A Critical Review of Adult Health Maintenance

Part 2. Prevention of Infectious Diseases

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This is the second paper in a four-part series that presents an updated protocol for selective longitudinal health maintenance of asymptomatic adults. Eight infectious diseases are reviewed with reference to six generally accepted screening criteria. A recommendation is made for each condition and is compared, when appropriate, to the recommendations of the Canadian Task Force on the Periodic Health Examination. In the fourth paper the recommendations will be combined into a practical health maintenance flow sheet for use by primary care physicians.

The purpose of this series of papers is to provide primary care physicians with an updated health maintenance protocol for asymptomatic adults that can be used in the everyday practice of medicine. The background and methods for this work were fully described in the first article of this series.[1]

This paper will evaluate eight infectious diseases with regard to six generally accepted screening criteria for useful health maintenance interventions:

1. The condition must have a significant effect on the quality or quantity of life.
2. Acceptable methods of treatment must be available.
3. The condition must have an asymptomatic period during which detection and treatment significantly reduce morbidity or mortality.
4. Treatment in the asymptomatic phase must yield a therapeutic result superior to that obtained by delaying treatment until symptoms appear.
5. Tests that are acceptable to patients must be available at reasonable cost to detect the condition in the asymptomatic period.
6. The incidence of the condition must be sufficient to justify the cost of screening.

It is necessary for a disease to meet all six criteria before inclusion in the health maintenance plan. Failing a single criterion is adequate reason for exclusion.

A brief discussion of the rationale for or against including each condition in a health maintenance program is presented, and a specific recommendation is compared with the most recent recommendation of the Canadian Task Force on the Periodic Health Examination.[2]

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PREVENTION OF INFECTIOUS DISEASES

INFLUENZA

Recommendation. Persons at high risk for lower respiratory tract infection should receive influenza vaccine annually regardless of age.

Canadian Task Force. Annual vaccination is recommended for all persons aged over 65 years and those at any age at high risk for lower respiratory tract infection.

Influenza is an epidemic viral infection usually occurring during the winter months. In some years it may cause little morbidity or mortality. In epidemic years it may cause an excess of about 80 hospitalizations and 12 deaths per 100,000 population.[3]

Influenza affects all age groups, but the greatest morbidity and mortality occurs in persons at high risk because of concomitant chronic diseases including heart disease, pulmonary disease, renal disease, diabetes mellitus, anemia, and immune deficiency syndromes.[4] Low-risk persons aged over 65 years experience increased morbidity from influenza compared with healthy younger persons, but have less morbidity than younger high-risk persons.[3]

Vaccination is the major strategy for preventing influenza. Amantadine can be used to protect high-risk

persons during an epidemic, but is not recommended as a first-line of prevention.[5]

The influenza virus undergoes frequent antigenic change. This characteristic necessitates annual immunization and constant modifying of the vaccine to fit the expected upcoming strain. The efficacy of a given vaccine will depend on the accuracy of predicting the strain of next year's influenza. Thus vaccine efficacy is highly variable. Furthermore, the decision of which antigens to put in next year's vaccine must be made in mid-winter before the end of the current influenza season.[6]

The influenza vaccine is potentially invasive. Minor local reactions and flu-like symptoms are common. In at least one epidemic an excess of one case of Guillian-Barré syndrome per 100,000 persons vaccinated occurred.[7] The exact cause of this association has not been determined.

The best data on the effectiveness of influenza vaccination come from a series of studies on a defined population enrolled with the Kaiser Health Plan of Portland, Oregon.[3,8,9] These studies show vaccine effectiveness to be closely related to the antigenic fit with the particular influenza strain. In a 1968-1969 epidemic vaccination failed to decrease either influenza-related hospitalizations or deaths in either low- or high-risk populations.[8] Conversely, during the 1972-1973 epidemic there was a significant reduction in influenza-related hospitalizations and deaths among vaccinated high-risk persons. Low-risk persons aged over 65 years had a trend toward fewer hospitalizations, which was not statistically significant. They had no significant decrease in deaths.[8]

Ninety-five percent of influenza-related deaths occurred in persons with coexisting chronic disease, especially cardiovascular and pulmonary disease.[9] Sixty-eight percent occurred in persons aged over 65 years. Only two deaths involved persons free of major chronic disease.[9]

Given the variable efficacy of influenza vaccination and its potential invasiveness, the major focus for prevention should be vaccination of high-risk persons regardless of age. The evidence that healthy persons aged over 65 years benefit from influenza vaccinations is weak.

