

Writing Multiple Choice Questions

Lynne M. Kirk, M.D.
Linda R. Margraf, M.D.

Objectives

- Purpose of testing in medical education
- Formats used for test items
- Technical flaws in items
- Rules for one-best-answer items
- Introduction to item analysis

Why do we test in medical
education?

Purposes of Testing

- Communicate what is important
- Evaluation drives behavior
- Identify areas of deficiency
- Determine grades
- Identify areas where the course/curriculum is weak

What Should be Tested?

- Exam content should match course objectives
- Greater weight on important topics
- Testing time on topic reflects importance
- Items should reflect educational goals

Multiple-choice Item Formats

- A=one best answer out of 4 or more choices
- B=2 or more stems with 4 or more matching items
- R=Extended matching with 2-20 items
- T/F=True/False

Parts of a Multiple-choice test question "Item"

- A 65-year-old man has difficulty rising from a seated position and straightening his trunk but he has no difficulty flexing his leg. Which of the following muscles is most likely to have been injured?
 - A. Gluteus maximus
 - B. Gluteus minimus
 - C. Hamstrings
 - D. Iliopsoas
 - E. Obturator internus
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- vignette
- lead-in
- answer
- distractors
- stem
- options

“Testwise” Issues

- Grammatical cues
- Logical cues
- Absolute terms
- Long answer
- Word repeats
- Convergence

A 6 month old infant was diagnosed with dilated cardiomyopathy, poor right ventricular function and pulmonary hypertension. He underwent transplantation at 28 month of age. A representative section of the explanted heart is provided. **Clinical manifestations of a child with this condition could include:**

- A. Asymptomatic
- B. Depressed left ventricular function
- C. Systemic emboli
- D. All of the above

A 9 year-old girl has a 1 month h/o back pain, intermittent fever and multiple subcutaneous nodules on her back. A biopsy of the lesions shows a dense infiltrate of atypical CD8+ lymphoid cells. Which of the following statements is true?

- A. Systemic hemophagocytosis syndrome may be associated with this lesion
- B. Patients always respond to steroid therapy with complete resolution
- C. Fat necrosis is always absent
- D. Eosinophils never play a pathogenetic role

Avoid convergence and word repeats

- What is the answer?
- A. pencil and pen
- B. pencil and marker
- C. pencil and crayon
- D. pen and highlighter
- E. pen and ink

- A psychiatric patient speaks of experiencing the world as unreal. This symptom is called:
- A. Depersonalization
- B. Derailment
- C. Derealization
- D. Signal anxiety

Irrelevant Difficulty

- Options long, complicated, or double
- Inconsistent numeric data
- Vague frequency terms
- Options language not parallel
- Options in nonlogical order
- “None of the above”
- Tricky or complicated stem

Following a second episode of pelvic infection, what is the likelihood that a woman is infertile?

- A. Less than 20%
- B. 20-30%
- C. Greater than 50%
- D. 90%
- E. 75%

Following a second episode of pelvic infection, what is the likelihood that a woman is infertile?

- A. Less than 20%
- B. 20 to 40%
- C. 41 to 60%
- D. 61 to 80%
- E. Greater than 80%

Embolism of a cerebral artery most commonly occurs from all of the following situations EXCEPT

- A. Atheromatous plaques of the vertebral artery
- B. Atheromatous plaques of the internal carotid artery
- C. Endocarditis of the mitral valve
- D. Atheromatous plaques of the abdominal aorta.

A 76 year-old right handed man has the sudden onset of weakness in his left arm and leg. It is determined that he has had an arterial embolism. The most likely source of the embolus that caused this is atheromatous plaques of the

- Abdominal aorta
- Internal carotid artery
- Right iliac artery
- Vertebral artery

Guidelines for Item Construction

- Stem can be answered without looking at the options.
- Most of content is in the stem
- No superfluous information in stem
- Options are grammatically consistent and logically compatible with the stem
- List options in logical or alphabetical order

Guidelines (cont.)

- Write distractors that are plausible and about the same length
- Avoid absolutes or vague terms
- Avoid negatively phrased items
- FOCUS ON IMPORTANT CONCEPTS, not trivial facts

Terms and phrases to avoid

- Is associated with
 - Is important for
 - May or could
 - Usually or frequently
 - Always and never
 - None of the above, All are true except
- Imprecise terms
- Absolute terms
-
- A diagram consisting of two large curly braces on the right side of the list. The top brace groups the first four items: 'Is associated with', 'Is important for', 'May or could', and 'Usually or frequently'. The bottom brace groups the fifth item: 'Always and never'. The text 'Imprecise terms' is positioned to the right of the top brace, and 'Absolute terms' is positioned to the right of the bottom brace.

