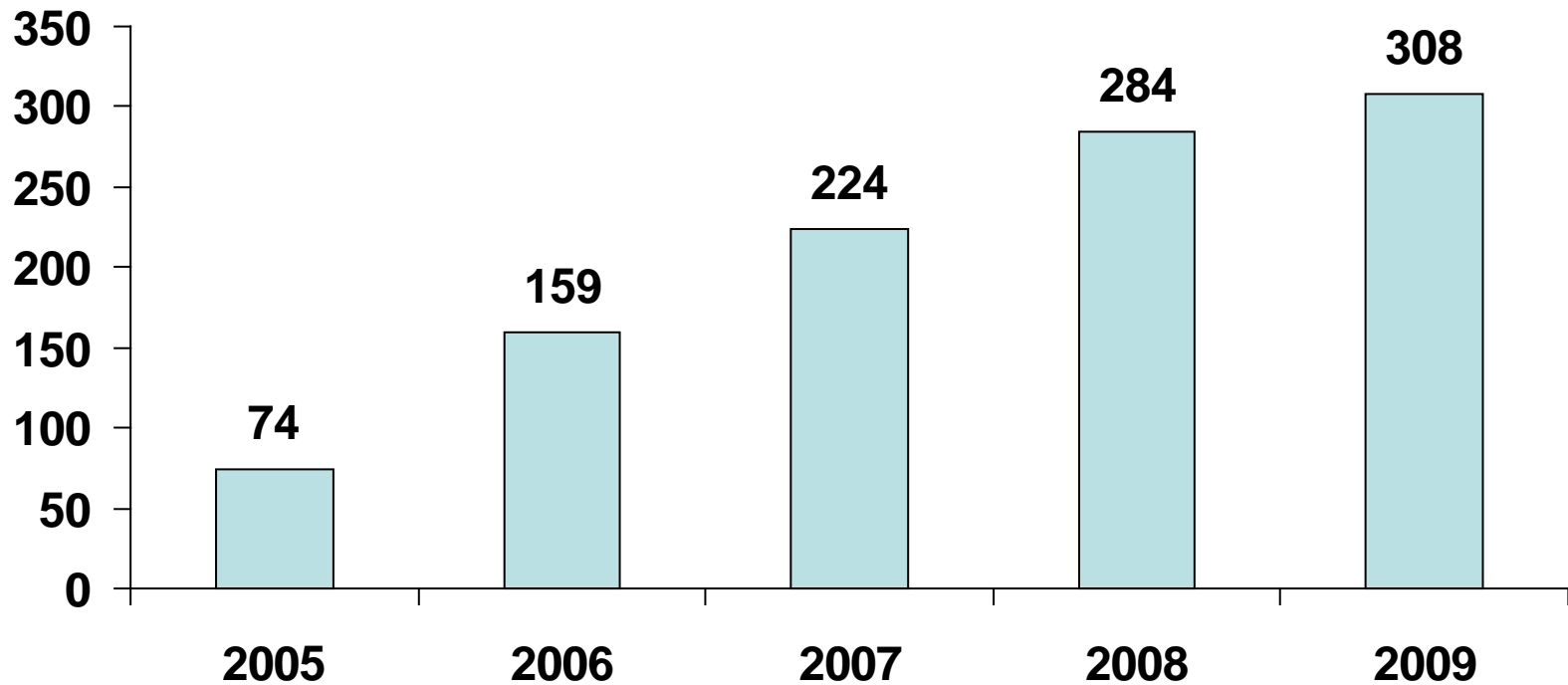
- Until 2003 only specialists could sit the examination
- Since 2004, the EBO examination has been opened for residents → official use by different countries to assess the level of education in ophthalmology of residents at the end of their training:
  - Replacement of national examination (Belgium, Switzerland)
  - Highly mandatory (France, Slovenia)
  - Highly recommended (Finland, The Netherlands)





# EBOD Examination: European standards

Number of Candidates





## EBOD Examination: Structure

- Written examination (2.5 hours) “MCQ”
  - 52 MCQs (260 true/false items)
  - Accounting for 40 percent of the total candidate score
  - Relative pass mark (average minus 1 standard deviation)
  - Conversion table to convert MCQ-score to a scale of 1-10
- Oral examination (1 hour) “Viva Voce”
  - 4 different topics (open questions) (equally rewarded)
  - Accounting for 60 percent of the total candidate score
  - Absolute pass mark (arbitrary pass mark of 6 out of 10)
  - Scores range on a scale of 4-10



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## EBOD Examination: Written part (MCQs)

