

study was concluded, the Columbia Fire Department provided appropriate HPDs to all personnel and carried out a policy requiring their use. Six months after the study was completed, shift commanders were asked to observe HPD use during emergency responses for 1 week. They reported that most of the firefighters in the Columbia City Fire Department were regularly using HPDs.

## References.....

1. Promoting health/preventing disease: objectives for the nation. U.S. Department of Health and Human Services, U.S. Government Printing Office, Washington, DC, 1981.
2. Kryter, K. D.: The effects of noise on man, Ed. 2. Academic Press, Orlando, FL, 1985.
3. Department of Research, Health and Safety Division, IAF: Fire fighter occupational noise exposure. International Association of Fire Fighters, AFL-CIO, Central Labor Council, Washington, DC, 1983.
4. Tubbs, R. L., and Flesch, J. P.: Health hazard evaluation:

Newburgh, NY Fire Department. HHE Report No. 81-059-1045, National Institute of Occupational Safety and Health, Cincinnati, OH, 1982.

5. Tubbs, R. L.: Hazard evaluation report: New York Fire Department. HHE Report No. 459-160, National Institute of Occupational Safety and Health, Cincinnati, OH, 1982.
6. Pepe, P. E., Jerger, J., Miller, R. H., and Jerger, S.: Accelerated hearing loss in urban emergency medical services firefighters. *Ann Emerg Med* 14: 99-103 (1985).
7. Reischl, U., Hanks, T. G., and Reischl, P.: Occupation related firefighter hearing loss. *Am Ind Hyg Assoc J* 42: 656-661 (1981).
8. Hearing levels of adults by age and sex, United States, 1960-1962. PHS Publication No. 1000, Series 11, No. 11. Washington, DC, 1965.
9. Spoor, A.: Presbycusis values in relation to noise induced hearing loss. *Int Audiol* 6: 48-57 (1967).
10. Lebo, C. P., and Reddell, R. C.: The presbycusis component in occupational hearing loss. *Laryngoscope* 82: 1399-1409 (1972).

## Equipment

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## Awareness and Use of Hepatitis B Vaccine Among Homosexual Male Clients of a Boston Community Health Center

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## Synopsis.....

*Factors associated with awareness and acceptance of hepatitis B vaccine were identified among 150*

*homosexual male clients of a Boston community health center. Five percent of the subjects were unaware of hepatitis B and 25 percent had a history of hepatitis. Among the remaining 106 men, 68 percent were aware of the vaccine, and 25 percent of these had been vaccinated. Awareness of vaccine was associated with education beyond the baccalaureate level. Factors associated with vaccination included at least one prior visit to the health center, having health insurance, and extent of knowledge of the effects of hepatitis B. Among those not vaccinated, 68 percent would like to be but were deterred by the perceived high cost of the vaccine. The predominant reason given by the 31 percent who have decided not to be vaccinated was the perception that they were not at risk because of monogamous sexual relationships, or "safer" sexual practices. Strategies for maximizing vaccine use among homosexually active men should focus on increasing both awareness of the vaccine and appropriate perceptions of risk.*

THE OVERALL MORBIDITY and mortality from chronic hepatitis B and its sequelae, cirrhosis and primary hepatocellular carcinoma, produce a major burden on public health and the health care delivery system (1,2). Homosexually active men have been recognized as a group at high risk of hepatitis B (3); the virus appears to be transmitted in this risk group by sexual contact, perhaps most efficiently by anogenital contact (4-8).

The introduction in 1982 of hepatitis B vaccine derived from donated serums was expected to influence markedly programs to prevent and control hepatitis B. Despite the vaccine's proven efficacy and safety in clinical trials with homosexual men (9,10) and health care workers (11), the Public Health Service estimates that less than 10 percent of high-risk persons have been vaccinated (12). A new vaccine has been introduced recently that is derived by the genetic engineering of yeast cells (13,14) in order to dispel some of the concerns regarding the use of donated serum (15,16). The cost for the newer vaccine preparation is similar to that of the original vaccine, yet no marked increase in use of the vaccine has been noted (12).