A 50 year old man with a history of alcohol and nicotine abuse has difficulty swallowing for solid food and has lost ten pounds over the past two months. He now has difficulty swallowing fluids. Which of the following statements is correct?

- A. The patient's prognosis is good
- B. Barium contrast study is indicated
- C. The most likely tumor is adenocarcinoma
- D. The patient has achalasia

A 50 year old man with a history of alcohol and nicotine abuse has difficulty swallowing for solid food and has lost ten pounds over the past two months. He now has difficulty swallowing fluids. What is the most likely diagnosis in this patient?

- A. Achalasia
- B. Adenocarcinoma of the colon
- C. Adenocarcinoma of the esophagus
- D. Gastric carcinoma
- E. Squamous cell carcinoma of the esophagus

Which of the following will be increased in an infant with phenylketonuria?

- A. Homocysteine
- B. Homogentisic acid
- C. Isoleucine
- D. Isovaleric acid
- E. Phenylacetic acid

A 9-month old girl has had two seizures in the past month. She was born at home and received no newborn screening. She has developmental delays. Her skin and hair are fair and lighter colored than that of her siblings. Her diapers have a musty odor. Which of the following is most likely to have an increased concentration in this infant's urine?

- A. Homocysteine
- B. Homogentisic acid
- C. Isoleucine
- D. Isovaleric acid
- E. Phenylacetic acid

Item Analysis Guidelines

- P-value (percent correct)=Measure of difficulty
 - Optimal 55-75
 - Unacceptable <35, >95
 - OK 45-55, 75-85
 - Fix, if you can 35-45, 85-95
- Discrimination measurement:
 - Point biserial - proportion of better vs. poorer students getting question correct (rpb)
 - >.30 very good item
 - .2-.29 ok
 - .09-.19 needs improvement
 - <0.09 poor

An otherwise healthy 25-year old woman presents withWhich of the following lab results are consistent with a diagnosis of immune thrombocytopenic purpura?

	% of marks	Test Average
A. Prolonged PT, normal PTT and TT	2	75.95
B. Prolonged PTT, normal PT and TT	3	74.83
C. Prolonged TT, PTT and PT	2	73.21
D. Normal PT, PTT and TT	79	79.48
E. Prolonged PT, PTT and TT	13	76.88

An otherwise healthy 25-year old woman presents withWhich of the following coagulation study results are consistent with the most likely diagnosis?

	% of marks	Test Average
A. Prolonged PT, normal PTT and TT	3	78.44
B. Prolonged PTT, normal PT and TT	8	80.21.
C. Prolonged TT, PTT and PT	3	76.90
D. Normal PT, PTT and TT	74	81.32
E. Prolonged PT, PTT and TT	12	76.99

Rpb= 0.53 much improved!

Example #1

Group	A	B	C*	D	E	F
Hi	0	1	90	3	3	3
Lo	0	1	60	25	8	6
Total	0	1	74	12	7	6

p-value: 76

discrimination index: 0.33

Interpretation: 91% of the Hi group and 61% of the Lo group selected the correct answer. These are excellent overall statistics. You could rewrite A and B before you reuse the item because few students selected those options.

Example #2

Group	A	B	C*	D	E	F
Hi	44	1	50	2	1	2
Lo	20	15	21	22	20	2
Total	32	7	34	14	11	2

p-value: 34

discrimination index: 0.30

Interpretation: 51% of the Hi group and 21% of the bottom group selected the correct answer. This is a very difficult item that is probably NOT OK. Too many of the Hi group selected Option A; the item may be poorly worded. Check Option A for "fairness." Make sure Option A is not equally correct.

Example #3

Group	A	B	C*	D	E	F
Hi	18	10	51	17	2	2
Lo	24	24	21	25	4	2
Total	22	17	34	22	3	2

p-value: 34

discrimination index: 0.30

Interpretation: The Hi/Lo group breakdown on option C is identical to Item #3, but this item may be OK. In contrast to Item #3, those who don't know the correct answer are widely spread across the various distractors. Of course, it would still be desirable to review options A, B and D for correctness and clarity.

Reference

“Constructing Written Test Questions For
the Basic and Clinical Sciences”

Susan Case

David Swanson

National Board of Medical Examiners

www.nbme.org/about/itemwriting.asp