

CHAPTER 13

THE USE OF MARIHUANA IN THE TREATMENT OF ALCOHOLISM

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The past decade has seen an increasing awareness of the impact on man of alcohol abuse. The skid-row stereotype of alcoholism has slowly given way to the realization that this illness ranges from mild and reversible to severe and chronic and that all strata of the population are affected. Not only does alcoholism impair the physical and mental health of the individual but it also diminishes his social and economic well-being and that of his family.

In spite of a very considerable effort to provide effective treatment for alcoholic persons, success has largely eluded us. All too often people who develop clear signs of alcoholism deny their addiction and avoid seeking treatment until their condition has entered a destructive stage. Those who enter treatment frequently continue to drink episodically and most soon drop out and are lost to follow-up. It would seem that the power of alcohol on the person is so strong that a tremendous resolve is required before the drug is given up completely.

Several models have been developed in an effort to treat the alcoholic. Most of these models insist upon continuous sobriety as a basic requirement before psychological and social rehabilitation can occur. Unfortunately, the use of psychotherapy alone or combined with tranquilizers or antidepressant medication has not proved very effective in reducing drinking or improving clinic attendance (Ditman, 1966; Kissin, Platz and Su, 1971; Gerrein, Rosenberg and Manohar, 1973; Rosenberg, 1974). The drug disulfiram (Antabuse) blocks a stage in the metabolism of alcohol and if taken at the same time as alcohol it causes a severe reaction. Many alcoholics take this drug as added protection against the impulse to drink. When disulfiram was introduced in 1948 it was hailed as a considerable advance in the treatment of alcoholism. With the passage of time, however, the enthusiasm for it has dwindled. The disulfiram-alcohol reaction is feared and many patients

refuse to take the drug. The majority of those who do agree to take disulfiram soon discontinue its use and return to the use of alcohol. Several explanations are given why patients stop taking the drug. Firstly, failure to comply with treatment is not unique to alcoholism but occurs in all illnesses, especially those which are of long duration (Davis, 1968; Blackwell, 1973; Marston, 1970).² Secondly, disulfiram blocks the effects of alcohol but provides nothing in its place. Alcohol is more than a beverage to the alcoholic. It is a way of life -- involving barroom atmosphere, friendships, and a way to fill time. The patient is faced with a choice and usually chooses to give up disulfiram and return to his old haunts. Since there are no withdrawal symptoms from stopping disulfiram, the return to alcohol is possible after a few days.

Methadone maintenance in the treatment of heroin addiction provides us with another model for the treatment of addictions. Not only does methadone "block" the euphoric effects of heroin but it also prevents heroin withdrawal symptoms. The addict soon becomes dependent on methadone and needs to attend the clinic very regularly to receive the drug. While he attends, progress can be made towards his integration into society and moving him away from crime. Complete abstinence is a difficult goal to reach. The methadone model suggests that if one drug is to be given up, then something should be substituted in its place. We speculate that an alcoholic would be willing to give up alcohol and take disulfiram on a regular basis only if an acceptable alternative to alcohol is provided. At the present time, however, there is no substance available in the treatment of alcoholism that is equivalent to methadone use in heroin addiction. Perhaps marihuana -- or some similar preparation -- could serve as a reinforcer for disulfiram and as a substitute for alcohol?

We first became interested in this idea some four years ago. At that time it was commonly believed that while each drug could provide a "high" the use of one precluded the use of the other. Marihuana was the part of the youth counterculture, while alcohol was the drug of the establishment. Thus, Zinberg and Weil (1970) stated that where the use of marihuana became more regular, so "the use of alcohol, especially distilled spirits, declined proportionately or even more steeply." Becker (1963) suggested that when people begin to use larger amounts of alcohol, barbituates, or opiates they reduce their use of marihuana. The passage of time, alas, has shown that the assumed antagonism between alcohol and marihuana was more the result of societal forces than a pharmacological incompatibility. Nowadays both drugs are used by young people -- often at the same time.

A look into the literature shows that the therapeutic use of marihuana in alcoholism is not a new idea. Kane in 1881 described a patient who took hashish in an effort to control her addiction to alcohol. Thompson and Proctor (1953) used a marihuana derivative -- pyrahexyl -- in the treatment of alcohol withdrawal states.

