

Note 1: The following example of an EBM skills test assesses learners' ability to compose relevant, concise, and searchable clinical questions; conduct an efficient literature search; choose relevant and methodologically sound evidence; and, based on the literature, calculate statistics relevant to diagnosis and treatment.

Note 2: From "Smith CA, Ganschow PS, Reilly BM. Teaching residents evidence-based medicine skills: a controlled trial of effectiveness and assessment of durability. *J Gen Intern Med* 2000;15:710-5." Printed with permission from Christopher A. Smith, Department of Medicine, Cook County Hospital and Rush Medical College, Chicago.

EBM Skills Test
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QUESTION 1.

A 75-year-old man presents to your outpatient clinic complaining of urinary frequency, urgency, hesitancy, and nocturia five times per night. He is otherwise healthy with good appetite, no weight loss, or bone pain. Your physical exam is unremarkable except for a slightly enlarged smooth prostate. His PSA is normal. You suspect he may have BPH and suggest that he may need surgery. The patient insists that he does not want an operation and asks you if there is any medication he can take instead. You reply that you think there are several medications that might be effective.

Many different clinical questions might arise during the care of this patient. The medical student working with you asks how you are going to treat this patient recognizing that medical therapy (e.g. alpha blockers) and surgical management are commonly used.

Please write down as clearly and precisely as you can, the ONE question whose answer you think will enable the student to identify the best available treatment.

The medical student returns the next day and says her medical textbook simply states that "there are several medical alternatives to surgery in treating BPH". She tried doing a computer search of the literature, but was unable to identify any articles that seemed appropriate to the question. You offer to help her with a Medline search on Ovid.

Please write out step by step below, your strategy for constructing an effective search of the literature to answer your question above.

STEP 1: Write in your first subject heading.

STEP 2: Your subject appears as a MeSH heading with three subcategories, what do you do now? Choose ONE of the following options.

- a) Limit
- b) Explode
- c) Combine the subheadings and MeSH term of interest with the “AND” function
- d) Combine the subheadings and MeSH term of interest with the “OR” function

STEP 3: You are now given various options. Which ONE do you choose?

- a) Restrict to Focus
- b) All Documents
- c) Both of above
- d) Neither of above

STEP 4: You are now given the option to choose from among the subheadings listed below. Which ONE do you choose?

- a) Treatment
- b) Drug Therapy
- c) Pathophysiology
- d) All subheadings

STEP 5: Your initial search retrieves 224 articles on your subject. You now have 3 options. Please follow the ONE you believe will lead to the quickest and most effective search. (Please choose ONE of the following)

- a) view your search for an appropriate article
- b) continue your search by adding a second subject
- c) limit your above search with quality filters

Note: If you chose (a), skip Steps #6 & #7 and go on to Step #8

If you chose (b), go on to Step #6

If you chose (c), skip Step #6 and go on to Step #7

STEP 6: Write in your second subject to be searched.

Your search retrieves another 490 articles. You decide these two subject headings are sufficient. How would you focus your search to include both subject areas of interest? (Please choose ONE option below)

- a) Combine Subject 1 PLUS Subject 2
- b) Combine Subject 1 OR Subject 2

- c) Combine Subject 1 AND Subject 2
- d) Search for a MeSH term that includes both your subjects
- e) Search for MeSH term that includes one subject or the other

(You can now **EITHER** skip Step 7 and proceed directly to Step 8 **OR** continue on with Step 7)

STEP 7: You decide to narrow your search further. Please choose ONE of the options below.

- a) Limit set → Publication Type → Clinical Trials
- b) Limit set → Publication Type → Treatment Trials
- c) Limit set → Publication Type → Diagnostic Test
- d) Limit set → English Language → Review Articles
- e) Limit set → Latest Update → English Language

(Go on to Step 8)

STEP 8: Please complete your search by choosing ONE of the following options.

- a) Scan treatment guidelines
- b) Scan review articles
- c) Scan treatment articles
- d) Scan Randomized Controlled Trials
- e) Scan all remaining articles

QUESTION II.

