How to Assess Clinical Decision Making: The "Key Features" Approach

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Congreso Nacional de Educacion Medica
Puebla, Mexico, Jan. 11, 2007

Acknowledgements

■ Stephen Aaron ■
University of Alberta

■ Robert Lee ■
Medical Council of Canada

■ Gordon Page ■
University of British Columbia

INTRODUCTIONS

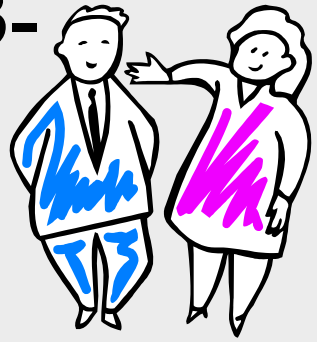
1-

North. Mexico

Mexico City

South. Mexico

3-



- Institution

- Position

2- Item writing experience

- Not had workshop in test development
- Workshop on: - MCQs
  - Case-based items
  - KFs

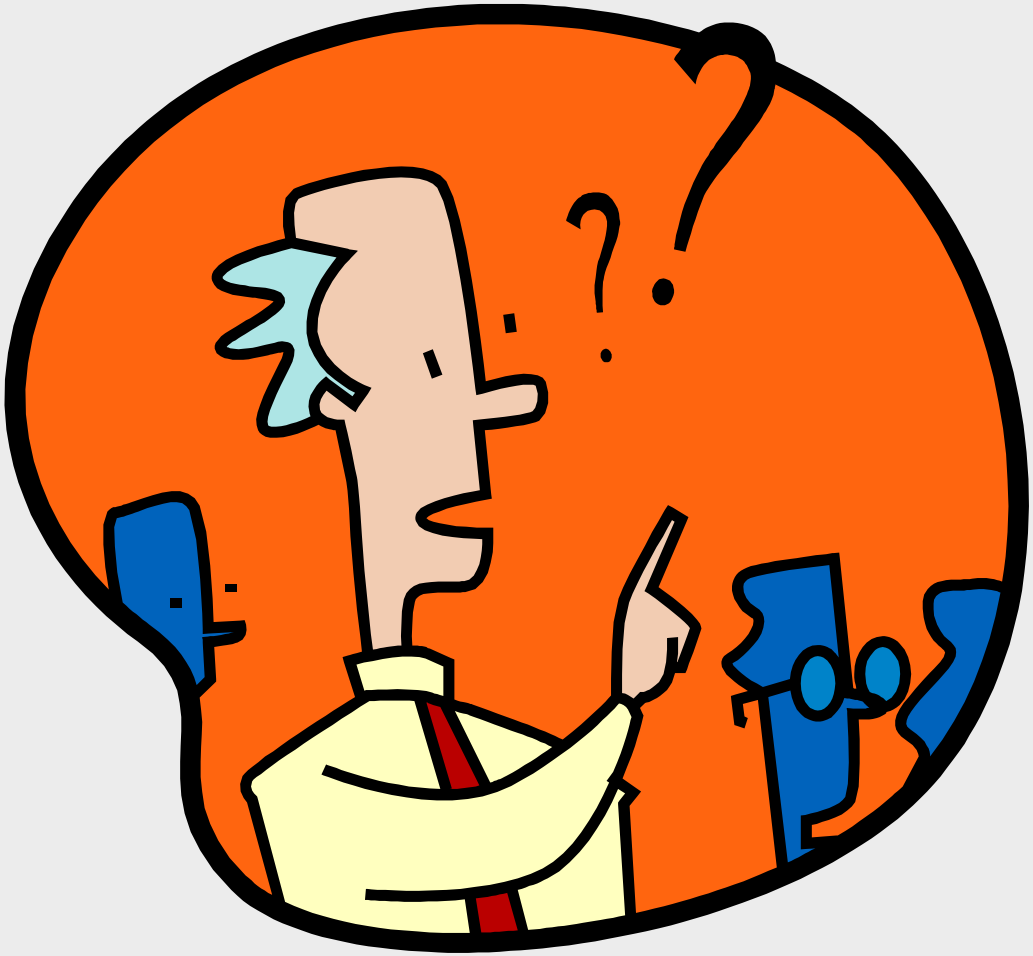
Workshop Objectives

1. Define "**Key Features**" (KFs).
2. Understand **psychological** & **measurement** basis of KFs approach to assess clinical decision making.
3. Use a **systematic strategy** to:
   - select problems & define KFs,
   - develop KF cases and questions, &
   - score KFs & KF exams.

Agenda

- 16:00-16:10 Introductions
- 16:10-16:25 Why Key Features
- 16:25-16:45 How to develop KFs
- 16:45-17:40 Develop KFs
- 17:40-18:00 QA & Closure

In doubt… ask question.



What are Key Features?

Unique challenges, critical steps, decisions, or actions in the resolution of a clinical problem

Key Features

Problem: infant in severe, early respiratory distress

Examinee: a graduating medical student

KF-1 Consider following 3 impending conditions: respir. failure, dehydration, & congestive heart failure.

KF-2 Administer immediate evaluation & management, including: ABG, nebulized salbutamol, O2, IV line, and portable chest x-ray; and avoid unnecessary investigation in acute phase.

What's a KF Case?