PNEUMOCOCCAL DISEASE

Recommendation. Routine pneumococcal vaccination is not indicated in any age group. High-risk persons, especially those with functional asplenia, may benefit from vaccination.

Canadian Task Force. Pneumococcal vaccination is indicated for high-risk groups only.

Streptococcus pneumoniae is a significant cause of pneumonia, otitis media, and meningitis. Attack rates of 2.5/1,000 population have been reported.[10] The pneumococcus is highly sensitive to penicillin, with only 1 percent of isolates resistant to this antibiotic.[11] Nonetheless, serious morbidity from pneumococcal infection does occur. In 1977 vaccine containing capsular material from 14 types of pneumococcus became available. Currently a 23-valent vaccine is being used.[12]

Studies in patients during the preantibiotic era showed earlier pneumococcal vaccines to be effective in preventing pneumococcal disease.[10,11,13] Today, however, the pneumococcus is responsible for less than 25 percent of all cases of pneumonia.[11] Randomized controlled studies in this country have not shown that pneumococcal vaccination decreased morbidity or mortality from respiratory disease.[10,11] Vaccination did decrease pneumococcal disease in children and young adults with sickle cell anemia or who had had splenectomy.[14]

Repeat or booster vaccinations are not recommended because of a high incidence of severe local and systemic side effects.[11] Inadvertent repeat vaccinations could be a major problem if vaccination were recommended for a large portion of the population.

Because of the unproven benefit of the vaccine in older populations and the easy treatability of pneumococcal disease with antibiotics, routine pneumococcal vaccination is not indicated. High-risk persons, especially those with functional asplenia, may benefit from vaccination.

TETANUS AND DIPHTHERIA

Recommendation. Adults should have a tetanus-diphtheria booster every 10 years after a primary immunization series.

Canadian Task Force. Same recommendation.

The incidence of tetanus has decreased dramatically in the past 50 years since vaccination with tetanus toxoid became available. Only 88 cases were reported in the United States in 1982.[15] Clostridium tetani remains ubiquitous in the environment, however, and is a serious threat to inadequately immunized persons. The case fatality ratio remains between 45 and 55 percent.[16] Childhood immunization against tetanus has been more widely practiced than immunization of adults. A majority of cases of tetanus now occur in persons aged over 60 years,[15] and as many as 66 percent of older persons may have inadequate antibody titers.[17] Tetanus does not occur only in the setting of major trauma; one third of reported cases are associated with a trivial injury or no wound at all.[16] Thus routine immunization is preferred to immunization at the time of treatment for an injury. Tetanus toxoid provides adequate antibody titers for at least 10 years. More frequent immunization will cause an increased risk of adverse reactions to the vaccine.[15]

The incidence of diphtheria, like tetanus, has de-

creased dramatically in the last 50 years. Only two cases were reported in the United States in 1982.[18] Diphtheria is spread mainly by contact with infected persons or carriers. The majority of cases (52 percent) occur in persons aged less than 15 years.[19] Specific treatment for diphtheria with antibiotics and antitoxin is available, but the case fatality rate has remained constant at 10 percent over the past 50 years.[20] Young persons and unimmunized persons are at greater risk of death than are older persons or partially or fully immunized persons. Forty-six percent of diphtheria deaths occur in persons aged under 15 years.[19] Diphtheria toxoid does not provide total protection against clinical diphtheria. A few cases do occur in fully immunized persons, and the vaccine does not prevent nasopharyngeal carriage of Corynebacterium diphtheriae.[20]

The recommendation above follows that of the Immunization Practices Advisory Committee of the Public Health Service.[21] A strong case can be made for routine adult vaccination for tetanus. The case for diphtheria vaccination is less strong. Since the vaccines come together, tetanus-diphtheria immunization every 10 years after a primary immunization series is suggested.

