Module 2 – Screening

I. Introduction

Screening is the early identification and treatment of asymptomatic persons who have already developed subclinical (unrecognized) disease by use of periodic tests and examinations. Early detection and treatment is *secondary prevention*. Crucial to the success of a screening program are 1) the accuracy of the screening test and, 2) the effectiveness of treatment early in the course of disease.

Test Accuracy

Sensitivity and specificity are intrinsic properties of a screening test that help determine its accuracy. Test sensitivity indicates the proportion of persons with a disease who test positive when screened. A test with low sensitivity generates many false negative results; persons with subclinical disease may go undetected and medical treatment will be delayed.

Test specificity indicates the proportion of persons without a disease who test negative when screened. A test with low specificity generates many false positive results; healthy persons will be told that they *may* have a disease. This leads to additional testing and procedures that incur additional risk, distress and expense.

The positive predictive value [PPV] of a test is the proportion of patients with positive test results that have disease. Unlike sensitivity and specificity, PPV is not an *intrinsic* property of a test. It is dependent upon the prevalence of the disease in the screened population. As disease prevalence in a population increases, the PPV of a screening test in that population will also increase. Likewise, as disease prevalence decreases, the PPV of a screening test will decrease. *(More on these concepts can be found in chapter 7 of Glaser's book, High-Yield Biostatistics. They will also be explained more fully in class.)*

Effectiveness of Screening

For a screening program to be effective, a clinical intervention that can prevent or delay progression of disease must be available. Furthermore, early detection and treatment must offer some benefit (e.g. improved survival rate) over conventional diagnosis and treatment when the disease becomes clinically evident (symptomatic).

In evaluating the effectiveness of a screening program, one must consider several types of bias that could affect the reported results. *Lead-time bias* may result in the appearance of improved survival with screening. Survival will appear to be improved even if screening only identifies cancer earlier. It can lengthen the period between diagnosis and death, without truly prolonging life expectancy. *Length bias* may result in the identification of a disproportionate number of slowly progressive cancers

but miss aggressive cases that are present only briefly. If slowly progressive cases do not generally become clinically significant diseases, then the screening program may not provide a benefit.

When considering the benefits of screening, one must also ask about the effect of a program on an entire population (population benefit). If the disease in question is of low prevalence or morbidity, then even a highly sensitive screening test will have little impact on the population as a whole. Likewise, screening with even modestly sensitive tests may have dramatic impact on the total population if the disease prevalence and morbidity are high.

Finally, the effectiveness of any a screening program should also take into consideration the potential adverse effects of screening. There may be physical harm from the test itself, from misdiagnosis, and from treatment for non-aggressive disease. Cost-effectiveness should also be considered. From a population standpoint, the benefits must be weighed against the costs of implementation (especially since those resources could be used for other interventions). 'Years of life saved' and 'quality-adjusted life years' are some of the measures used in a cost-benefit analysis.

Quality of the Evidence about the Effectiveness of Screening

Randomized controlled trials (and well constructed meta-analyses of such trials) provide the highest level of evidence. The random assignment of volunteers should result in the equal distribution of potential confounding variables (known or unknown) among the intervention and control groups. These are prospective studies and thus require large sample sizes and years of observation.

A cohort study provides the next best level of evidence. These observational trials examine the outcome of individuals who received an intervention and those who did not. They are subject to multiple confounding variables, which must be accounted for. These studies also require large sample size and years of observation.

Overall Learning Objectives for the Screening Module

1. Define screening. Understand the role it should play in primary care practice.
2. Define and be able to utilize the following terms when reading a study about a screening test: sensitivity, specificity, positive predictive value, cutoff point.
3. Recognize the characteristics of diseases that are suitable for screening and the characteristics of a good screening test.
4. Understand the rationale behind the most recent US Preventive Services Task Force (USPSTF) and American Cancer Society (ACS) recommendations for breast, colon, prostate and cervical cancer screening.
5. Understand the rationale behind the most recent USPSTF recommendations on screening for lipid disorders, hypertension, coronary artery disease, and STDs.

II. Instructions for the Small Group Forum

A. *Prior* to the small group session.

1. *Everyone* should *review* the following resources prior to the small group session:

a. Chapter 7: "Statistics in Medical Decision Making" in Glaser, A. High Yield Biostatistics, 4th Edition. Lippincott Williams and Wilkins. 2013 or class lectures*

b. Grading Definitions (2012) used by the U.S. Preventive Services Task Force **(USPSTF)**: http://www.uspreventiveservicestaskforce.org/uspstf/grades.htm

c. Briefly review the USPSTF screening recommendations and in some cases the American Cancer Society screening recommendations for the following diseases:
- Breast cancer: USPSTF (2009 summary) and ACS recommendations
- BRCA screening: USPSTF (2013 summary)
- Colon cancer: USPSTF (2008 summary) and ACS recommendations
- Cervical cancer: USPSTF (2012 summary) and ACS recommendations
- Prostate cancer: USPSTF (2012 summary) and ACS recommendations
- Hypertension: USPSTF (2007 summary)
- Lipid disorders: USPSTF (2008 summary)
- Coronary Artery Disease screening with ECG: USPSTF (2012 summary)
- HIV: USPSTF (2013 summary)
- Hepatitis C: USPSTF (2013 summary)