- Selection of MCQs
  - Responsibility: EBO Education Committee
  - Selection based on pre-defined topics within ophthalmology
  - Broad indication of level of difficulty of the MCQs  
Easy - Intermediate - Difficult
  - If necessary: finetuning of the question
- Translation of MCQs
  - Under supervision of EBO Education Committee
  - Translation of the master MCQs (English) into German and French
  - Verification after translation to avoid differences due to translation



## EBOD Examination: Written part (MCQs)

- On-site calculation of test scores
  - Speedwell Multiquest analysis tool
  - In-house developed statistical analysis tool (written in R) for further preliminary statistical results (validation purposes) and score conversion
  - Until 2009: no negative marking
  - Introduction 2010: **negative marking** (true-false format of MCQs: guess factor)
- Question bank
  - Until 2009: “manual” question bank
  - Introduction 2010: **electronic question bank** (Speedwell QuestionBank) including statistical parameters of MCQs that have been used before





## EBOD Examination: Written part (MCQs)

	2005	2006	2007	2008	2009
MCQ Mean $\pm$ SD	193 $\pm$ 15	189 $\pm$ 14	191 $\pm$ 15	184 $\pm$ 15	204 $\pm$ 13

- Score conversion

- Pass mark = 6

$$6 = \overline{MCQ - score} - SD(MCQ - score)$$

- Other marks derived based on mean MCQ-score and its standard deviation

- EBO MCQ-bank is not yet completely validated
- Pass rate remains comparable over the years



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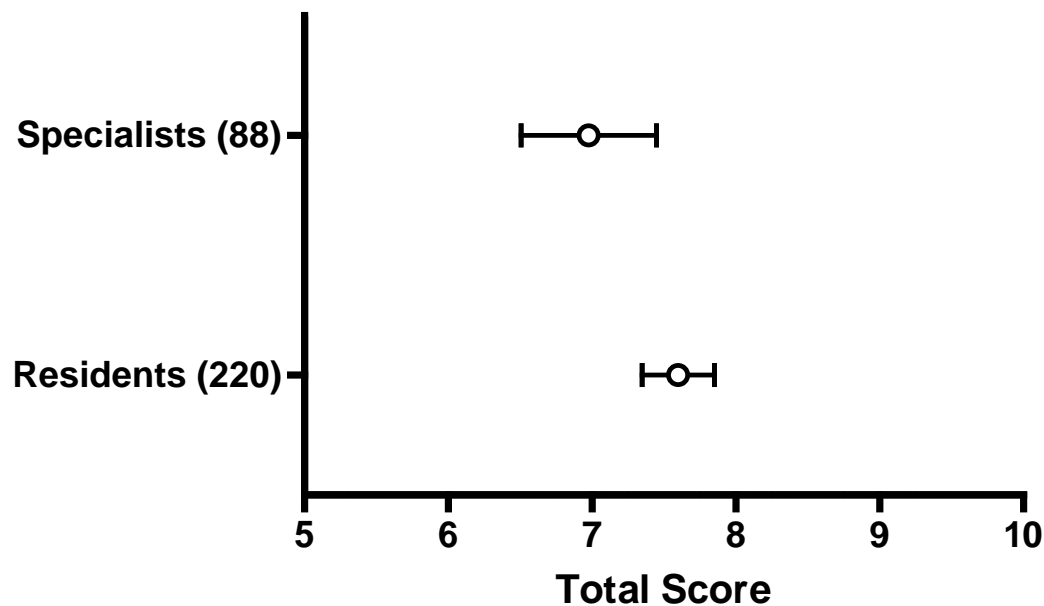
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## EBOD Examination: Written part (MCQs)

**EBOD 2009 MCQ Scores  
with 95 % Confidence Intervals**





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# EBOD Examination: Oral part (Viva Voce)

- Principle
    - Each Viva Voce is seen as to be a discussion among specialists in ophthalmology between the candidate and two examiners
    - Four topics with two examiners for each topic
      - each candidate is examined by eight different examiners
- Different examiners → different questions
  - Different languages (English, mother tongue, ...)
  - However, statistical analysis has indicated that the results of the Viva Voce are very well correlated, also with the written part (MCQs) of the examination



# EBOD Examination: Oral part (Viva Voce)

- Question
- Exam
- exam
- Base
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- Base
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• Topic D: Posterior segment, Ocular inflammation, and Uveitis