TUBERCULOSIS

Recommendation. No screening for tuberculosis in the general population is justified.

Canadian Task Force. No prevention is indicated for the general population. Bacillus Calmette-Guérin (BCG) vaccination is indicated for high-risk groups.

The overall incidence of tuberculosis in the United States is 11 cases per 100,000 population.[22] It has decreased dramatically in recent years, since the introduction of effective antituberculous drugs. Wide geographic variations in occurrence are found ranging from a rate of 2 cases per 100,000 population in Wyoming to 61 cases per 100,000 population in Miami.[22] There were 1,980 tuberculosis-related deaths in 1982.[23] Tuberculosis is more common in urban areas and among lower socioeconomic groups. Specific high-risk populations include immigrants from other countries, alcoholics, contacts or persons with a family history of tuberculosis, health care personnel, and persons living in institutions.[24,25]

BCG (bacillus Calmette-Guérin) vaccination is the only method available for the primary prevention of tuberculosis. Widely used in other parts of the world, the vaccine has received only limited use in the United States. Studies of BCG vaccine effectiveness have been highly variable, ranging from 0 to 80 percent protection.[26,27] Drawbacks to use of BCG vaccine include variations in vaccine quality, rare serious reactions from the vaccine, and the production of a positive tuberculin skin reaction, which makes subsequent skin testing invalid.[27] BCG vaccine is most effective when given to young children. It is an effective preventive measure, especially in populations with high rates of tuberculosis, where medical follow-up and supervision are difficult, and antituberculous drugs are either too expensive or not available.[27]

In the United States prevention of tuberculosis has emphasized mass screening and case finding to detect and treat infective or active cases of tuberculosis. Initially, in the 1950s mass screening for detection was done by chest x-ray examination. More recently with the decline in incidence of tuberculosis, chest x-ray screening is no longer cost effective.

Tuberculin skin testing using 5 units of purified protein derivative (Mantoux test) injected intradermally is now the most widely used screening test in the United States.[28] The Mantoux test detects current or previous tuberculosis infection (ie, the presence of antibodies to tuberculosis) in addition to active disease. It is highly sensitive for tuberculosis infection (perhaps 90 percent)[24]; however, false-negative reactions can occur as a result of anergy or improper handling or administration of the test.[24] False-positive reactions occur primarily because of reactions to mycobacterium other than tuberculosis, particularly common in warmer climates. Rates of tuberculin reactivity among naval recruits ranged from 8 percent in recruits from the southern states, Kentucky, and areas of Pennsylvania to less than 2 percent of recruits from Utah and Idaho.[29] A recent study in rural New York State found 1.7 percent of a family practice population to be tuberculin reactive.[25] Tuberculin reactivity among children in the United States is about 0.2 percent.[24]

The risk of a tuberculin-reactive patient developing active tuberculosis depends on the circumstances associated with the positive tuberculin reaction. Household contacts of an active tuberculosis case who develop a positive tuberculin reaction have a 1.2 percent risk of developing active tuberculosis in the first year and a 0.3 percent risk the next two years. In contrast, the risk of developing active tuberculosis among natural reactors in Denmark was only 29 per 100,000 persons.[29]

The incidence of tuberculosis in the United States is quite low and is continuing to decline. Treatment of tuberculosis is very effective even among symptomatic patients. Most patients with a positive tuberculin test will not develop active tuberculosis. For these reasons tuberculin testing of the general population is not indicated. Tuberculin testing of specific high-risk groups may be worthwhile.