This study is a description of hepatitis B vaccine use patterns among homosexually active male clients of a Boston community health center that functions as an ambulatory medical facility and a regional center for the health care of homosexual men. In 1982, when hepatitis B vaccine became commercially available, the health center developed a policy for vaccine use, including prescreening (4,5,17) and community education. Despite efforts to inform homosexual male clients of the health center by distributing a brochure as well as placing advertisements in both general and gay local press, the vaccine has been underutilized. Although the epidemic of acquired immunodeficiency syndrome (AIDS) has resulted in major modifications of high risk sexual practices among homosexually active males (18,19) including those studied at this health center (20), new human immunodeficiency virus (HIV) seroconverters and clinical cases of hepatitis B have been noted recently among the clients of this health center, according to one author, K.H.M.

## Methods

After pilot-testing, a questionnaire was administered during the period July 17 through August 15, 1985, to male clients attending the health center. Those coming for appointments with a primary care provider were sampled systematically (every

other appointment) and informed of the study, either by their provider or by referral to the interviewer at the end of their visit. During the study period, 195 men were sampled and 150 (77 percent) met the eligibility criteria: self-identification as gay or bisexual, no previous participation in the study, and consent to participate. Interviews were conducted by one author (E.M.H.); respondents remained anonymous. The questionnaire was designed to collect demographic information and a history of sexual behavior and medical care. Information was also gathered on attitudes, knowledge, and sources of information with respect to hepatitis B and hepatitis B vaccine.

Tests for associations between study variables were conducted using chi-square analyses for categorical variables, and *t*-tests for the knowledge scales. Levels of statistical significance are reported when  $P < 0.05$ .

## Results

The study subjects ranged in age from 19 to 64 years, with a mean of 30. Sixty-three percent had either attended or completed college, and 29 percent had pursued post-graduate education. Only 7 percent were nonwhite. Overall, 91 percent of the men reported having one or more episodes of a sexually transmitted disease (STD), excluding hepatitis B. By age 20, 53 percent of the sample reported regular homosexual activity, with at least one homosexual contact per month. One hundred forty-three men, 95 percent of the sample of 150, were aware of hepatitis B, and 37 (26 percent) had reported a history of the disease. The seven men who were unaware of hepatitis B tended to be younger than the rest of the sample (86 percent were under 30), and most were making their first visit to the health center. The small number in this group precluded further analysis. The men with a history of hepatitis B tended to be older with a longer history of STDs. The main analyses in this study were limited to the remaining 106 participants who were aware of hepatitis B but had no self-reported history of the disease.

**Factors related to vaccine awareness and use.** Of the 106 men aware of hepatitis B, 72 (68 percent) were aware of the hepatitis B vaccine; only 17 of the 72, or 24 percent, had been vaccinated. Table 1 shows the association of selected variables with hepatitis B vaccine awareness and use. Awareness of the hepatitis B vaccine was significantly higher in men with postgraduate education ( $P < .01$ ). Fac-

tors associated with vaccination were at least one prior visit to the health center and having health insurance ( $P < .05$ ).

#### Knowledge of hepatitis B transmission and effects.

In general, the 143 study participants aware of hepatitis B (including those with a history of the disease) exhibited extensive knowledge concerning transmission of the virus and possible effects of a hepatitis B infection (table 2). Overall, men tended to have more knowledge regarding transmission of hepatitis B infection than of the potential effects of such an infection.

Knowledge scales for transmission and effects were computed by summing the correct responses, giving a possible range in scores of 0 (low) to 7 (high) for each scale. Table 3 gives knowledge scale means in relation to a history of hepatitis B, awareness of the hepatitis B vaccine, and vaccine use. Knowledge of both transmission and the effects of hepatitis B was significantly higher in men with a history of hepatitis B, and it was higher in those aware of the vaccine than among those who were not aware. Men who had been vaccinated had significantly greater knowledge of the effects of hepatitis B than those aware men who had not been vaccinated, but knowledge of transmission scarcely differed in these two groups.

**Reasons for vaccine acceptance or rejection.** The 17 vaccine recipients in the study sample gave a total of 33 reasons for obtaining the vaccine, in response to an open-ended question. All 17 men indicated that they were aware of their susceptibility to hepatitis B. Additional reasons included recommendations by health care workers (18 percent), reading informational brochures (12 percent), and a family member's or lover's experience with hepatitis B (12 percent).