- A clinical scenario, with age & clinical situation specified:
  Severe (life-threatening) respiratory distress in an infant …
- Typically followed by 2 or 3 questions
- Assessing *only* unique challenges *("key features")* or critical decisions and actions in the resolution of the problem *(not underlying knowledge or reasoning)*
- Paper & pencil *(or OSCE)*

Sample Key Features Case

The triage nurse in the Emergency Department asks you to see a 9-month-old boy. The boy's mother tells you that her son has had a cold for the past 4 days and fever for the past 2 days. Over the previous 18 hours, he has developed fits of coughing associated with wheezing. He has become irritable and his condition is getting worse. He has not eaten well for the last 3 meals. On examination you see a drowsy boy with a blueish tongue, flat anterior fontanel, sunken eyes, and no nuchal rigidity. Temperature, 37°C; heart rate: 112/minute; Blood pressure: 78/56 mm Hg; Respiratory rate: 66/minute. First and second heart sounds are normal with presence of third heart sound, no cardiac murmurs. There is flaring of the alae nasae and intercostal and subcostal retractions, hyperinflated chest, reduced breath sounds with diffuse expiratory wheezes. Liver is palpable at 3.5 cm below the right costal margin.

Question 1. What impending condition(s), if any, will you consider in this infant? You may list up to three. Write “none” if no impending condition is likely.

1. _____

2. _____

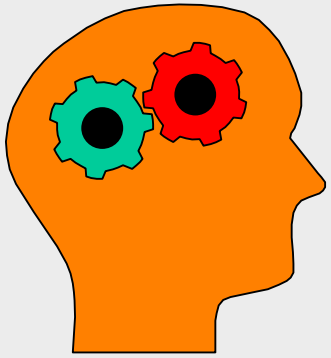
3. _____

Question 2. What orders or actions will you take, if any, in completing your immediate evaluation and management of this infant? You may select up to five or select item 30 if you wish to do nothing and continue to observe at this point in time.

1. Aminophylline IV
2. Blood cultures
3. Blood gases
4. Call ICU staff and anaesthesia
5. Cardiac ultrasound
6. Cardiac catheterization
7. Cefuroxime IV
8. Complete blood count (CBC)
9. Cricothyrotomy
10. CT of head
11. Diazepam rectally
12. Examine ear, nose, throat & fundi
13. Intubation, endotracheal
14. Lumbar puncture
15. Measure to plot growth chart
16. Morphine IM
17. Nasogastric tube
18. Normal saline, bolus
19. Normal saline, IV
20. Oxygen by nasal prongs
21. Racemic epinephrine
22. Rectal examination
23. Rectal temperature
24. Salbutamol, nebulized
25. Social Services consultation
26. X-ray: soft tissue of the neck
27. X-ray: chest (portable)
28. Ventilate w/ Ambu bag & mask
29. 2/3-1/3 IV
30. Do nothing; continue observation

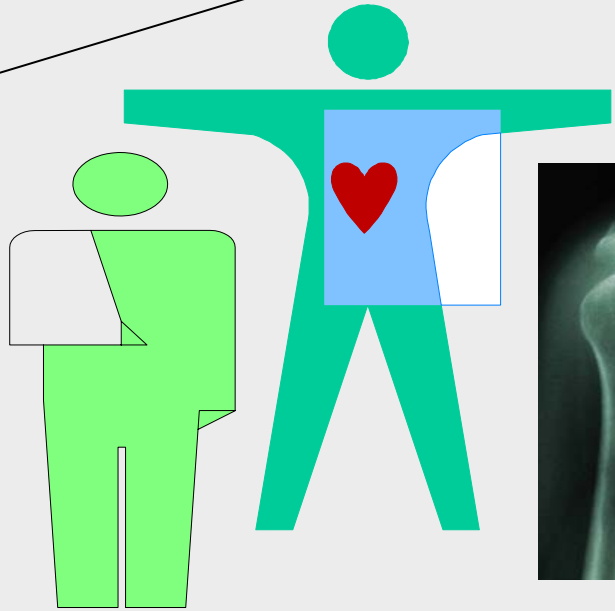
Why Key Features Cases?
Psychological Basis

Problem solving in medicine is:



Not a general skill

Specific to each case



- Inter-case correlation = .1 - .3

Case Specificity

- Each case presents unique challenges

Arthritis ≠ Anemia ≠ Crohns ≠ Diabetes

Key Features (KFs)

Thoroughness

is a predictor of

"poor" performance

Elstein, Shulman & Sprafka, 1978

When in doubt, collecting more data *(EKG features)*

- did not improve Dx accuracy
- indicator of uncertainty, Dx error

(Hatala et al, 1998)

Consequences for assessment

- Assess only unique challenges, case-specific decisions in resolution of a clinical problem

…best discriminators

- Assess effectiveness, not thoroughness

Permit broader sampling of problems to address "case specificity" / testing time

Why Key Features Cases?
Measurement Issues

Reliability – Many "focused" problems -- better sampling, more consistent assmt

Content Validity – Assessing the most important clinical decisions within a representative sample of cases

"Bottom-up" thinking – Assessing knowledge application in the context of what clinicians do in real life!

"Fidelity"

No Clinical Vignette

What is the most likely renal abnormality in children with nephrotic syndrome and normal renal function?

(A) acute poststreptococcal glomerulonephritis

(B) hemolytic-uremic syndrome

***(C)** minimal change nephrotic syndrome

(D) nephrotic syndrome due to focal and segmental glomerulosclerosis

(E) Schönlein-Henoch purpura with nephritis

Case SM, Swanson DB. Constructing Written Test Questions for the Basic and Clinical Sciences, 1996. Page 58-9.