At the present time marihuana does not seem to be widely used by alcoholic persons. We surveyed 240 new patients seen at the alcoholism

clinic at Boston City Hospital. Each patient was questioned about his drug and alcohol use during the month before coming to the clinic. Nearly one-third admitted to using tranquilizers on at least four days during each week. Five percent had used barbiturates but less than 2% had used either amphetamines or opiates. Nearly 7% of the 240 patients admitted to using marihuana up to four times a week but less than 1% had used the drug more than four times a week. Younger patients were more likely to have been using marihuana than older patients. Thus, nearly 20% of those under 36 years of age had used the drug during the previous month as compared to only 3% among those age 36 or older.

During 1972 we invited subjects who had completed treatment for alcohol intoxication to participate in an experiment involving the use of marihuana. Out of 25 patients we approached only 5 agreed to try the drug (one of whom developed an acute paranoid reaction). Most placed marihuana in the same category as heroin and considered it more dangerous even than alcohol. It is possible, however, that this extreme view has softened with time and that nowadays a greater proportion of alcoholics, especially those who are younger, will be willing to participate in an experiment with this drug.

Before testing the potential therapeutic uses of marihuana in alcoholism it was necessary to proceed through a number of steps and to seek answers to the following questions: (1) What are the acute effects of marihuana on alcoholics as compared to normals? (2) What are the acute effects of marihuana as compared to the effects of alcohol when these drugs are administered to normals and alcoholics? (3) What are the effects of disulfiram and marihuana when given at the same time? (4) Will alcoholics agree to take marihuana over a fairly lengthy period and at the same time agree to take disulfiram?

Advertisements were placed in local daily newspapers and student magazines calling for male subjects to participate in our drug studies. Ninety-one men responded and were asked to come in to complete a questionnaire dealing with their psychological and physical health and their patterns of drug use. In this part of the study we recruited healthy subjects who were only light users of alcohol, marihuana, and other drugs and had no history of serious physical or mental disorder. Thirty normal subjects completed the experiment (two others experienced a transient paranoid reaction after smoking marihuana and did not complete the procedure). The normal subjects varied in age from 21 to 32 years. Nearly all had attended college with an average of 15 years of education each. At the time of the study most of them were attending one or another of the universities in metropolitan Boston. They participated in the study out of curiosity as well as for the opportunity to smoke "good" marihuana. No doubt, the chance to earn some money also played a part.

We separately advertised in the same newspaper for persons who were experiencing difficulties with their use of alcohol. A total of 52 persons responded to this advertisement. We did not consider persons who had a

history of serious physical or mental disorder or had never smoked marihuana. We used the Michigan Alcoholism Screening Test (MAST) to determine the stage of alcoholism each of them had reached. To match our normal sample, we selected younger persons whose alcohol addiction was of intermediate severity and who did not show gross economic and social decompensation. The final group of 30 alcoholics were closely matched with the normals in age (mean 27 years, range 21 to 36 years). They had an average of 13 years of education but fewer of them were attending universities at the time of the study.

An immediate difference between the groups was that while only one normal subject failed to show up for the experiment, as many as 10 alcoholics did not come. Those who failed to attend were replaced by the next candidate. Since we offered each subject \$3 an hour -- and a chance to earn up to \$15 -- the poor attendance of the alcoholic group indicates that even the inducement of money is not always a strong reinforcer of behavior.

Our comparisons between normals and alcoholics included measures of physiological response (heart rate and forearm blood flow), mood changes, and mental acuity. All subjects were measured at rest and during mental stress. Heart rate and forearm blood flow were recorded on a polygraph using an EKG lead for heart rate and a plethysmograph with strain gauge to record blood flow. The subject lay comfortably on his back on the bed. The strain gauge was placed around the left forearm and the EKG lead was attached and linked to the polygraph. Blood flow to the left hand was stopped by means of a blood pressure cuff inflated to 180 mm Hg. The left upper-arm blood pressure cuff was inflated to a pressure of around 50 mm Hg, whereby the venous return was intermittently occluded while the arterial inflow continued without interference. In this way, changes in forearm blood flow altered the girth of the forearm. The resulting changes of tension in the strain gauge were recorded on the polygraph.

Two types of emotional stress were used. Firstly, each subject was asked to speak for three minutes into a videotape camera on a topic which he had previously disclosed as one that caused him much personal anxiety. While making the speech he could see himself on the monitor and was told that the videotape would later be played back to a panel of experts who would rate the speech for content of thought. Secondly, each subject was asked to solve mental arithmetic problems under pressure of time. The mental arithmetic consisted of groups of 20 problems of varying degrees of complexity. The subject was told that he would be paid according to the number of correct answers. Thus, in addition to acting as a stressor, this test also served as a measure of mental acuity. Both public speaking and mental arithmetic have been established as laboratory models of clinical anxiety and are associated with physiological arousal as shown by increases in heart rate, forearm blood flow, and finger sweating (Droppleman and McNair, 1971).