A 37-year-old man from your clinic has just been admitted to the hospital for the second time complaining of epigastric pain. He was last admitted 6 months ago when he underwent an endoscopy that revealed two non-bleeding duodenal ulcers. However, no biopsy or CLO test was performed and he was treated for 6 weeks with H2 blockers with symptomatic relief. You discover that he has never been treated for H pylori infection and recommend a repeat EGD. The patient adamantly refuses another invasive procedure. There is no evidence of GI Blood loss and the patient is hemodynamically stable. You have heard of serum antibody testing for H pylori but are unsure of how it will help you to confidently confirm or exclude infection in this patient.

The eager medical student working with you wants to eventually become a Gastroenterologist and decides that this will be his/her topic to look up and help the team and the patient out.

Please write down as clearly and precisely as you can the ONE question whose answer you think will enable the student to identify the pertinent information about the diagnostic test.

The medical student returns the next day and says that his medical textbook states “these tests should be available soon,” but has not been able to find any valuable information about them. You offer to help him/her with a MEDLINE search on OVID at the library.

Please write out step by step below, your strategy for constructing an effective search of the literature to answer your question above.

STEP 1: Write in your first subject heading.

STEP 2: Your subject heading is not listed as a MeSH heading but 8 other MeSH terms appear, one which is closely related to your subject (a) and one which is more of a broad category but still related to your subject (b). The other 6 are not related (c,d,e,f,g,h).

Which one (s) do you choose? (Please choose the ONE best answer from your choices below)

- a) a ONLY
- b) b ONLY
- c) a AND b
- d) a OR b
- e) all of a through h

STEP 3: Your initial search retrieves 120 articles on your subject. You now have 3 options. Please follow the one you believe will lead to the quickest and most effective search. (Please choose ONE of the following).

- a) view your search for an appropriate article
- b) continue your search by adding a second subject
- c) limit your above search with quality filters

Note: If you chose (a), skip Steps #4 & #5 and go on to Step #6

If you chose (b), go on to Step #4

If you chose (c), skip Step #4 and go on to Step #5

STEP 4: Write in your second subject to be searched.

Your search retrieves another 200 articles. You decide these two subject headings are sufficient. How would you focus your search to include both subject areas of interest? (Please choose ONE option below)

- a) Subject 1 PLUS Subject 2
- b) Subject 1 OR Subject 2
- c) Subject 1 AND Subject 2

- d) Search for MeSH that includes both your subjects
- e) Search for MeSH that includes one subject or the other

(You can now EITHER SKIP Step #5 and proceed to Step #6 OR continue on with your search and answer Step #5)

STEP 5: You decide to narrow your search further by combining with one of the options below. Please choose the ONE BEST option.

- a) Diagnostic Test
- b) Explode Sensitivity & Specificity
- c) Specificity
- d) Sensitivity & Specificity

(Now go on to Step #6)

STEP 6: Please complete your search by choosing ONE of the following options.

- a) Scan prognosis guidelines
- b) Scan review articles
- c) Scan meta-analysis articles
- d) Scan Randomized Controlled Trials
- e) Scan all remaining articles

QUESTION III.

A 24-year-old male is admitted with the chief complaints of cough, fever & malaise of one week's duration. He says the illness started as a "cold" and that several of his colleagues at the dormitory have also been sick in the recent past. Examination reveals a young man in mild distress, febrile to 101F. Physical exam is unremarkable except for decreased breath sounds and some crackles in the mid-zone of the right lung. An x-ray obtained in the ER shows a right middle lobe infiltrate. You entertain the diagnosis of *Mycoplasma pneumoniae* and start him on Erythromycin. You wonder if there is a test to rapidly and reliably confirm or exclude your working diagnosis.

A literature search retrieves the following abstract.

BACKGROUND:

Mycoplasma pneumoniae is a common respiratory pathogen causing a wide variety of upper and lower respiratory tract infections. The diagnosis is commonly based on the serology of paired sera, which takes 2-3 weeks to complete. Cultivation of the organism is not routine, and takes several days to several weeks. A commercial nucleic acid hybridization test has been introduced recently.

ABSTRACT:

A hybridization test for the diagnosis of *Mycoplasma pneumoniae* infection (Gen-Probe Rapid Diagnostic System) was evaluated using sputum and throat swabs from army conscripts with acute infection of the lower respiratory tract. *M. Pneumoniae* was cultivated from sputa, and serology was done with paired sera by both complement fixation and enzyme immunoassay techniques. *Mycoplasma*

infection was diagnosed if either the culture or the serology was positive. Among the screened patients, 600 had an infiltrate on chest x-ray and were included in the study. Mycoplasma was diagnosed by culture/serology in 200 patients. The Gen-Probe was positive in 300 patients out of which 180 had confirmed Mycoplasma. The Gen-Probe was negative in 300 patients out of which 20 patients had Mycoplasma confirmed.