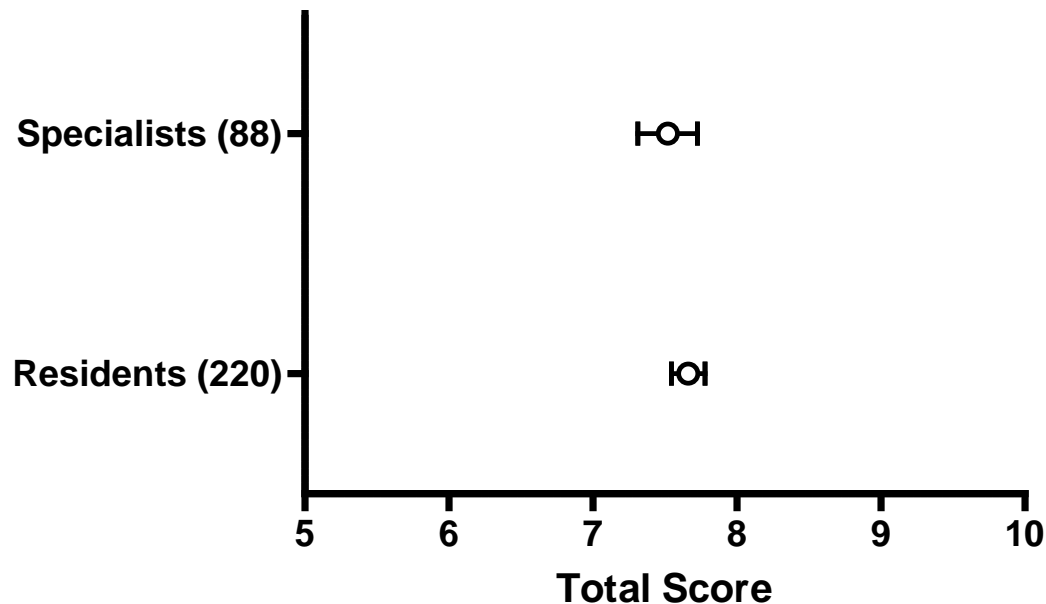
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# EBOD Examination: Oral part (Viva Voce)

**EBOD 2009 Viva Voce Scores  
with 95 % Confidence Intervals**





## EBOD Examination: Score calculation

$$TTS = (0.4 \times MCQ) + \sum_{i=1}^4 (0.15 \times VV_i)$$

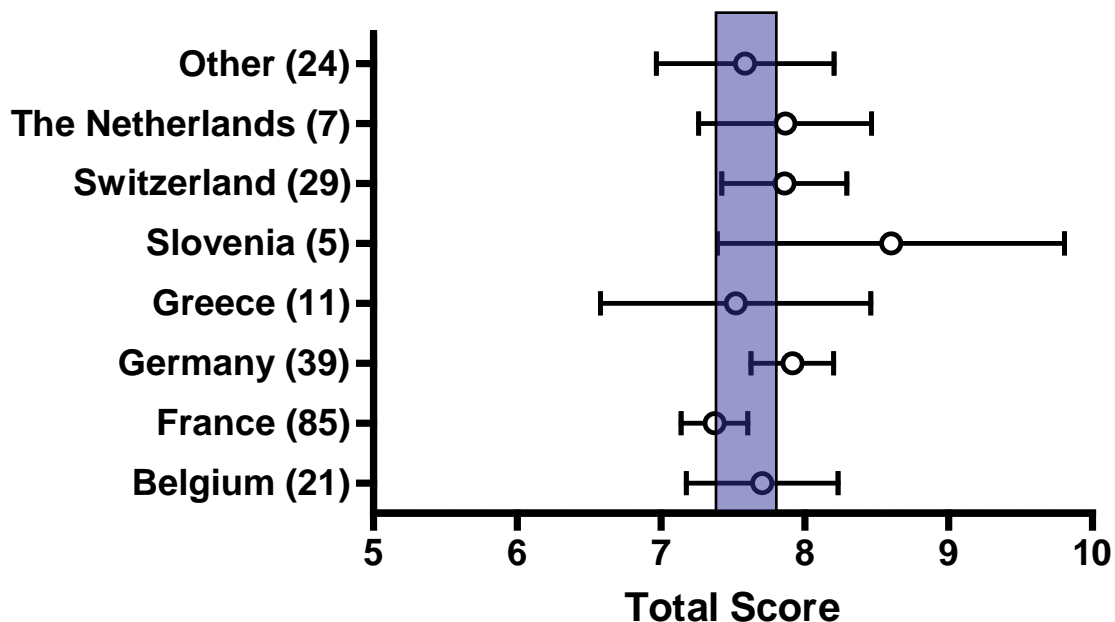
- Total examination score
  - MCQ-test accounts for 40 percent of total test score
  - Viva Voce scores account for the remaining 60 percent of total test score
  - Arbitrary pass mark of 6 out of 10 on the calculated total test score