Changes in mood during each rest and stress period were measured by means of subject self-evaluation using items selected from the Psychiatric Outpatient Mood Scale (POMS). This scale measures feeling states such as

friendliness, anxiety, anger, depression, and drowsiness. Finally, the subjects who were given alcohol or marihuana were asked to rank the drug "high" on a scale where 0 = no "high" at all, and 4 = extremely "high".

Ten normals and ten alcoholics were tested under control conditions and were not given any drug throughout the procedure. Ten others from each group smoked marihuana and a further ten from each group drank alcohol. The marihuana was obtained from the Center for Studies of Narcotics and Drug Abuse. The dosage we used was approximately 0.4 Gr. of cigarette/-50 lb. of body weight (the equivalent of 7.5 mgm Delta THC/50 lb. body-weight). Alcohol was consumed in the form of 100-proof vodka mixed with orange juice; the dosage was 2 ml. vodka/kgm bodyweight. Breathalyzer readings were taken before any subject participated to ensure that none had been drinking prior to the study. For those who received alcohol a further breathalyzer reading was made one half-hour after ingestion. The mean blood alcohol level was 0.06% (range 0.05 - 0.08%).

Each subject was tested for a period of 140-160 minutes. Resting levels of heart rate and blood flow were obtained. The subject was then told to speak for three minutes while looking into the videotape camera. Following the speech the subject was asked to relax and resting levels were recorded for 15 minutes. He was then subjected to additional stress by being asked to solve mental arithmetic problems within a limited time period. After this procedure the subject was asked to relax and further resting readings were taken. At this stage alcohol or marihuana was administered while the third group acted as controls. One half-hour after taking the drugs the procedure was repeated in the same sequence -- viz. resting, public speaking, rest, mental arithmetic, and rest.

Following each rest and stress procedure the subject was given the questionnaire to complete to measure changes in anxiety, confusion, depression, anger, drowsiness, and friendliness. Lastly, we recorded the number of correct answers obtained by each subject during the mental arithmetic tests.

These data provided us many comparisons of marihuana and alcohol effects as well as comparisons between normals and alcoholics.

Before taking marihuana or alcohol, the 30 normal subjects had a mean heart rate of 64 beats/minute at rest. The rate increased by some 20-30% during periods of stress but returned rapidly to baseline levels once the stress was over. The 30 alcoholics as a group had a mean resting level somewhat higher than the normals but their response during stress was less, with the rate of increase only half that of the normals. The normal and alcoholic subjects who were given alcohol showed no appreciable change in their initial baseline rate nor in their response to stress. However, following each stress the heart rate for both normals and alcoholics failed to return to baseline but remained raised by some 5-10%. Both the normals and the alcoholics who smoked marihuana showed a dramatic rise in resting heart rate of about one-fourth above pre-marihuana levels. The responses to stress

were proportionately similar to those in the pre-marihuana conditions. Again the normals showed an increase above baseline of some 20% during stress while the stress response of the alcoholics was only half as great.

The results with forearm blood flow at rest and during stress were in a similar direction to those of the heart rate. We concluded that alcoholic subjects had resting heart rate and blood flow levels somewhat higher than normals. However, the response of alcoholics to stress was lower. When given alcohol or marihuana the alcoholics responded similarly to normals but throughout their response to stress was attenuated. In both normals and alcoholics, marihuana markedly increased heart rate and blood flow but did not impair the relaxation response at the end of each stress. Alcohol, by contrast, impaired this relaxation response.

Changes in mood states were more difficult to evaluate than measures of physiological response. In general, the normal subjects showed a greater responsiveness to stress than the alcoholics by becoming less friendly but more alert and anxious. When alcohol was given to alcoholics they experienced increases in anger and depression. Marihuana, by contrast, did not intensify these mood states. For both normals and alcoholics, the marihuana "high" was substantially greater than the alcohol-induced "high". In both normals and alcoholics the ability to solve mental arithmetic problems was reduced after smoking marihuana by 10%. Alcohol, in the doses we gave, did not impair mental acuity in either group.