Short Clinical Vignette

A 2-year-old boy has a 1-week history of edema. BP: 100/60 mm Hg. There is generalized edema and ascites. Serum concentrations are: creatinine 0.4 mg/dL, albumin 1.4 g/dL, and cholesterol 569 mg/dL. Urinalysis shows 4+ protein and no blood.

What is the most likely diagnosis?

Longer Clinical Vignette

A 2-year-old black child developed swelling of his eyes and ankles over the past week. BP: 100/60 mm Hg, pulse 110/min, and respirations 28/min. In addition to swelling of his eyes and 2+ pitting edema of his ankles, he has abdominal distension with a positive fluid wave. Serum concentrations are: creatinine 0.4 mg/dL, albumin 1.4 g/dL, and cholesterol 569 mg/dL. Urinalysis shows 4+ protein and no blood.

No Clinical Vignette

What is the most likely renal abnormality in children with nephrotic syndrome and normal renal function?

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Short Vignette

A 2-year-old boy has a 1-week history of edema. BP: 100/60 mm Hg, and there is generalized edema and ascites. Serum creatinine 0.4 mg/dL, albumin 1.4 g/dL, and cholesterol 569 mg/dL. Urinalysis: 4+ protein and no blood.

Longer Vignette

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Is discrimination effected by the "fidelity" of the question stem? …YES

What is the most likely renal abnormality in children with nephrotic syndrome and normal renal function?

	A	B	*C*	D	E	
U:	1	0	99	0	0	Overall difficulty
L:	8	1	90	1	0	94

A 2-year-old boy has a 1-week history of edema. Blood pressure is 100/60 mm Hg, and there is generalized edema and ascites. Serum concentrations are: creatinine 0.4 mg/dL, albumin 1.4 g/dL, and cholesterol 569 mg/dL. Urinalysis shows 4+ protein and no blood. What is the most likely diagnosis?

U:	0	0	98	2	0	
L:	5	2	82	8	1	88

A 2-year-old black child developed swelling of his eyes and ankles over the past week. Blood pressure is 100/60 mm Hg, pulse 110/min, and respirations 28/min. In addition to swelling of his eyes and 2+ pitting edema of his ankles, he has abdominal distension with a positive fluid wave. Serum concentrations are: creatinine 0.4 mg/dL, albumin 1.4 g/dL, and cholesterol 569 mg/dL. Urinalysis: 4+ protein and no blood.