	2005	2006	2007	2008	2009
Success Rate	87.6%	88.1%	89.2%	90.8%	88.6 %



# EBOD Examination: Score calculation

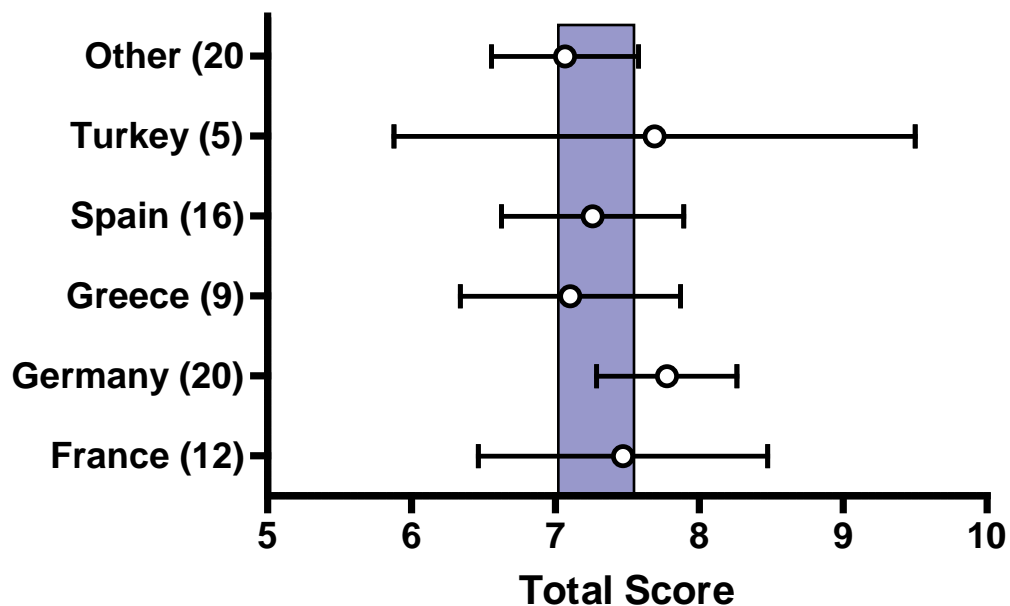
**EBOD 2009 Total Scores Residents  
 with 95 % Confidence Intervals**





# EBOD Examination: Score calculation

**EBOD 2009 Total Scores Specialists  
 with 95 % Confidence Intervals**





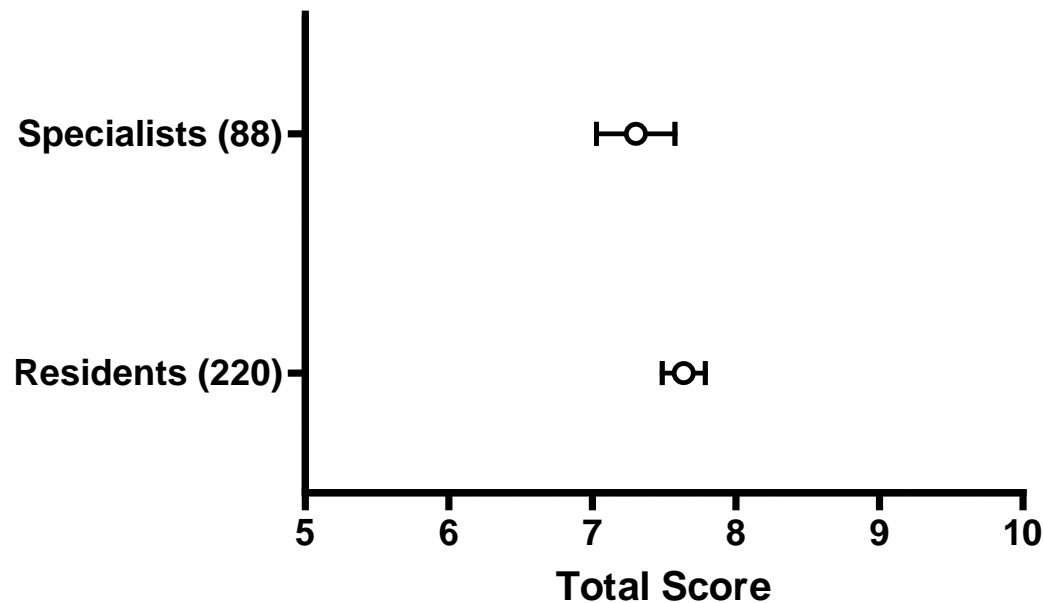
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# European Board of Ophthalmology exam

**EBOD 2009 Total Scores  
with 95 % Confidence Intervals**



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Thank  
you