The **USPSTF recommendations** can be found from their recommendations page (http://www.uspreventiveservicestaskforce.org/adultrec.htm).
The **American Cancer Society (ACS) recommendations** can be found at (http://www.cancer.org/Healthy/FindCancerEarly/CancerScreeningGuidelines/american-cancer-society-guidelines-for-the-early-detection-of-cancer)

d. **All students should know*** the generally recommended screening guidelines for health adult men and women:
- http://www.ahrq.gov/ppip/healthymen.htm
- http://www.ahrq.gov/ppip/healthywom.htm

*** Frequently on test questions**

2. *Everyone* should critically read one of the following pre-selected papers prior to the small group session (assigned by group number).

These papers are posted on Moodle.

Groups 1, 5, 9, and 13:
Cohen MS, Chen YQ, McCauley M, et al. Prevention of HIV-1 Infection with Early Antiretroviral Therapy. NEJM 365(6):493-505, 2011.

Groups 2, 6, 10, and 14:
Schroder FH, Hugosson J, Roobol MJ, et al. Screening and Prostate Cancer Mortality in a Randomized European Study. NEJM 360(13):1320-28, 2009.

Groups 3, 7, 11, and 15:
Young LH, Wackers FJT, Chyun DA, et al. Cardiac Outcomes after Screening for Asymptomatic Coronary Artery Disease in Patients with Type 2 Diabetes. JAMA 301 (15):1547-55, 2009.

Groups 4, 8, 12, and 16:
Buys SS, Partridge E, Black A, et al.: Effect of Screening on Ovarian Cancer Mortality: the Prostate, Lung, Colorectal and Ovarian (PLCO) Cancer Screening Randomized Controlled Trial. JAMA 305 (22): 2295-303, 2011.

3. Two students should search for and select a different primary study that addresses the same question addressed by the papers

One student should present the paper using the guidelines provided by Dr. Mussell at the start of the course. The second student should critique the paper. *Send a copy of the paper to your faculty leader a week before the group meets.*

Groups 1, 5, 9, and 13: find a primary study about screening the general population for HIV
Groups 2, 6, 10, and 14: find a primary study about the efficacy of prostate cancer screening.
Groups 3, 7, 11, and 15: find a primary study about screening for coronary artery disease in asymptomatic individuals.
Groups 4, 8, 12, and 16: find a primary study about screening for ovarian cancer.

B. Suggested guidelines for the first small group forum

1. One student should present the paper you chose to read from section 3 (above), and the second student should critique the paper. Then the group should discuss the merits and/or flaws of the paper under the guidance of your faculty.

2. Discuss the pre-selected paper from section 2 (above). How does this paper compare to the paper that two students just presented? What are the merits and flaws of this paper? Does it provide good evidence regarding the question that was posed?

3. Your group has been asked to research one of the topics on the following pages for a **symposium to be held in 4 weeks**. At that symposium, **two members of the group will be expected to give a 15-minute presentation** on this topic using PowerPoint. Each student in the group is required to present at least once during the year.

Look over your assigned topic and the guidelines that have been provided. Begin working on this presentation. It should be a group effort. Look at some of the suggested data sources and discuss how you will put this information together into a coherent and concise (15 minute) presentation. Assign each member of the group to help gather information. You may wish to meet again to work on your presentation.

Group Projects and Presentations

Small Groups 1, 5, 9 and 13

Study Topic #1: Screening for Sexually Transmitted Diseases

Instructions: Give a 15-minute PowerPoint presentation on the above topic using the following questions as a guide. Consult the USPSTF and CDC websites as well as other resources. You should answer these questions as background information to a discussion of the article you have read on prevention of HIV transmission. You may find a lot of information, so please try to limit the discussion to the essential statistics and arguments.

1 **Briefly** review the U.S. and Louisiana incidence rates of gonorrhea, syphilis, and chlamydia For each of these diseases, describe and explain any significant disparities in the rates based on ethnicity, geography, gender, and sexual orientation. (The 2012 STD surveillance reports from the CDC are the most recent data available: http://www.cdc.gov/std/stats12/default.htm *Browse the report online* and then look at the tables for the data you need.)

2 **Briefly** review the USPSTF recommendations and rationale for chlamydia, gonorrhea, herpes simplex, and syphilis screening. Briefly report on any data you can find relating to the rates of screening for chlamydia in the U.S. Does the USPSTF recommend chlamydia screening for adolescent boys and men? Explain the rationale.

3 The USPSTF recently developed new recommendations for Hepatitis C screening. Briefly review the

4 Briefly review the 2013 USPSTF recommendations about screening for HIV infection. What is the rationale for the expanded screening recommendations? Discuss the paper on preventing HIV transmission that you read for the small group session. Does this paper adequately justify the recommendations for expanded HIV screening? Why or why not?