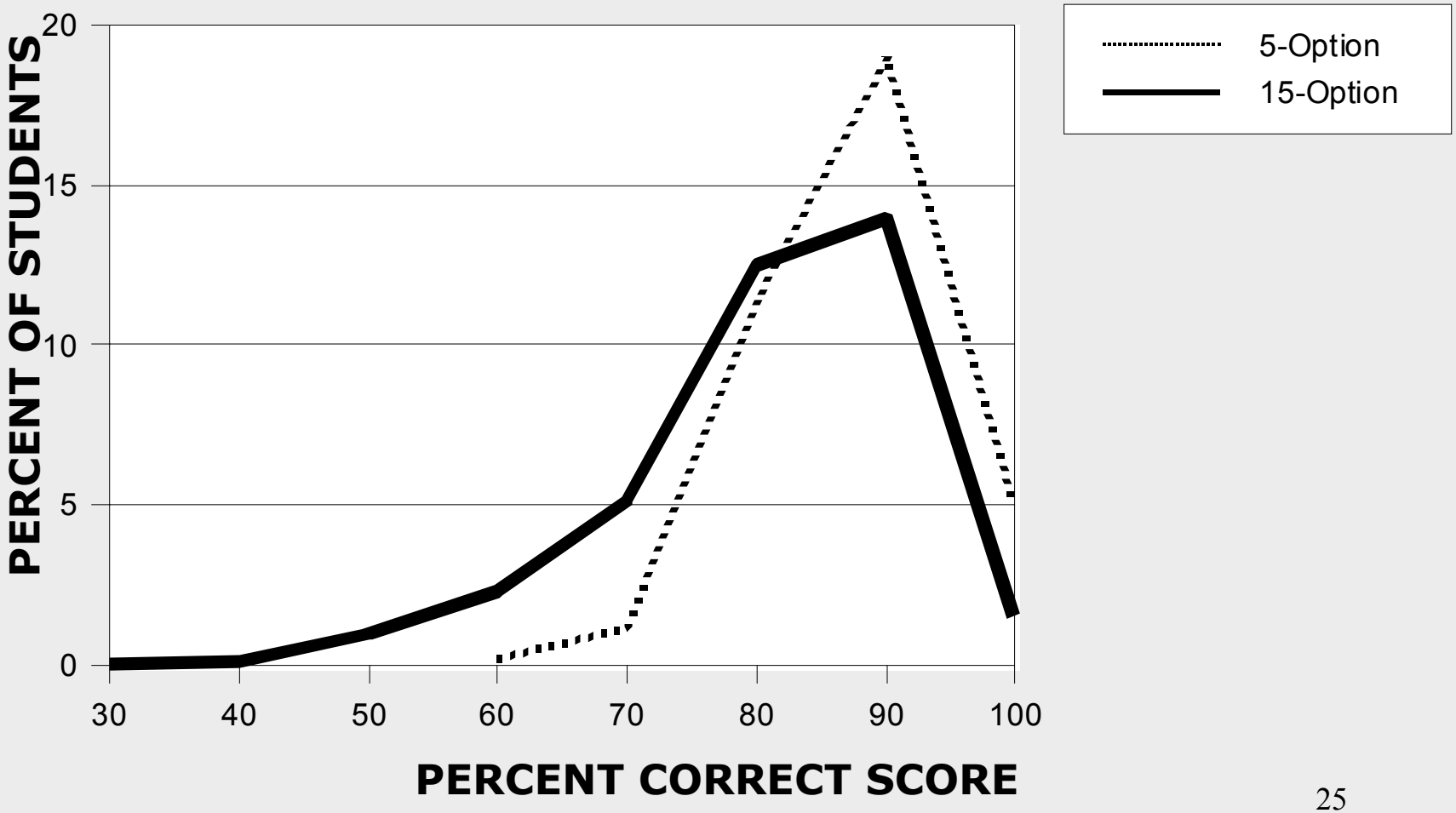
U:	0	1	98	1	0	
L:	10	9	66	10	5	84

Case SM, Swanson DB. Constructing Written Test Questions for the Basic and Clinical Sciences, 1996. Page 58-9.

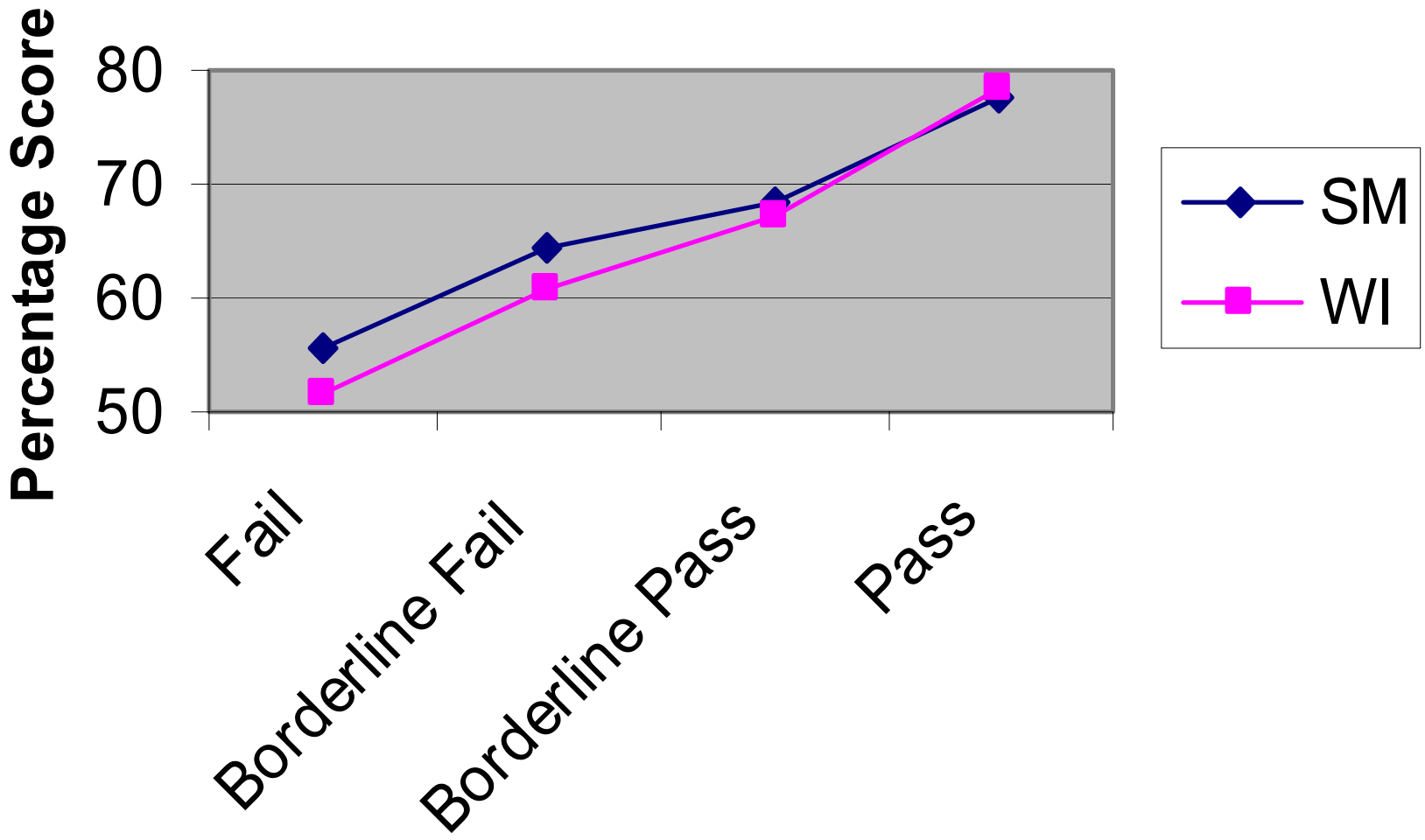
The "fidelity" of the
question stem
is important

What about the fidelity of the
response format ?

Discrimination as a function of the number of options?