Of the 55 aware men who have not been vaccinated, 38 said that they intended to be vaccinated. The remaining 17 men who have elected not to accept hepatitis B vaccine gave a total of 35 reasons for this decision. Low perceived susceptibility was the reason given by 53 percent either because they were in a monogamous sexual relationship, or because they practiced safe sex or monogamy, and two men practiced "cautiousness" and "health consciousness" in relationships. Five men (29 percent) felt that the vaccine cost too much. A similar percentage—29—expressed concern about the vaccine-related health problems, but

*'Despite the vaccine's proven efficacy and safety in clinical trials with homosexual men and health care workers, the Public Health Service estimates that less than 10 percent of high-risk persons have been vaccinated.'*

Table 1. Factors associated with awareness and use of hepatitis B vaccine<sup>1</sup>

| Variable                              | Aware of hepatitis B |                       | Aware of vaccine |                    |
|---------------------------------------|----------------------|-----------------------|------------------|--------------------|
|                                       | Number of men        | Percent aware vaccine | Number of men    | Percent vaccinated |
| Total .....                           | 106                  | 68                    | 72               | 24                 |
| Age (years):                          |                      |                       |                  |                    |
| 19-29 .....                           | 60                   | 62                    | 37               | 19                 |
| 30 and older .....                    | 46                   | 76                    | 35               | 28                 |
| Race:                                 |                      |                       |                  |                    |
| White .....                           | 96                   | 70                    | 67               | 24                 |
| Nonwhite .....                        | 10                   | 50                    | 5                | 20                 |
| Education:                            |                      |                       |                  |                    |
| College or less .....                 | 77                   | 60                    | 46               | 20                 |
| Postgraduate .....                    | 29                   | <sup>2</sup> 90       | 26               | 31                 |
| Residence:                            |                      |                       |                  |                    |
| Metropolitan Boston ...               | 61                   | 69                    | 42               | 24                 |
| Other .....                           | 45                   | 67                    | 30               | 23                 |
| Duration regular homosexual activity: |                      |                       |                  |                    |
| 5 years or less .....                 | 52                   | 67                    | 35               | 20                 |
| 6 years or more .....                 | 52                   | 69                    | 36               | 25                 |
| History of STDs:                      |                      |                       |                  |                    |
| 0-1 episodes .....                    | 35                   | 60                    | 21               | 24                 |
| 2-5 episodes .....                    | 52                   | 71                    | 37               | 22                 |
| 6 or more episodes .....              | 19                   | 74                    | 14               | 29                 |
| Previous health center visit(s):      |                      |                       |                  |                    |
| No .....                              | 43                   | 63                    | 27               | 11                 |
| Yes .....                             | 63                   | 71                    | 45               | <sup>3</sup> 31    |
| Health insurance:                     |                      |                       |                  |                    |
| Insurance .....                       | 82                   | 72                    | 59               | <sup>2</sup> 29    |
| No insurance .....                    | 24                   | 54                    | 13               | 0                  |

<sup>1</sup> Excludes 37 men with a history of hepatitis B.

<sup>2</sup>  $P < .01$ .

<sup>3</sup>  $P < .05$ .

only 1 man mentioned concern about getting AIDS from the vaccine.

The 38 men who stated that they intended to receive the vaccine but had not yet received it were asked what had prevented them from getting the vaccine to date. Sixty-seven responses were given. Eighteen men (47 percent) cited lack of informa-

Table 2. Knowledge of transmission and health effects of hepatitis B among 143 men aware of hepatitis B

| Knowledge of hepatitis B                                     | Knowledge of hepatitis B scales |         |
|--|---------------------------------|---------|
|  | Number of correct responses     | Percent |
| <b>Mode of transmission:</b>                                 |                                 |         |
| Sexual contact .....   | 133                             | 93      |
| Sharing needles .....  | 133                             | 93      |
| Contact with someone's blood .....                           | 132                             | 92      |
| Receiving blood transfusions .....                           | 122                             | 85      |
| Casual contact (for example, a handshake) <sup>1</sup> ..... | 127                             | 89      |
| Donating blood <sup>1</sup> .....                            | 101                             | 71      |
| Sharing food <sup>1</sup> .....                              | 68                              | 48      |
| <b>Health effects:</b>                                       |                                 |         |
| Chronic hepatitis B .....                                    | 104                             | 73      |
| Carrier .....  | 102                             | 71      |
| Asymptomatic hepatitis B .....                               | 102                             | 71      |
| Acute hepatitis B .....                                      | 98                              | 69      |
| Liver cancer .....   | 75                              | 52      |
| Cirrhosis of liver .....                                     | 61                              | 43      |
| Mononucleosis <sup>2</sup> .....                             | 55                              | 39      |

<sup>1</sup> Transmission unlikely; correct response is no.