RUBELLA

Recommendation. Routine vaccination of adults for rubella or screening for evidence of immunity is not indicated. Until the population of women of childbearing age is more uniformly immune to rubella, their im-

mune status should be determined and they should be vaccinated, if susceptible.

Canadian Task Force. Immunization of all children and women at risk is indicated.

The reason for preventing rubella is not prevention of the disease itself, a mild viral illness, but prevention of the congenital rubella syndrome (CRS). Congenital rubella syndrome affects the developing fetus of mothers infected by rubella virus during pregnancy. Its many manifestations include miscarriage, stillbirths, deafness, blindness, and mental retardation.[30]

Introduction of rubella vaccination in 1969 started a dramatic decline in both cases of rubella and CRS.

In 1964 and 1965, during the last big rubella epidemic, 12.5 million cases of rubella were reported and 20,000 children were born with CRS.[30] In 1982 only 2,325 cases of rubella and 9 cases of CRS were reported in the United States.[31] In several ways rubella is favorable for prevention: The vaccine is 90 to 95 percent effective, a single immunization provides lifelong immunity, and there is no known animal reservoir for rubella.

The major preventive strategy has been to immunize all children and thus decrease the prevalence of the disease in the community.[31] That this strategy has been effective is evidenced by the decline in the incidence of rubella and CRS. By itself immunization of all children should eliminate rubella within the next ten to 30 years.[30] However, at present, between 20 and 33 percent of fertile women are susceptible to rubella.[30,32] Young women should be screened for rubella antibodies and vaccinated if not immune.

SYPHILIS

Recommendation. No screening for syphilis is indicated in the general population. Screening is justified for high-risk groups.

Canadian Task Force. No screening for syphilis is indicated in the general population.

The incidence of primary and secondary syphilis in the United States declined dramatically between 1943 and 1957. It has gradually risen since then to a rate of 14.6 per 100,000 population in 1982. The rate is 22.5 per 100,000 men and 7.3 per 100,000 women. Two hundred fifty-nine cases of congenital syphilis were reported in the United States in 1982.[33] The incidence of syphilis is highly variable from region to region. It is more common in urban areas and among lower socioeconomic groups and is especially common among male homosexuals. Forty to 50 percent of cases in some areas occur in homosexuals.[34] The highest rates of syphilis are found in the Gulf Coast States and California.[33] The lowest rates are found in the Midwest and North Central States. San Francisco has an incidence of 153 per 100,000 population, whereas Wichita, Kansas, has only 1.1 cases per 100,000 population.[35] The disease usually occurs in young and middle-aged adults.

Syphilis is a subacute or chronic infectious disease that undergoes the well-known primary, secondary, and tertiary stages. Left untreated, 30 percent of cases will develop tertiary complications, especially of the cardiovascular and nervous systems.[36] Treatment with penicillin in the primary, secondary, and early latent stages is highly effective. It is not effective once tertiary changes have developed. The goal of early detection and treatment is to prevent development of tertiary syphilis and prevent congenital syphilis in infants born to infected mothers.

Several good serologic tests for syphilis are available. The most popular is the VDRL (Venereal Disease Research Laboratory) test. It has a low rate of false-positive results and few false-negative results. Darkfield examination is useful in the acute primary phase, but not for screening. Tests such as the fluorescent treponemal antibody-absorption test (FTA-ABS) are used to confirm positive serologic tests.

Screening for syphilis by serologic testing has been widely used in this country, especially as a requirement for marriage license. Recently there has been increased concern that premarital serologic screening tests are not cost effective.[34] In 1976, 43 million serologic tests were done to detect 59,846 new cases of syphilis. Most of the positive serologic tests results were known cases that had been previously treated.[34]

Syphilis is a disease that meets most screening criteria. It is a serious disease with an asymptomatic period during which treatment is effective. Good methods of detection are available. The problem is that most of the population is at very low risk while the small high-risk population usually avoids the screening process. Thus screening is not justified in the general population. High-risk groups, especially male homosexuals, should be screened. Pregnant women should also be screened for syphilis.