Performance on Open Response (WI) vs. Selected Response Items (SM)



Why Use Key Features Cases?
Measurement Issues

Reliability – "Focused" cases -- better sampling, more accurate assessment

Content Validity – assessing the most important clinical decisions within a representative sample of cases

"Bottom-up" thinking – assessing knowledge application and what clinicians do in real life!

"Fidelity" and discriminating power – More effectively identify weaker candidates

Writing a KF Case

Select problems from blueprint

AGE GROUPS

▪ Preg., neonat., infant	5%*	3
▪ Children (Peds)	16%	6
▪ Adolescents	16%	6
▪ Adults	47%	19
▪ Elderly (geriatrics)	16%	6
		40

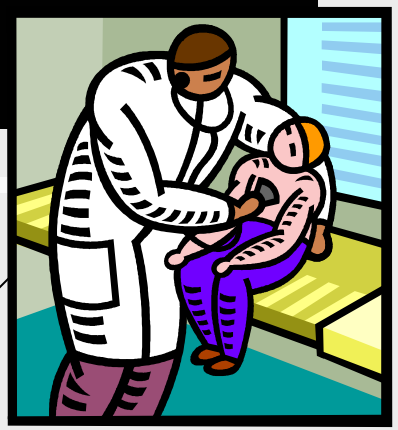
* Health Services Data

ADULTS

- **Seizures (epilepsy)**

How does the problem present itself?

Clinical situations



- Undifferentiated complaint
- Simple, typical/ atypical
- Multiple, multi-system
- **Urgent, life-threatening**
- Prevention,
  health promotion

What Kind of Case?

- Can be single patient
- Can be public health *(e.g., population based)*
- Can "**look like**" single patient , but be about the population *(e.g., diarrhea in a patient, but about calling public health)*
- Can look like it's about one person, but actually be about another *(e.g., spousal abuse, genetic disease).*

SEIZURES

Adult – Life-threatening:
ER Rx Status Epilepticus

Given a man brought to the ER with multiple seizures and without having regained consciousness, the **graduating medical student** should:

What Needs Examining?

Key Features

- **Unique challenges**, **critical** steps, decisions in the resolution of the problem.

- Steps, actions most likely to **lead to error.**
- Most **difficult aspects** of problem identification and management in practice.

What Needs Examining?

Key Features

for the graduating medical student

What Needs Examining? KFs

1.

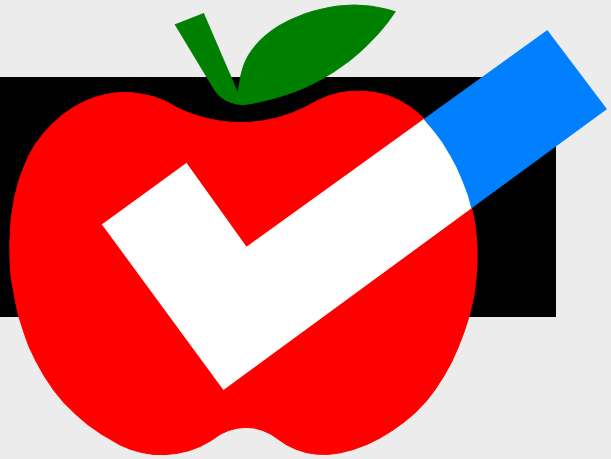
2.

3.

4.

5.

Validity of KFs



Clerkship directors from across Canada confirmed :

- Existing KFs 92%
- Generating KFs 94%

Key Features

- Focus on unique challenges, difficult, critical decisions.
- Discriminating elements that make a difference in practice!

Writing the Case

- Sounds real
- Data presented as in real life: "finger nails & finger beds normal" vs. "no clubbing or cyanosis"
- Leave out data if you want to ask about history, exam or investigation
- Put it in if you want to ask about management
- Put non-contributing data in the case even if they don't relate to the KFs, as in real life

Mr. “X,” a 36-year-old man, is brought to the emergency room in your hospital by ambulance because he fell to a sidewalk unconscious while waiting for the bus. A witness immediately called an ambulance and reported to the ambulance crew that before falling to the ground, he seemed confused, agitated, and was arguing with some invisible person. After falling, he began to twitch for a short while, his face became blue, and then he began to have jerky movements all over his body for about a minute. He did not recover consciousness after the episode. During the 10-minute ambulance trip, he presented two other similar episodes, without recovering consciousness, and a third episode that you witnessed on arrival. His temperature is 37.8 C. He looks neglected and is unconscious. No relatives or friends accompanied Mr. “X.”

Asking the Question(s)

Generally 1 question / KF

What Needs Examining? KFs

KF-1 Generate provisional Dx of status epilepticus

What's the exam question?

Question 2 *(KF-2 & 3)*

What is your immediate management at this point in time? List as many things as you feel are appropriate.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Question 3 *(KF-4)*

Ten minutes after arrival, Mr. "X" is still unconscious. The nurse found a telephone number in his wallet that you decide to call immediately. What questions will you ask the person answering the phone – assuming he/she knows the patient? You may select up to six questions. Select option 35 if you think that it is not appropriate to call at this point in time.