<sup>2</sup> Unlikely effect; correct response is no.

Table 3. Knowledge of transmission and effects of hepatitis B among study subgroups

| Variable                      | Number | Knowledge of hepatitis B scales |              |
|-------------------------------|--------|---------------------------------|--------------|
|                               |        | Transmission mean               | Effects mean |
| <b>History of hepatitis B</b> |        |                                 |              |
| Yes .....                     | 37     | 6.1                             | 5.2          |
| No .....                      | 106    | 5.6                             | 3.8          |
| <b>Awareness of vaccine</b>   |        |                                 |              |
| Aware .....                   | 72     | 5.9                             | 4.4          |
| Not aware .....               | 34     | 4.9                             | 2.6          |
| <b>Acceptance of vaccine</b>  |        |                                 |              |
| Accepted .....                | 17     | 6.2                             | 5.1          |
| Not accepted .....            | 55     | 5.8                             | 4.2          |

<sup>1</sup>  $P < .05$ .

<sup>2</sup>  $P < .001$ .

NOTE: Scales computed by obtaining sum of correct responses to questions on transmission and effects of hepatitis B for each participant.

tion. The predominant barrier, cited by 45 percent, was the high cost of the vaccine, with low perceived susceptibility the next most frequent reason mentioned by 21 percent. No one in the group who intended to be vaccinated mentioned fear of getting AIDS from the vaccine as a reason that kept them from getting vaccinated.

**Information sources.** The main sources of the respondents' health information during the past year were pamphlets from health centers (91 percent),

gay newspapers (90 percent), and health care providers (78 percent). Other, less frequently cited sources given by at least 50 percent of the sample included local gay advocacy groups, gay magazines, general newspapers, television, general magazines, and posters in gay bars. These sources were similarly ranked as good sources for future health information.

The 98 men in the study sample who knew a vaccine for hepatitis B was available became aware of the vaccine from several sources including gay newspapers (64 percent), health care providers (44 percent), friends (37 percent), and brochures of health care facilities or gay organizations (36 percent). Other, less frequently cited sources included general newspapers, gay magazines, general magazines, or a lover.

## Discussion

The sample of men in this study appeared to be representative of gay and bisexual men attending the health center. Demographic characteristics of the study sample were generally similar to the characteristics of the population of male clients who attend the center, based on previous surveys (20,21).

Two-thirds of the men in this study were aware of hepatitis B and may have been susceptible because they had no previous history of the disease. Education beyond the baccalaureate level and more extensive knowledge about methods of transmission and effects of the disease differentiated aware from unaware subjects.

Vaccine use was quite low: only about one-sixth (17 of 106) of potentially susceptible subjects had been vaccinated. Vaccination rates among men who were aware of the vaccine were significantly influenced by previous attendance at the health center, an indication of the effort by the center to educate these men about the vaccine and, possibly, a reflection of increased health consciousness and concerns. Having health insurance was also associated with being vaccinated, although health insurance plans may not cover the cost of the vaccine. The men who had been vaccinated had significantly greater knowledge of the effects of the disease than the unvaccinated, indicating a better understanding of the severity of the disease. However, knowledge of the means of transmission was not associated with the decision to be vaccinated.

One of the main barriers to vaccine acceptance identified in this study is the lack of perceived susceptibility by study subjects. Previous studies of

hepatitis B vaccine use among health care workers have also identified this problem. Palmer and King (22) found that vaccination rates among high-risk hospital employees varied by their perceived occupational risk of acquiring hepatitis B. Anderson and Hodges (23) also found that vaccine acceptance was associated with a high perceived risk. In our study, men in monogamous relationships or who practiced "safer" sex felt that they were not at risk of hepatitis B infection. Although hepatitis B infection is more likely among men with multiple partners and among those whose sexual practices include unprotected anogenital or oroanal contact (7), the prevalence rates of hepatitis B markers in gay and bisexual men who do not engage in risky practices are high enough to warrant concern about the safety of persons who do not stringently refrain from any unprotected anogenital or oroanal contact. More than 90 percent of gay men in one large cohort had some anogenital contact in 1984-85 (24). Results from an ongoing study of HIV infection at the community health center when the current study was conducted (20) indicate that among men with similar sociodemographic characteristics who did not have a history of hepatitis B and had not been vaccinated, more than half were engaging in unprotected anogenital or oroanal sexual contact, and more than one-fifth were engaging in these practices with multiple partners. Although the frequency of these practices has declined subsequently, a significant percentage of these men continue to practice high-risk behaviors (25).