Small Groups 2, 6, 10 and 14

Study Topic #2: Cancer Screening in Men

Instructions: Give a 15-minute PowerPoint presentation on the above topic using the following questions as a guide. Consult the USPSTF and ACS websites as well as other resources. You should answer these questions as background information to a discussion of the article you have read on screening for prostate cancer. You may find a lot of information, so please try to limit the discussion to the essential statistics and arguments.

1. **Briefly** review the incidence and mortality of colon, prostate and testicular cancer in U.S. men (in the case of colon cancer, use U.S. men and women). How does in Louisiana compare to the national average? *You may want to use the CDC Cancer Data and Statistics website or the National Cancer Institute (NCI) SEER (Surveillance Epidemiology and End Results) database.*

2. **Briefly** review the USPSTF recommendations about cancer screening in men (include colon cancer screening, which applies to men and women). Include the sensitivity, specificity and (if available) the predictive values of recommended screening tests.

3. Briefly report on any data you can find relating to the rates of screening in the U.S. for the diseases discussed above. Are there differences based on ethnicity or socioeconomic status?

4. Briefly discuss the possibility of screening for lung cancer. Are there effective screening tests or strategies? What are the current USPSTF recommendations?

5 Discuss screening for prostate cancer in more detail. What are the risks of screening and subsequent treatment? What are arguments for and against screening using PSA or other methods? Discuss the paper on prostate cancer screening that you read for the small group session. Does this paper adequately answer the question as to whether PSA testing improves mortality? Why or why not? What would you recommend to your patients?

Small Groups 3, 7, 11 and 15

Study Topic #3: Cardiovascular Screening

Instructions: Give a 15-minute PowerPoint presentation on the above topic using the following questions as a guide. Consult the USPSTF website as well as other resources. You should answer these questions as background information to a discussion of the article you have read on screening for coronary ischemia in diabetics. You may find a lot of information, so please try to limit the discussion to the essential statistics and arguments.

1. **Briefly**, review the morbidity and mortality from coronary heart disease in the United States. If possible, compare rates in Louisiana to those of the nation. Are there differences based on ethnicity or socio-economic groups?

2. **Briefly** list the *major* risk factors for coronary heart disease. Are there other contributing (minor) risk factors? Briefly list those for your classmates.

3. Review and explain the USPSTF recommendations about screening for hypertension, hyperlipidemia, abdominal aortic aneurysm, and carotid artery disease.

4. What are the current rates of screening and treatment for lipid disorders and hypertension?

5. Review and explain the USPSTF recommendations about screening for coronary artery disease in asymptomatic patients with risk factors. Are there consistent guidelines for this? What is the utility of screening with tests such as ECG and stress tests? Can you find data about the sensitivity and specificity of these tests? Does the USPSTF recommend the use of these tests in asymptomatic individuals with multiple risk factors? Discuss the paper on screening asymptomatic patients with type 2 diabetes that you read for the small group session. Does this paper adequately answer the question as to whether stress testing can improve mortality? Why or why not? What would you recommend to your patients?

Small Groups 4, 8, 12 and 16

Study Topic #4: Cancer Screening in Women

Instructions: Give a 15-minute PowerPoint presentation on the above topic using the following questions as a guide. Consult the USPSTF and ACS websites as well as other resources. You should answer these questions as background information to a discussion of the article you have read on screening for ovarian cancer. You may find a lot of information, so please try to limit the discussion to the essential statistics and arguments.

1. **Briefly** review the incidence and mortality of breast, cervical, and ovarian cancer in U.S. women. How does in Louisiana compare to the national average? *You may want to use the CDC Cancer Data and Statistics website or the National Cancer Institute (NCI) SEER (Surveillance Epidemiology and End Results) database.*

2. **Briefly** review the USPSTF and ACS recommendations about cancer screening in women. Include the sensitivity, specificity and (if available) the predictive values of recommended tests. (*Note: while colon cancer screening is recommended for women and men, a more detailed discussion will be presented by the group presenting cancer screening in men. In the interest of time, your group should mention that women should be screened, but should not discuss the specific recommendations and the performance characteristics of colonoscopy or fecal occult blood testing.*)

3. Discuss screening for breast cancer in more detail. In particular, discuss the pros and cons of screening mammograms beginning at age 40 as opposed to delaying routine mammography until age 50. What is the role of testing for *BRCA* 1 and *BRCA* 2?

4. Report on any data you can find relating to the rates of screening for the diseases discussed above in the U.S. How does Louisiana compare to the national average? Are there differences based on ethnicity or socioeconomic status?

5. Discuss the recommendations of the USPSTF regarding ovarian cancer screening. Is there any evidence that routine screening for ovarian cancer is beneficial? Discuss the paper on ovarian cancer screening that you read for the small group session. Does this paper adequately answer the question as to whether stress testing can improve mortality? Why or why not? What would you recommend to your patients?