…Question 3

1. Abdominal pain
2. Alcohol history
3. Back pain history
4. Benzodiazepine
5. Cancer history
6. Cocaine abuse
7. Coronary bypass history
8. Diabetes history
9. Diarrhea
10. Dizziness
11. Drug allergy
12. Family history
13. Food allergy
14. Headache
15. Hearing disability
16. Heroin abuse
17. Joint pain
18. LSD abuse
19. Lung infection
20. Medication history
21. Muscular disease
22. Nausea
23. Palpitation history
24. Pet in household
25. Previous similar problem
26. Profession
27. Sexual history
28. Smoking history
29. Social integration difficulties
30. Surgery
31. Travel history
32. Viral infection
33. Visual impairment
34. Vomiting
35. Not appropriate to call at this point in time.

Question 4 *(KF-5)*

It has been 15 minutes since Mr. X's arrival. What ancillary exams will you order at this point? You may select as many as you feel appropriate. Select option 35 if you think that ancillary exams are not needed at this point in time.

…Question 4

1. Alanine Aminotransferase (ALT)
2. Alcohol level
3. Aldolase, serum
4. Alkaline phosphatase, serum
5. Amylase, serum
6. Arterial blood gases (ABG)
7. Aspartate Aminotransferase (AST)
8. Brain CT-scan
9. Brain MRI
10. Brain PET-scan
11. Calcium, serum
12. Carotid US-doppler
13. Cerebral angiography
14. Cerebro-spinal fluid exam
15. Complete Blood Count (CBC)
16. C-Reactive Protein
17. Creatine Phophokinase, serum
18. Creatinine, serum
19. Drug screening, serum
20. Drug screening, urine
21. Echovirus, serology
22. EEG recording
23. Electrolytes (Na, K, Cl)
24. g-Glutamyl Transferase
25. Glucose, serum
26. Lactate Deshydrogenase, serum
27. Lyme disease, serology
28. Protein electrophoresis, plasma
29. T4, Free
30. Temporal artery biopsy
31. Thyroid-Stimulating Hormone
32. Total protein, plasma
33. Urea, serum
34. VDRL (Venereal Disease Research Laboratory), serum
35. No tests needed at this point in time

…Question 4

- Clinical pathology (labs)
- Anatomical pathology (incl. biopsy)
- EEG
- EKG
- Imaging (x-rays…)
- Microbiology
- No tests needed at this point in time

Questions – KFs matrix

	KF1	KF2	KF3	KF4	KF5
Q1	●				
Q2		●	●		
Q3				●	
Q4					●

Asking the Question

- Write in's avoid cueing, but are more labor intensive to score
- Menus can be computer scored, but can cue to your intention.

Open response vs. Selected response — WIs SMs

- Nbr responses — WI < **SM** (+14%; cueing)
- Difficulty — **WI** > SM (-18pts; 54 – 72)
- Variance — **WI** > SM
- Discrimination — **WI** > SM
- Marginal cand. — **WI** > SM

➔ **SMs:** H&P, Lab. & Investigation

➔ **WIs:** Dx & Rx, Management

Scoring

- **Only score answers that relate to the Key Features**
- Partial credit for multiple correct answers (e.g., 3 responses: .33 each)
- Give zero for too many options or harmful actions (e.g., zero for choosing more than 5 out of the 15 options; doing a catherization when uncalled for)

KF-1

Score	Keyed responses
1	Status epilepticus *(**Note**: both elements are required)*
0	Did not answer the above or wrote more than two diagnoses.

Scoring: Partial credit

KF-3 Begin initial therapy

1

1

NS	.25	.17
Vit B	.25	.17
Glucose	.25	.17
Diaz+Phen	.25	.50

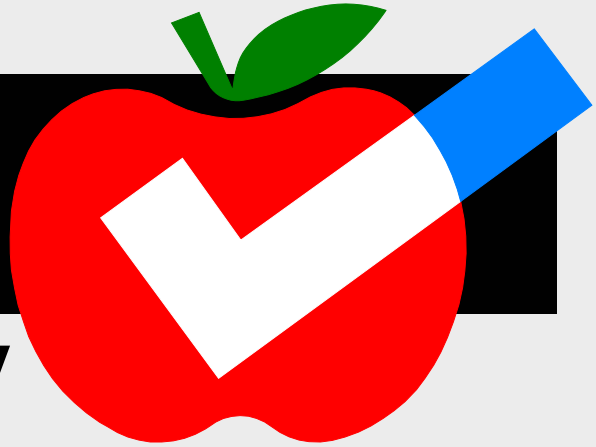
2

3

0 Not mentioning above

Best reliability

Reliability



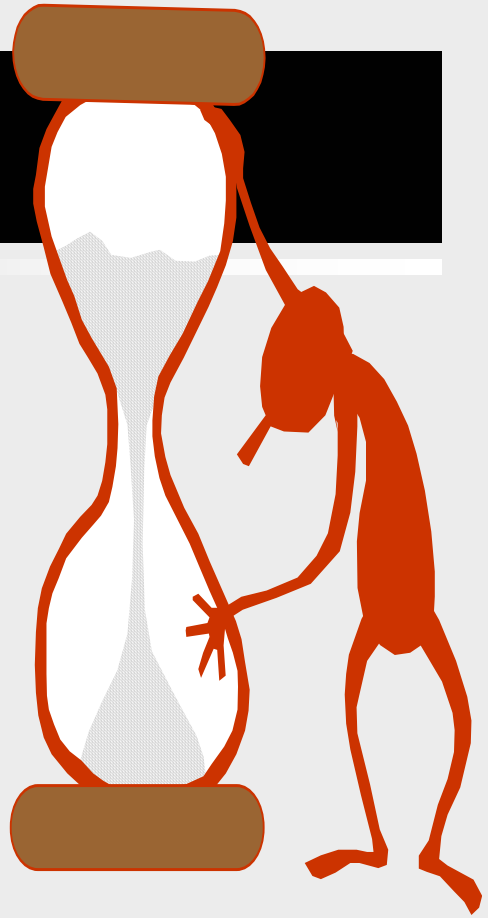
Consistency, reproducibility

- KF exams (1/2-day; 32-36 cases) : ~.65 -.71

- Spearman - Brown Prof. Formula

.80 ➔ 45-50 cases = 1 day

Qs/ case



- *Reliability went down with single-q. cases*
- Generalisability study maximize reliability with **2 -3 q. / case**