We have interpreted the data as follows: Alcoholics are less responsive to stress than normal subjects, and they are more likely to "give up" and withdraw from the stress situation. Among alcoholics and normals alike, the drug alcohol interferes with the defense reaction of "flight or fight" by preventing complete relaxation after stress. Among alcoholics, this drug has the added effect of increasing anger and depression (see also, McNamee, Mello and Mendelson, 1968; Warren and Raynes, 1972). Marihuana, by contrast, produced more positive mood states and did not interfere with the arousal reaction. Marihuana, however, is not without negative effects. It greatly increases heart rate and sometimes produces an acute psychiatric syndrome of which we saw 3 among 27 subjects tested. These findings confirmed our belief that marihuana could have a place in the treatment of alcoholism. Careful screening of subjects is necessary to avoid giving the drug to persons who are prone to psychiatric disturbances. Also a smaller dose should be used to reduce the effect of the drug on the cardiovascular system.

We have studied the interaction of disulfiram and marihuana on 15 male subjects who were in good health and had a history of some prior marihuana usage. The subjects were asked to fill out a medical screening questionnaire before being admitted to the research ward.

Baseline measures of heart rate, blood pressure, and temperature were recorded 3 times at 15-minute intervals before administration of the two drugs. Each subject was asked about his alcohol consumption in the preceding

24-hour period to ensure that his system was free from alcohol before the administration of 250 milligrams of disulfiram crushed and dissolved in orange juice. The subject was then given a marihuana cigarette to smoke.

The subject was monitored immediately after ingestion, then at 15-minute intervals for the first hour, 30-minute intervals for the second hour, and 60-minute intervals for the third and fourth hours. Approximately 15 minutes after smoking the marihuana cigarette the subject was asked to rate his high on a scale of 0-4; 0 representing no subjective effects and 4 representing extreme effects. Finally, each subject was reminded that he would not be able to drink any kind of alcoholic beverage for at least five days.

The results indicate that there is no subjectively discernible interaction between marihuana and disulfiram. One subject developed a headache one hour after administration of the two drugs but reported later that it had disappeared.

We are now entering the fourth phase of our study. This involves testing the value of marihuana as a reinforcement for the use of disulfiram (Antabuse) by persons with alcohol problems. Our previous research has shown that giving alcoholics disulfiram twice weekly under staff supervision improves clinic attendance and leads to reduced drinking over our research period of two months. However, less than half of all alcoholics will accept disulfiram. Many who start discontinue its use. Our purpose is to see if marihuana can be used as a positive reinforcer or inducement for alcoholics to accept and continue taking disulfiram under our twice-weekly supervision.

Sixty subjects will be tested. Persons with a history of excessive alcohol use will be invited to come to our office to complete a questionnaire dealing with alcohol and drug use as well as physical and mental status. Persons who are judged to be early- or intermediate-stage alcoholics will be invited to participate in the study. Each of these 60 subjects who agrees to participate will be paid \$1.00 per visit to meet travel expenses. Since we plan to measure return rates we do not wish to offer a large sum of money because it is likely that some of the subjects may be coming principally for the money and this will seriously impair the study as a whole.

Our purpose is to determine whether the smoking of marihuana will reinforce the use of disulfiram in patients with alcohol problems. We, therefore, plan to see whether the smoking of marihuana will (1) increase the attendance patterns of alcoholic subjects, (2) increase their willingness to take disulfiram, and (3) alter the drinking patterns of alcoholic subjects.

Subjects will be allocated at random to one of four groups each with 15 subjects: (1) Control Group -- This group will not receive drugs of any kind. (2) Disulfiram only -- Each time they attend the subjects in this group will be invited to ingest 250 mgm of disulfiram crushed in orange juice. On each occasion they will be informed about the alcohol-disulfiram reaction and strongly urged to avoid all forms of alcohol. Only persons sober for 24

hours will be given disulfiram. All persons will be given a card to carry stating they are taking disulfiram in case of an alcohol-disulfiram reaction. (3) Marihuana only -- Each time they attend the subjects in this group will be permitted to smoke up to one marihuana cigarette. (4) Disulfiram-Marihuana together -- The subjects in this group will be permitted to smoke up to one marihuana cigarette after they have ingested 250 mgm disulfiram crushed and mixed with orange juice. They will be warned about the alcohol reaction and strongly urged to avoid any form of alcohol. If subjects in this group refuse to take disulfiram, they will not be given marihuana.