PELVIC INFLAMMATORY DISEASE*

Recommendation. No routine screening for gonorrhea or chlamydia is indicated.

Canadian Task Force. Same recommendation.

Approximately 850,000 cases of pelvic inflammatory disease (PID) occur in the United States each year. Twenty percent of women with one episode of PID have chronic pain. Thirty to 40 percent of infertile women have a history of PID. It causes a 10-fold increase in the incidence of ectopic pregnancy.[37] The

**The most recent recommendations concerning Chlamydia are found in The Canadian Task Force on the Periodic Health Examination: The periodic health examination: 2. 1984 update. Can Med Assoc J 1984; 130:1278-1285*

economic cost of PID is over $1 billion per year.[38] Young, sexually active urban women are at greatest risk of PID.[39] Nonwhites are affected three times as often as whites.[37]

Pelvic inflammatory disease is caused by several organisms. Gonorrhea causes 30 to 65 percent of PID in the United States, but the proportion of cases due to gonorrhea is decreasing.[37] In Scandinavia only 5 to 32 percent of PID is due to gonorrhea.[40] Thirty to 60 percent of women with gonorrhea are asymptomatic, while 10 percent develop salpingitis or PID. Most men with gonorrhea have symptoms, but up to 20 percent are asymptomatic carriers.[39]

Chlamydia trachomatis has recently been recognized as a major, if not the most common, cause of PID. In Scandinavia 30 to 67 percent of PID is caused by C trachomatis with a smaller proportion found in US studies.[41] Most women with infections due to C trachomatis are asymptomatic. Studies have shown C trachomatis can be cultured from the cervix of 3 to 5 percent of all women, and 20 to 40 percent of sexually active women have antibody titers to C trachomatis.[41]

Other organisms including Mycoplasma hominis and Ureaplasma urealyticum have been associated with a small percentage of PID cases, but their role in causing PID or infertility is controversial.[42] Thus preventing PID depends on preventing or treating gonococcal and chlamydial infection.

Infections due to both C trachomatis and Neisseria gonorrhoeae are easily treated with antibiotics once the diagnosis is made. A penicillin is the treatment of choice for N gonorrhoeae, while tetracycline and erythromycin are effective against C trachomatis. Since 40 to 60 percent of women have a mixed infection with both organisms,[41] combination antibiotic treatment is recommended.

Diagnosis of both gonorrheal and chlamydial infections is best done by culture of the organism. In both cases, however, culturing is difficult. The gonococcus is a fragile organism that must be cultured in modified Thayer-Martin or similar media using careful technique. Transport of specimens poses particular problems. Chlamydia is an obligate intracellular parasite that must be grown in tissue culture—an expensive and tedious process. Only 5 percent of hospitals and 15 percent of reference laboratories can culture Chlamydia adequately.

Recently new tests using an enzyme-linked immunoassay procedure (Gonozyme, Chlamydiazyme) have been developed to detect gonorrhea and chlamydia.[43] These tests are inexpensive and simple to do. One study comparing the Gonozyme test to culture by modified Thayer-Martin technique in an asymptomatic low-prevalence population of women found a 100 percent sensitivity and a 97 percent specificity for the Gonozyme test.[44] However, in this population the predictive value of a positive test was only 31.9 percent.

A national gonorrhea control program was initiated in 1972 by the US government to screen and treat asymptomatic women with the goal of reducing the incidence and complications of gonorrhea. The short-term result was an expected increase in reported cases of gonorrhea.[45] No study has shown that screening for gonorrhea or Chlamydia reduces the incidence or complications of pelvic inflammatory disease.

The major impediment to preventing pelvic inflammatory disease is the ease with which sexually active patients can become reinfected after treatment. The majority of patients are asymptomatic, and there is a large community reservoir of both Chlamydia and gonorrhea. Even with adequate screening tests and treatment available, there is no evidence that screening will decrease morbidity from PID.

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