---

1 question/ case, not enough

>3 redundant, wasting testing time

Reference*

Sirven, JI & Waterhouse, E. Management of status epilepticus. *Am Fam Physician* 2003;68:469-76

** EBM: Evidence based medicine*

Common Administration Pitfalls

- Failure to follow, read instructions:

  http://www.mcc.ca/english/examinations/qualifying_e1.html
  - To be aware of scoring
  - No reversal once case submitted
  - One case at a time

➔ Read & practice before examination day:

  http://www.mcc.ca/english/examinations/qualifying_e1_practice.html
  - Practice cases (6 available)

The Medical Council of Canada / Le Conseil médical du Canada

CLINICAL REASONING SKILLS (CRS) EXAM (Online demonstration version)

This is the demonstration version of the CRS component MCC's Qualifying Exam Part I in a computer-based format. You must be using Netscape Navigator 4 or Microsoft Internet Explorer 4, 5 or 6 in order to try out this exam. In addition, your browser must have Java and JavaScript enabled. Click your "Back" button to return to the MCC's main web site if you do not want to try the exam or if your browser version is incorrect.

EXAMEN DE RAISONNEMENT CLINIQUE (ERC) (Version de démonstration)

L'examen qui suit est une version de démonstration de la composante ERC de la Partie I de l'Examen d'aptitude du CMC dans un format informatisé. Cet examen a été conçu pour être utilisé de concert avec Netscape Navigator version 4 ou Internet Explorer de Microsoft version 4, 5 ou 6. En plus, les languages Java et JavaScript devraient être initialisés. Si vous n'avez pas la bonne version de fureteur ou que vous ne voulez pas essayer l'examen en ce moment, veuillez cliquer sur le bouton "Back" afin de retourner au site du CMC.

Start / Commencer

Common Administration Pitfalls

- Running out of time…
  - Built-in time management tools
- Keeping track…
  - Flags that count # of responses
  - Provide [N] values, calculator

…in general, candidates do well

MCC CRS Exam
Case One

Switch to French

0:13:38
Time remaining in exam

Case 1
Question 1
Question 2

Normal values
Normal values for most common laboratory tests

Calculator
Online calculator

Check your answers before clicking "Submit."
Submit

QUESTION 2 (Case 1)

4 hours after the beginning of your treatment. The patient feels somewhat better. Vital signs are: blood pressure mm Hg; pulse 104/minute; respirations 28/minute; rectal temperature 38.2°C. Total urine output has been 200 mL. The latest laboratory results are as follows:

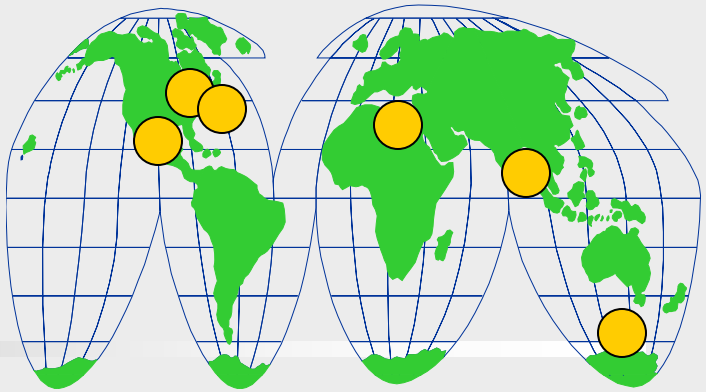
Blood sugar	12 mmol/L	Serum electrolytes	
Serum ketones	++	• Na	135 mmol/L
Arterial blood gases		• K	3.9 mmol/L
• pH	7.24	• Cl	98 mmol/L
• P_aCO_2	20 mm Hg	• HCO_3	13 mmol/L
• P_aO_2	100 mm Hg		
• HCO_3	12 mmol/L		

ning all previous orders are cancelled or terminated, what orders would you write for the next few hours of treatment?

Select up to ten.
(N.B. There are 32 options.)