Q1. If the Gen-Probe is positive on the sputum of one of the study subjects, what is the probability that the given subject has Mycoplasma pneumoniae?

- a) 50%
- b) 60%
- c) 70%
- d) 80%
- e) 90%

Q.2. In what proportion of patients with Mycoplasma infection was the Gen-Probe positive?

- a) 50%
- b) 60%
- c) 70%
- d) 80%
- e) 90%

Q3. In what proportion of patients without Mycoplasma infection was the Gen-Probe positive?

- a) 10%
- b) 20%
- c) 30%
- d) 40%
- e) 50%

Q4. On the morning rounds, your attending (an Infectious Disease specialist who is always right) tells you that the pre-test probability of Mycoplasma in your patient is 50%. What then is the probability that your patient has the disease if the Gen-probe is negative, given the test characteristics in the study?

- a) 5-10%
- b) 10-15%
- c) 15-20%
- d) 20-25%
- e) 25-30%

QUESTION IV.

A 43-year-old African American male Mr. B is referred to you at GMC 2 weeks post discharge from a suburban hospital. He had presented there with 2 weeks history of progressive shortness of breath and bilateral leg swelling. He also admitted to orthopnea and paroxysmal nocturnal dyspnea. On physical examination his BP was 150/90 and pulse 110. There was elevated JVD, laterally displaced PMI and S3 gallop. Clinical diagnosis of congestive heart failure was made and

patient responded to diuretics and digoxin. He also had a MUGA with LVEF of 30%. Patient feels much better now. Your GMC attending suggests adding ACE inhibitor to his medication but patient is reluctant about having to take more pills and retorts: “my uncle died of congestive heart failure 10 years ago even though he took a lot of pills. How will this new medicine help me?”. To answer your patient precisely your attending asks you to do a literature search and you obtain the abstract below.

TITLE:

Effect of enalapril on survival in patients with reduced left ventricular ejection fraction and congestive heart failure.

ABSTRACT:

BACKGROUND: Patients with congestive heart failure have a high mortality rate and are also hospitalized frequently. We studied the effect of an angiotensin-converting-enzyme inhibitor, enalapril, on mortality and hospitalization in patients with chronic heart failure and ejection fractions less than or equal to 0.35. **METHODS.** Patients receiving conventional treatment for heart failure were randomly assigned to receive either placebo (n=1284) or enalapril (n=1285) at doses of 2.5 to 20 mg per day in a double-blind trial. Approximately 90 percent of the patients were in New York Heart Association functional classes II and III. The follow-up averaged 41.4 months. **RESULTS.** There were 510 deaths in the placebo group (39.7 percent), as compared with 452 in the enalapril group (35.2 percent) (reduction in risk, 16 percent; 95 percent confidence interval, 5 to 26 percent; P = 0.0036). Although reductions in mortality were observed in several categories of cardiac deaths, the largest reduction occurred among the deaths attributed to progressive heart failure. There was little apparent effect of treatment on deaths classified as due to arrhythmia without pump failure. Fewer patients died or were hospitalized for worsening heart failure (736 in the placebo group and 613 in the enalapril group; risk reduction, 26 percent; 95 percent confidence interval, 18 to 34 percent; P less than 0.0001).

A. After reading the Methods section of the paper carefully you decide that this study can be applied validly to your patient. Based on the results reported in the abstract, which ONE of the following statements is correct?

- 1) Patients with Class II-III CHF - like Mr. B - have an average life expectancy of 41.4 months.
- 2) The absolute risk reduction in cardiac mortality due to enalapril treatment maybe as high as 26%.
- 3) You would need to treat 20-25 patients like Mr. B with enalapril for 3-4 years in order to prevent one death.
- 4) Enalapril is better than digitalis & diuretics in the treatment of CHF.
- 5) Your patient should take enalapril.

B) Describe in layman's terms the meaning of the 95% confidence interval found on the last line of the abstract. Choose ONE of the following.