For each group, subjects will be told to come twice weekly on Monday and Thursday or Tuesday and Friday at a fixed time. Each time a subject comes he will see an alcoholism counselor for 30-45 minutes of individual therapy. He will then be interviewed by a research worker who will inquire about his job status, drinking behavior, and living arrangements. In addition, the research assistant will record the number of visits made by each subject as well as conducting a breathalyzer test to determine present blood-alcohol levels. The maximum time each patient can remain in the study will be 28 days involving 8 visits. After this period he will be invited to continue treatment in the Outpatient Alcoholism Clinic at Boston City Hospital.

A study of this kind is bound to meet a considerable degree of resistance and we have encountered more than our fair share. We have now obtained all necessary authority to proceed with the study. We have contacted the various alcoholism programs in Boston and have placed advertisements in local papers. These advertisements invite persons with alcohol problems to contact us with regard to participating in a study involving alcohol education, counseling and drug management with disulfiram and/or marihuana.

From November, 1975 to January 31, 1976, 101 persons responded by telephone to over 20 separate advertisements. The purpose and nature of the study was explained to them but only 62 agreed to come in for an appointment. The most frequent reason for not coming was the refusal to take disulfiram (13 out of 39; 33%). Only 2 people refused to smoke marihuana. Most of the remaining 24 who refused to come in were looking for a job or money rather than treatment. Only 27 of the 62 who agreed to come for an appointment actually did so. A further 7 dropped out before starting the study leaving only 20 persons who actually received disulfiram; marihuana; disulfiram and marihuana or served as controls. The five subjects who served as controls attended 40 percent of the possible visits. While they remained in the study, the controls admitted to drinking alcohol on 17 percent and smoking marihuana outside of the study on 20 percent of the days. Two of the controls completed the 28 day study but neither of them later continued in the outpatient clinic. The 5 patients who received disulfiram alone attended 45 percent of the possible visits. None of them was drinking but as a group they smoked marihuana on 16 percent of the days they were in the study. Two of them completed the study and one continued in the outpatient clinic. The 5 subjects who received marihuana alone attended on 64 percent of the

possible visits. Compared with the controls, they drank alcohol (49 percent of days) and smoked marihuana on their own (32 percent of days) more often. Three of them completed the study, but none continued in the outpatient clinic. Finally, the 5 subjects who received both disulfiram and marihuana attended on 63 percent of possible visits. While they remained in the study, they were unable to drink alcohol, but they did smoke marihuana outside of the study on 48 percent of the study days. Three of the five subjects on disulfiram and marihuana completed the study, and all continued in the outpatient clinic.

The results of the study must remain tentative until we have tested more subjects. The reluctance of many alcoholics to disulfiram is known (Gerrein, Rosenberg, and Manohar, 1973; Rosenberg, 1974) but it would also seem that neither is marihuana particularly attractive to them. The smoking of marihuana by itself in a research setting seems to increase outside use of both marihuana and alcohol. However, when marihuana is given with disulfiram, this combination blocks alcohol use but boosts the outside use of marihuana. Overall, the combination of disulfiram and marihuana appears to be the most effective both in terms of continued attendance and reduced alcohol intake. Adverse reactions were limited to one subject who became anxious while smoking marihuana. No untoward effects were reported with the combination of disulfiram and marihuana.

We plan to continue this prospective study for several more months to determine the possible value of marihuana in the treatment of chronic alcoholism. Our preliminary findings indicate that marihuana by itself is neither sought after nor particularly useful in alcoholism treatment. However, as a reinforcer to disulfiram, it may well be of value.

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DISCUSSION

Rubin: I would like to make two comments based on the Jamaican study: one on alcoholism and one on mental function. Jamaica, as you must know, is a rum-producing country, as is the rest of the Caribbean, and there are not many teetotalers there. For the most part, people there are very relaxed about drinking. However, there are some very interesting differences in statistics of admissions to mental hospitals. In the Bahamas, where ganja is not used very much, the rate of annual admissions to mental hospitals for alcoholism is 55 percent, whereas in Jamaica, where ganja is endemic, the rate of annual admissions for alcoholism is less than one percent. I think this is a very interesting idea for Dr. Rosenberg to know about. On the question of mental function, I have been somewhat concerned all day long that a great many studies that are being presented on the acute effects of cannabis are presented without regard to any long-term study, and it seems to me they have to be placed in perspective. In the Jamaica study, there were 30 smokers and 30 nonsmokers. The 30 smokers had a history of smoking from 7 to 37 years with a mean of 17.5 years; they also smoked more heavily and with a higher THC content than is the case in this country, as you probably know. We gave a panel of 19 psychological tests, including neuropsychological, psychomotor, and personality tests. No significant differences were found between smokers and nonsmokers on any of the tests. But the important thing is that there was no indication whatsoever of disturbance of mental function or brain damage or anything that matches some of the findings that appear in acute studies. My reason for bringing this up is that I believe that acute reactions have to be seen in relation to the perspective of the effects of long-term chronic use.