Another major barrier identified was the perceived high cost of the vaccine. Although the costs of vaccination are high (26), several studies have indicated the favorable cost-benefit ratio of hepatitis B vaccination in high-risk groups, as long as prescreening for susceptibility is part of the program (27,28).

Interestingly, concerns about the safety or efficacy of the hepatitis B vaccine were not major concerns in this population, as they were among previous studies of health care workers (23,29). Bodenheimer and coworkers (29) found that beliefs regarding the safety and efficacy of the hepatitis B vaccine were the major determinants of decisions to accept or reject the vaccine.

What are the implications of this study for those who seek to maximize vaccine use among homosexually active males? First, awareness of the vaccine needs to be enhanced in the gay community. The three main sources cited by participants, both for general health information and for specific information on the vaccine, were gay newspa-

*'What are the implications of this study for those who seek to maximize vaccine use among homosexually active males? First, awareness of the vaccine needs to be enhanced in the gay community.'*

pers, health care providers, and brochures provided by health care facilities or gay organizations. It would seem appropriate to rely heavily on these sources in an educational campaign.

A second implication is the need to educate gay men both on the potentially serious sequelae of hepatitis B infection and on their susceptibility to the disease. Although such information may be incorporated into educational messages about the vaccine, there is also the need to discuss with the individual the risks associated with his particular sexual lifestyle. This discussion could be initiated by the health care provider or by designated counselors within the context of "safer sex" counseling sessions. The intense concern with safer sexual practices that has been engendered by the AIDS epidemic may provide an important opportunity for discussion of the hepatitis B vaccine (30).

A third implication of this study is the age group that must be targeted for educational programs. Our study indicates that regular homosexual activity began during the teenage years for about half of the sample. Younger men may be a particularly difficult group to reach both because they do not identify with gay organizations and may be preoccupied with concerns around gay identity and "coming out." Nevertheless, efforts must be made to reach this group soon after homosexual activity begins (4). As preventive care was the main reason given by our study subjects for seeking medical care after regular homosexual activity had begun, medical providers need to be alerted to identify this risk group promptly and promote the use of hepatitis B vaccine.

Finally, the cost barrier needs to be addressed in order to allow low-income men to take advantage of this important preventive technology. Cost will continue to be a deterrent to optimal use of the vaccine unless all third party payors are convinced of the favorable cost-benefit ratio of hepatitis B vaccination for homosexually active males.