- 1) If this study were repeated many times, there is a 95% chance that the absolute risk reduction for hospitalization or death due to worsening heart failure in that study would be between 18% and 34%.
- 2) If this study were repeated many times, there is a 95% chance that the relative risk reduction for hospitalization or death due to worsening heart failure in that study would be between 18% and 34%.
- 3) There is a 5% chance that the relative risk reduction for hospitalization or death due to worsening heart failure is less than 18% in patients treated with enalapril.
- 4) There is a 5% chance that the absolute risk reduction for hospitalization or death due to worsening heart failure is more than 34% in patients treated with enalapril.
- 5) There is a 95% chance that the “true” absolute risk reduction for hospitalization or death due to worsening heart failure lies between 18% and 34% in patients treated with enalapril.

C) According to the study, Enalapril Rx reduces the relative risk of death or hospitalization due to progressive CHF by:

- 1) 7.4% per year over about 3.5 years
- 2) 35.2% overall
- 3) 16% over about 3.5 years
- 4) 4.5 % over about 3.5 years
- 5) None of the above

D) In answer to your patient’s question, in what way can you say treatment with enalapril will help him?

- 1) It will prevent him from dying of CHF
- 2) It will prevent him from hospitalization in the future
- 3) It will prevent his death due to “several categories” of cardiac mortality
- 4) All of the above
- 5) None of the above

QUESTION V.

A 50 year-old man with no PMH is found to have a cholesterol of 290 on routine screening. He has a family history of CAD. You start him on a low cholesterol diet; repeat cholesterol after 6 months is 270. At this point, you want to start the patient on cholesterol lowering drug therapy. The patient is worried about his family history of CAD and asks if lowering his cholesterol will prevent CAD. You ask the patient to return to the clinic in a week, and in the mean time, do a literature search and come up with the following four abstracts. (See next 4 pages)

A. Which ONE of these four abstracts do you think is the best evidence regarding your question. (Circle ONE)

Abstract No.	1	2	3	4
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B. Give the 3 main reasons you selected the above abstract.

1. _____
2. _____
3. _____

C. Give your ONE primary reason for not selecting each of the three abstracts you did not circle in A. above.

Reason for not selecting:

Abstract 1 _____

Abstract 2 _____

Abstract 3 _____

Abstract 4 _____

ABSTRACT #1

TITLE

Randomized trial of cholesterol lowering in 4444 patients with coronary heart disease.

ABSTRACT

The present trial was designed to evaluate the effect of cholesterol lowering with simvastatin on mortality and morbidity in patients with coronary heart disease (CHD). 4444 patients with angina pectoris or previous myocardial infarction and serum cholesterol 5.5-8.0 mmol/L on a lipid-lowering diet were randomized to double-blind treatment with simvastatin or placebo. Over the 5.4 years median follow-up period, simvastatin produced mean changes in total cholesterol, low-density-lipoprotein cholesterol, and high-density-lipoprotein cholesterol of -25%, -35%, and +8%, respectively, with few adverse effects. 256 patients (12%) in the placebo group died, compared with 182 (8%) in the simvastatin group. The relative risk of death in the simvastatin group was 0.70 (95% CI 0.58-0.85, p= 0.0003). The 6-year probabilities of survival in the placebo and simvastatin groups were 87.6% and 91.3%, respectively. There were 189 coronary deaths in the placebo group and 111 in the simvastatin group

(relative risk 0.58, 95% CI 0.46-0.73), while noncardiovascular causes accounted for 49 and 46 deaths, respectively. 622 patients (28%) in the placebo group and 431 (19%) in the simvastatin group had one or more major coronary events. The relative risk was 0.66 (95% CI 0.59-0.75, $p < 0.00001$), and the respective probabilities of escaping such events were 70.5% and 79.6%. This risk was also significantly reduced in subgroups consisting of women and patients of both sexes aged 60 or more. Other benefits of treatment included a 37% reduction ($p < 0.00001$) in the risk of undergoing myocardial revascularisation procedures. This study shows that long-term treatment with simvastatin is safe and improves survival in CHD patients.

ABSTRACT #2

TITLE

Prevention of Coronary Artery Disease with HMG-CoA Reductase Inhibitors.