Lemberger: I want to ask Dr. Vachon a question. You were talking about propranolol blocking some of the effects of marihuana. I am sure you realize that propranolol is not only a beta-blocking agent but it also affects many other functions. One of the major things it does affect is blood flow,

and thereby would be affecting the metabolism of the marihuana and many other subsequent effects.

Harris: It would be nice if some kind of a dose-response relationship could have been shown. I always get concerned with one fixed dose of one drug vs. one fixed dose of another drug. It would have been nice if you had fixed the dose of one and then had done a dose-response curve with the other. That would have given you a much better idea of whether you have a true interaction.

Miller: Did you use a 25 mg THC dose?

Vachon: No, it was a one-gram cigarette containing either 1 percent or 2 percent of THC.

Stillman: I want to ask you, is it possible that the tranquilizing or sedative effect of propranolol would reduce the depth of pulmonary inspiration, thus resulting in a lower dose of marihuana? Your reduction in marihuana effects would then result not from a direct effect of propranolol but simply from a lower delivered dose of marihuana.

Vachon: The smoking of the joint is timed. We ask the subject to inhale and we time his inhalation, and so on.

Hanley: I have a question for Dr. Neu. How did you determine this stage of sleep after the subjects retired?

Neu: There was an observer who walked into the room every 15 minutes with a small flashlight. When the subjects were obviously awake, there was no problem. A couple of subjects were faking that they were asleep, but when he put the flashlight close to their eyes, they would blink or make some sign that they were awake.

Cohen: I would like to ask Dr. Hill about her placebo. It seemed from her slides that it has an enormous effect on thresholds and on sensitivity, and in fact more so than the active drug but in the opposite direction.

Hill: We did find changes when we repeated the test. I think it should be pointed out that when you repeat the procedure there is a tendency to get a decrease in thresholds. The fact that we got opposing findings with the marihuana even further dramatizes the effect of marihuana.

Phillipson: I would like to go back to the point Vera Rubin made about findings in the Jamaica study. I believe it was not really the custom in Jamaica to inhale deeply and to retain that inhaled smoke for a long period of time. I got the idea that they didn't smoke it the way we do up here.

Rubin: I can't give you an exact measure of that, but there is some measure of it from the substudy that was done with videotaping to try to assess work performance.

Phillipson: I definitely remember being told about videotapes where the Jamaicans who might be chronic users might sort of puff the joints like a young American girl smoking her first cigarette.

Petersen: Someone did try to get them to inhale deeply and apparently deep inhalation was not the custom, but they certainly inhale some of it. But in Jamaica they don't inhale as deeply as they do here where material is scarce.

Harris: Isn't it a question of a dose-response thing? When you've got good stuff and plenty of it, you don't have to spend a lot of time trying to extract everything out of it. It's the same thing with nicotine. You give people good heavy-nicotine cigarettes, and they smoke it quite differently than they smoke low-nicotine filter cigarettes. My experience is that people who smoke marihuana smoke just enough to get the feeling that they want to get.

Rubin: We have chain smokers in Jamaica, you know, who smoke the way I smoke cigarettes.

Hill: I would just like to say that recently I had the opportunity to hear Dr. Dornbush talking about the Greek study, and although it is often said that there is no long-term effect of marihuana on brain functioning, and so on, actually there was very little done in the way of psychological testing in that study, and those that were given did not make it possible to conclude an absence of brain damage from chronic marihuana smoking. But I would like to say that we are trying to look at heavy users of marihuana in St. Louis -- which requires interviewing over 50 people to get 10 daily users. But our results show that using the computerized brain scan -- none of the people tested so far give any indication of abnormality.

Neu: I want to ask Dr. Rubin, regarding the statistics you mention of 55 percent on one island and one percent on another island: Is the pattern for hospitalization for other illnesses throughout the year parallel? Were different criteria used for admission on the two islands?

Rubin: I don't have the figures for that. We were primarily interested in the figures for alcoholism.