## References .....

- Francis, D. P., and Maynard, J. E.: The transmission and outcome of hepatitis A, B, and non-A, non-B: a review. *Epidemiol Rev* 1: 17-31 (1979).
- Blumberg, B. S., and London, W. T.: Hepatitis B virus and the prevention of primary hepatocellular carcinoma. *N Engl J Med* 304: 782-784, Mar. 26, 1981.
- Francis, D. P., et al.: Occurrence of hepatitis A, B, and non-A, non-B in the United States. *Am J Med* 76: 69-73 (1984).
- Centers for Disease Control: Immunization Practices Advisory Committee (ACIP). Inactivated hepatitis B virus vaccine. *MMWR* 31: 317-322, 327-328, June 25, 1982.
- Centers for Disease Control: Immunization Practices Advisory Committee (ACIP). Recommendations for protection against viral hepatitis. *MMWR* 34: 313-324, 329-335, June 7, 1985.
- Szmunn, W., et al.: On the role of sexual behavior in the spread of hepatitis B infection. *Ann Intern Med* 83: 489-495 (1975).
- Schreeder, M. T., et al.: Hepatitis B in homosexual men; prevalence of infection and factors related to transmission. *J Infect Dis* 146: 7-15 (1982).
- Willoughby, B., et al.: Seroepidemiology of hepatitis B infection in a male homosexual population. *Am J Public Health* 77: 349-353 (1986).
- Szmunn, W., et al.: Hepatitis B vaccine: demonstration of efficacy in a controlled clinical trial in a high risk population in the United States. *N Engl J Med* 303: 833-841, Oct. 9, 1980.
- Francis, D. P., et al.: The prevention of hepatitis B with vaccine. Report of the Centers for Disease Control multicenter efficacy trial among homosexual men. *Ann Intern Med* 97: 362-366 (1982).
- Dienstag, J. L., et al.: Hepatitis B vaccine in health care personnel: safety, immunogenicity, and indicators of efficacy. *Ann Intern Med* 101: 34-40 (1984).
- Duma, R. J., editor: U.S. reports poor in immunization. *The Double Helix* 12: 1 (1987).
- Davidson, M., and Krugman, S.: Immunogenicity of recombinant hepatitis B vaccine. *Lancet* No. 8420: 108-109, Jan. 12, 1985.
- Stevens, C. E., Taylor, P. E., and Tong, M. J.: Yeast recombinant hepatitis B vaccine immune globulin in prevention of perinatal hepatitis B transmission. *JAMA* 257: 2612-2616, May 15, 1987.
- Centers for Disease Control: Hepatitis B virus vaccine safety: report of an inter-agency group. *MMWR* 31: 465-467, Sept. 3, 1982.
- Sacks, H. S., Rose, D. N., and Chalmers, T. C.: Should the risk of acquired immunodeficiency syndrome deter hepatitis B vaccination? A decision analysis. *JAMA* 252: 3375-3377, Dec. 28, 1984.
- Kane, M. A., Hadler, S. C., Maynard, S. C., and Maynard, J. E.: Antibody to hepatitis B surface antigen and screening before hepatitis B vaccination. *Ann Intern Med* 103: 791-792 (1985).
- Centers for Disease Control: Self-reported behavioral change among gay and bisexual men—San Francisco. *MMWR* 34: 613-615, Oct. 11, 1985.
- McKusick, L., et al.: Reported changes in the sexual behavior of men at risk for AIDS, San Francisco, 1982-84—the AIDS Behavioral Research Project. *Public Health Rep* 100: 622-629 (1985).
- McCusker, J., et al.: Behavioral risk factors for HIV infection among homosexual men at a Boston community health center. *Am J Public Health* 78: 68-71 (1988).
- Mayer, K. H., et al.: Association of human T lymphotropic virus type III antibodies with sexual and other behaviors in a cohort of homosexual men from Boston with and without generalized lymphadenopathy. *Am J Med* 80: 357-363 (1986).
- Palmer, D. L., and King, R.: Attitude toward hepatitis vaccination among high-risk hospital employees. *J Infect Dis* 147: 1120-1121 (1983).
- Anderson, A. C., and Hodges, G. R.: Acceptance of hepatitis B vaccine among high risk health care workers. *Am J Infect Control* 11: 207-211 (1983).
- Kingsley, L. A., et al.: Risk factors for seroconversion to human immunodeficiency virus among male homosexuals. Results from the Multicenter AIDS Cohort Study. *Lancet* No. 8529: 345-348, Feb. 14, 1987.
- McCusker, J., et al.: Predictors of AIDS-preventive behavior among homosexually active men: a longitudinal study. *AIDS* 3: 443-448 (1989).
- Chin, J.: The use of hepatitis B virus vaccine. *N Engl J Med* 307: 678-679, Sept. 9, 1982.
- Mulley, A. G., Silverstein, M. S., and Dienstag, J. L.: Indications for use of hepatitis B vaccine, based on cost-effectiveness analysis. *N Engl J Med* 307: 644-652, Sept. 9, 1982.
- Adler, M. W., Belsey, E. M., McCutchan, J. A., and Mindel, A.: Should homosexuals be vaccinated against hepatitis B virus? Cost and benefit assessment. *Br Med J* 286: 1621-1624, May 21, 1983.
- Bodenheimer, H. C., Fulton, J. P., and Kramer, P. D.: Acceptance of hepatitis B vaccine among hospital workers. *Am J Public Health* 76: 252-255 (1986).
- Francis, D. P., and Chin, J.: The prevention of acquired immunodeficiency syndrome in the United States. An objective strategy for medicine, public health, business, and the community. *JAMA* 257: 1357-1366, Mar. 13, 1987.