

Sequential Patterns of Multiple-Drug Use Among High School Students

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• Only recently have multiple-drug use studies involving more than heroin and marijuana begun to be reported in the literature. Four of these studies have found evidence that multiple-drug use is a progressive phenomenon, although the particular pattern of multiple-drug use reported in different populations varies somewhat. This study examines the patterns of multiple-drug use reported by a random sample of 1,094 high school students living in greater New Haven, Conn in the 1972-1973 academic school year. Scalogram analysis reveals a progressive relationship for nine drugs: alcohol, marijuana, hashish, barbiturates, amphetamines, LSD, mescaline, cocaine, and heroin. Cigarettes and glue were not found to play a part in this pattern. The temporal order in which respondents reported that they had begun using each drug supports the results of scalogram analysis only in part.

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Although public and medical concern about the abuse of mind-affecting drugs dates back well over a century,¹ concern about "polydrug abuse" is of fairly recent origin in this country. "Polydrug abuse," which is defined as the use of more than one mind-affecting drug either simultaneously or in succession,² is of particular concern to clinicians who manage drug treatment programs, as it is reported that treatment is exceptionally difficult for this group of drug patients.^{3,4}

The earliest research on polydrug use concentrated on the question of whether marijuana use leads to heroin use. In recent years, however, research has been expanded to include other drugs, and the notion has been proposed that there may be a whole range of drugs that drug takers use in some kind of regular and orderly sequence.⁵ This particular notion is sometimes referred to as the "stepping-stone" hypothesis of multiple-drug use.⁶ This study is designed to analyze how well this hypothesis describes the reported drug-use behavior of a random sample of 1,094 high school students in the greater New Haven, Conn, metropolitan area in the 1972-1973 academic year.

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PRIOR RESEARCH

A number of studies have explored the extent to which marijuana users or heroin users take other drugs, but only a relatively few have examined the intercorrelations of the use of more than a few drugs. It is these multiple-drug studies that are most pertinent to the issue of polydrug use.

All of these studies report positive associations between the use of a wide variety of drug combinations.⁷⁻¹¹ One,¹¹ however, reports some negative associations—between the use of marijuana and heroin, amphetamines and heroin, barbiturates and heroin, and psychedelics and heroin—for some drug treatment applicants.

Four of these studies¹¹⁻¹⁴ also found a tendency for the use of drugs to be progressive. That is, those persons who reported that they had used the least frequently used drug were also likely to report that they had used all other drugs; those who reported that they had used the next least frequently used drug (but not the least frequently used drug) also tended to report that they had used all the more frequently used drugs, and so on. The particular progressive patterns of drug use (measured in each case by scalogram analysis, Guttman scaling) varied somewhat between studies both in terms of which drugs were most frequently used and which drugs were included in the pattern. Among drug treatment patients,¹¹ use of marijuana, amphetamines, barbiturates, and psychedelics, in that order, formed an acceptable scale, but heroin and cocaine, the two most frequently used drugs in this population, did not scale with the other drugs. Among Halifax, Nova Scotia adolescents who used marijuana,¹² the use of stimulants, tranquilizers and barbiturates (a combined category), hallucinogens, and opiates formed an acceptable Guttman scale. For Midwestern US college students,¹³ the pattern found was: alcohol, marijuana, psychedelic drugs, speed, barbiturates, and heroin. A similar pattern emerged among New York state public secondary school students,¹⁴ except that psychedelic drugs in that study were used less frequently than amphetamines or barbiturates.

"STEPPING-STONE" HYPOTHESIS

The unidimensionality of each of the drug-use scales found in these studies is consistent with the general "stepping-stone" idea of drug use. The differences in

patterns of use found in different populations, however, are inconsistent with a notion that progressive drug use patterns are universal. Not all researchers, however, have claimed that the patterns will be universal. There are, as Johnson¹ points out, at least six versions of the hypothesis, based on different assumptions about the psychological or social characteristics of users and different qualities of the drugs involved. Furthermore, most statements of the hypothesis refer only to a progression from marijuana to heroin; only a few authors^{1,2,3} have suggested that other drugs might also be involved in the progressive sequence. However, these authors do not specify the exact nature of this progression, and suggest only that it may involve such factors as a search for more potent "highs," availability of different drugs, or subcultural preferences.

Without a clearer statement of the "stepping-stone" hypothesis, it is hard to relate it clearly to polydrug use. As things stand now, it is not even clear which drug comes first in the sequence, although most discussions of the subject begin with marijuana, leading one to infer that marijuana is the starting point in the "stepping-stone" hypothesis of polydrug use. That heroin comes at the end of the line seems to be taken for granted by everyone. How people get from marijuana to heroin, however, is not at all clear. Can they go directly, or will they invariably progress from marijuana to some intermediate drug or drugs before going on to heroin? Is there only one drug path from marijuana to heroin, or are there several paths? Can people skip a step along the way, or do they try all the drugs in order? Once people have tried one drug and moved on to another, will they abandon the first drug?

SUBJECTS AND METHODS

This article explores these questions with survey data gathered from a simple random sample of all high school youth attending 20 high schools (grades 10 to 12) in New Haven, Conn, and 11 surrounding cities and towns in the 1972-1973 academic year. The sample of 1,094 represents an overall high school population of 18,481. (The general population for the area served by these high schools is approximately 400,000 and includes rural, suburban, and urban areas.)