1. ☑ Aminophylline I.V.
2. ☐ Amoxicillin
3. ☑ Bicarbonate I.V.
4. ☐ Blood cultures
5. ☑ Central venous catheter
6. ☐ Check blood sugar in 2 hours
7. selected ☑ Check blood sugar in 4 hours
8. ☐ eck electrolytes in 2 hours
9. ☐ eck electrolytes in 4 hours
10. ☐ hest x-ray
11. ☐ Daily weights
12. ☑ Dental x-rays
13. ☐ Electrocardiogram
14. ☐ Glucagon I.V.
15. ☐ Hourly intake/output
16. ☑ Hydrocortisone I.V.
17. ☐ Insulin (regular) I.V.
18. ☐ I.V. fluids D5 in NaCl 0.9%
19. ☑ I.V. fluids D50W
20. ☐ I.V. fluids D5W

Dissemination



- Medical schools across **Canada**
- 1991 Collège des Médecins du **Québec** *(SOI)*
- 1993 College Physicians & Surgeons of **Pakistan**
- 1995 **American** College of Physicians (MKSAP)
- 1996 Amer. C. Colon & Rectal Surgeons (CARSEP)
  9 cases – 30 KFs; *Crb α=.95 overall .93 CRS*
- 1997 Royal **Australian** College General Practice
- **Swiss** National Examination Board
- 2002 Hatala & Norman, clerkships*(k=15; Crb α=.49)*

Why Use KF Cases ?

1. High fidelity tests of applied knowledge, w/ case-specific clinical decisions
2. Better sampling of cases
3. Better reliability in fixed testing time
4. Better discrimination of weaker candidates
5. Simple & focused scoring: key decisions
6. Varied formats to fit purpose

- Defensible pass-fail decisions
- Predictive of complaints

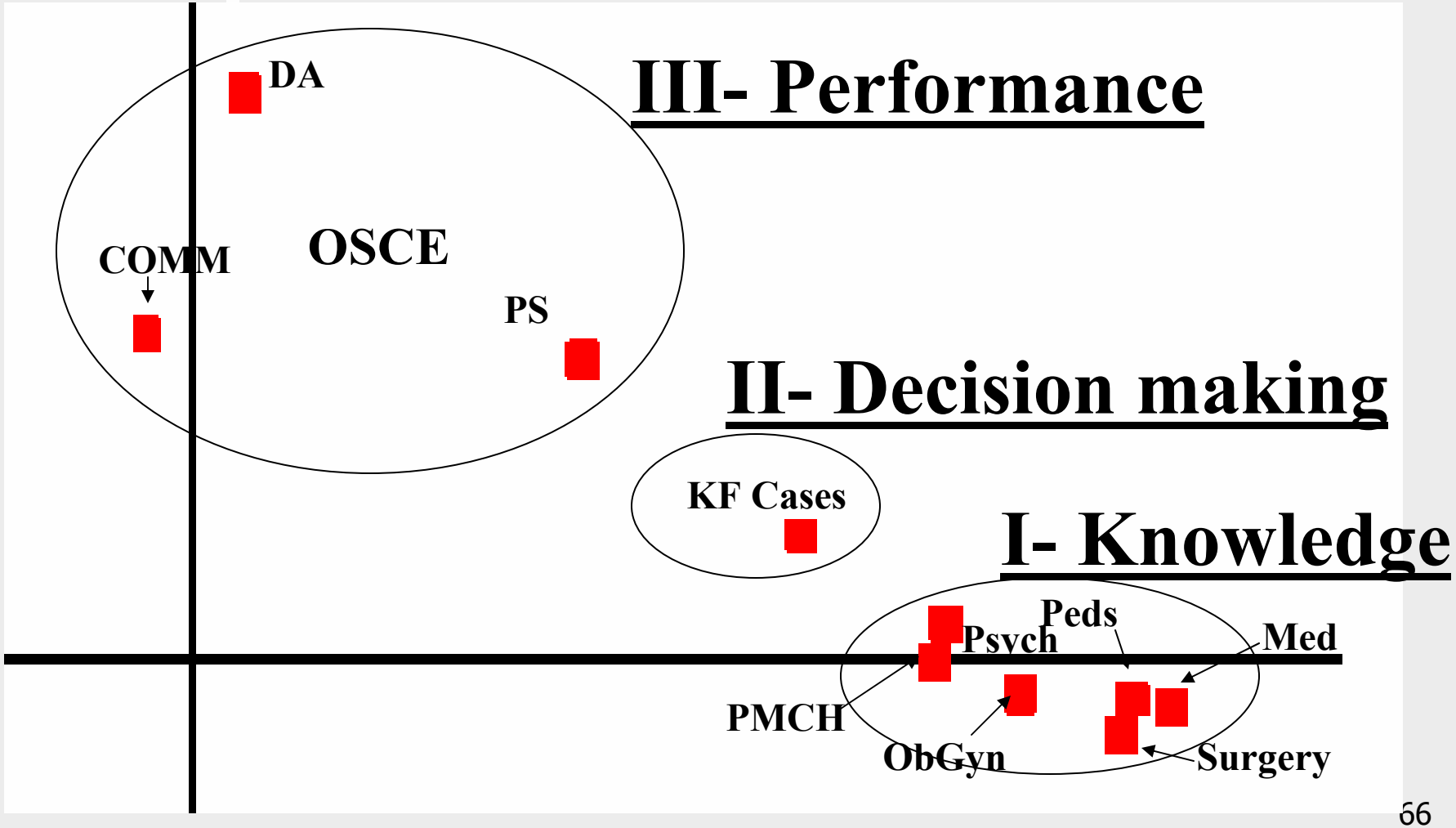
Key Features approach

- Important to assess key clinical decisions
- KFs performance as predictor of future practice

MCC Qualifying Exam

- Knowledge (MCQs)
- Decision making (KF cases)
- Performance (OSCE)

Breadth of testing on MCC QE



Any 

Muchas 

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Acknowledgements:

Dr. Stephen Aaron

Mr. Robert S. Lee

Dr. Gordon Page

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