ABSTRACT

BACKGROUND: HMG CoA reductase inhibitors have been found to reduce elevated cholesterol levels but their effect on CAD has not been studied previously. **METHODS:** Patients were recruited from outpatient clinics at six different U.S. medical centers. 1,494 adults with no known cardiac disease and serum cholesterol levels > 270 mg/dl were treated with atherostatin 2.5 - 7.5 mg/d. These patients were matched with 1,494 age/sex controls from a similar population who were not given atherostatin. All patients were followed up for a mean of 4.5 years with 90% of all study participants for at the conclusion of study. Primary endpoints were the development of symptomatic or fatal CAD.

RESULTS: In the experimental group 60 (4%) patients developed symptomatic CAD of which 12 (0.8%) were fatal. In the control group 102 (6.8%) patients developed symptomatic CAD of which 36 (2.4%) were fatal ($p < 0.001$). The risk of death from CAD in patients treated with atherostatin was reduced by 67% (95% CI: 30% - 75%). In addition the development of symptomatic CAD was reduced by 41% (95% CI: 29% - 53%) in the treatment group (NNT=36). **CONCLUSION:** This study shows that treatment of hypercholesterolemic patients with a HMG-CoA reductase inhibitor reduces both cardiac mortality and the development of CAD.

ABSTRACT #3

TITLE

Prevention of coronary heart disease with pravastatin in men with hypercholesterolemia.

ABSTRACT

BACKGROUND. Lowering the blood cholesterol level may reduce the risk of coronary heart disease.

This double-blind study was designed to determine whether the administration of pravastatin to men with hypercholesterolemia and no history of myocardial infarction reduced the combined incidence of nonfatal myocardial infarction and death from coronary heart disease. **METHODS.** We randomly assigned 6595 men, 45 to 64 years of age, with a mean (\pm SD) plasma cholesterol level of 272 \pm 23 mg per deciliter (7.0 \pm 0.6 mmol per liter) to receive pravastatin (40 mg each evening) or placebo. The average follow-up period was 4.9 years. Medical Records, electrocardiographic recordings, and the national death registry were used to determine the clinical end points. **RESULTS.** Pravastatin lowered plasma cholesterol levels by 20 percent and low-density-lipoprotein cholesterol levels by 26 percent, whereas there was no change with placebo. There were 248 definite coronary events (specified as nonfatal myocardial infarction or death from coronary heart disease) in the placebo group, and 174 in the pravastatin group (relative reduction in risk with pravastatin, 31 percent; 95 percent confidence interval, 17 to 43 percent; $P < 0.001$). There were similar reductions in the risk of definite nonfatal myocardial infarctions (31 percent reduction, $P < 0.001$), death from coronary heart disease (definite cases alone: 28 percent reduction, $P = 0.13$; definite plus suspected cases: 33 percent reduction, $P = 0.042$), and death from all cardiovascular causes (32 percent reduction, $P = 0.0333$). There was no excess of deaths from noncardiovascular causes in the pravastatin group. We observed a 22 percent reduction in the risk of death from any cause in the pravastatin group (95 percent confidence interval, 0 to 40 percent; $P = 0.051$). **CONCLUSIONS.** Treatment with pravastatin significantly reduced the incidence of myocardial infarction and death from cardiovascular causes.

ABSTRACT #4

TITLE

Pravastatin reduces total and LDL cholesterol levels in middle-aged males.

ABSTRACT

OBJECTIVE: To determine the efficacy of a new Hmg CoA reductase inhibitor, pravastatin, in reducing total and LDL cholesterol levels. **METHODS:** In a randomized controlled trial, the effects of pravastatin on serum cholesterol levels were compared with placebo in double-blind fashion among 338 males age 45-65 years. **RESULTS:** After a mean follow-up period of 1.9 years, serum cholesterol levels less than 180 mg/dl were found among 132 of 169 patients in the intervention group (78.1%) compared with 58 of 169 patients in the placebo group (33.7%), who were treated with diet alone ($P < .001$). $NNT = 3$ mean LDL cholesterol levels were significantly lower in the intervention group (mean difference 27 mg/dl, 95% CI 6.2, 49.4). Drug side effects requiring discontinuation of therapy did not vary significantly between groups. **CONCLUSION:** Pravastatin significantly reduces total serum and LDL cholesterol levels in middle-aged males.