The overall high school population, as estimated from our sample, is about equally divided between boys and girls. Eighty-seven percent is white, 12% black, 1% Puerto Rican, and 0.4% of other racial-ethnic groups. Sixty-two percent of the population is Roman Catholic, 27% Protestant, 7% Jewish, and 1% of other religious groups. Three percent identified with no religious denomination. The majority of the sample, 87%, attended public schools; 10% attended Roman Catholic schools, and 3% went to private schools.

Experienced survey teams from outside the school conducted the surveys during school time. To insure anonymity and to convince respondents that all material was confidential, we did not ask for the students' names. Informal "raps" following each group-administered questionnaire session convinced us that students accepted our pledges of anonymity and by and large tried to give thoughtful and truthful answers. (We excluded from analysis the few cases—0.5%—(which included obvious internal questionnaire inconsistencies indicating the possibility that the respondents were attempting to give false information.)

The overall participation rate for the study was 83%. This rate is higher than most similar surveys reported to date. Nevertheless, the possibility of bias due to nonresponse does exist. As a partial check on the nature of this possible bias, we compared respondents

and nonrespondents on those sociodemographic and school participation dimensions available to us. Unfortunately, this comparison can only be approximate since our source of data for nonrespondents (school records) is different from our source of data for respondents (questionnaire responses). Nevertheless, differences between the two groups on all but one variable were small, and only a few were statistically significant. Sex, ethnicity, religion, years enrolled in present school, and employment of head of household were not significantly different between respondents and nonrespondents. Nonrespondents were very slightly older than respondents (average, 16.7 as opposed to 16.3 years; $P < .001$), more likely to be attending public or private schools as opposed to Catholic schools ($\chi^2 = 20.2$; $df = 2$; $P < .001$), and more likely to have a father as head of household ($\chi^2 = 5.7$; $df = 1$; $P < .02$). Nonrespondents were also likely to have lower grade point averages, and this difference, in addition to being statistically significant ($P < .001$), was fairly large. On a nine-point scale, the difference in mean grades was 1.2. We suspect that some portion of this difference could be due to reporting bias; that is, the respondents, who reported their own grade point averages, may have reported slightly higher grades than they actually had. Since we cannot check this possibility, we must assume that some nonresponse bias exists. If it were the case that grades in school were not related to reported drug-taking behavior, then this bias would be of little concern. As it turns out, however, grades in school are somewhat related to the use of drugs. Using gamma as the measure of association, the relationship is moderately strong (and significant) for cigarettes, barbiturates, amphetamines, cocaine, and heroin (values of gamma ranged between .27 and .34). For the rest of the relationships, the gamma values ranged between .09 and .21. All but one, grades in school and the use of mescaline, were statistically significant at $P < .05$. This means, then, that there is some chance that our findings are biased in the direction of less drug use than actually occurred in the population. Since our analysis is less concerned with amount of drug use than with patterns of multiple-drug use, it does not seem likely that this degree of potential bias could have a serious effect on our conclusions.

The analyses described below rely on responses to that portion of our questionnaire dealing with the drugs the respondents used and when they first used them. The questionnaire included items pertaining to 11 legal and illegal mind-affecting drugs: marijuana, hashish, barbiturates, amphetamines, glue, LSD, mescaline, cocaine, heroin, alcohol (beer, wine, or liquor), and cigarettes. Both "ever used" and "currently use" items were included about each drug, as well as items relating to the amount of use. Except for cigarettes and alcohol, amount of use was coded as: none (or never), once or twice, three to five times, six to ten times, 11 to 20 times, 21 to 50 times, and over 50 times. Cigarette use was coded as: never regularly, few a day, under a pack a day, and a pack or more a day. Alcohol use (outside the home with friends) was coded as: never, two to three times a year, one to two times a month, one to two times a week, more than two times a week, and daily.

For all drugs, including alcohol and cigarettes, respondents were asked to indicate how old they were when they first used the drug. For nine of the drugs, all except alcohol and cigarettes, we also asked the respondents to rank the order in which they first used each. We introduced this question on rank ordering because our earlier surveys, which asked at what age drug use began, indicated that many students began using a number of drugs in the same year. Although this rank order question differentiates sequences in drug use patterns better than the question on age when drug use began, it too has limitations: it does not include alcohol and cigarettes, and a sizable number of respondents failed to make forced rank distinctions between drugs even though the question asked them to. Therefore, we combined the two items as follows to construct a single measure of reported priority in drug use:

Table 1.—Percent of Respondents Who Reported Ever Using Each of 11 Drugs by Number of Drugs Used

Drugs Used, % (N = 217)	No. of Drugs Reported "Ever Used"											All Respondents (N = 1,080*)	
	0 (N = 217)	1 (N = 244)	2 (N = 146)	3 (N = 128)	4 (N = 110)	5 (N = 65)	6 (N = 52)	7 (N = 32)	8 (N = 33)	9 (N = 38)	10 (N = 12)		11 (N = 3)
Alcohol†	0	88	94	98	96	98	98	94	100	100	92	100	75
Marijuana	0	6	54	99	99	100	100	100	100	100	100	100	52
Cigarettes‡	0	6	42	48	78	75	77	84	85	95	100	100	39
Hashish	0	0	1	44	77	94	88	97	100	100	100	100	34
Barbiturates	0	0	1	2	15	48	71	81	97	97	100	100	18
Amphetamines	0	0.4	3	2	12	34	79	78	94	100	100	100	18
LSD	0	0	1	1	6	12	23	53	100	97	100	100	12
Mescaline	0	0	4	0	1	12	29	50	70	92	100	100	10
Glue	0	0	0	5	11	17	33	25	21	47	58	100	9
Cocaine	0	0	0	1	4	8	2	34	27	61	92	100	6
Heroin	0	0	0	0	0	1	0	3	6	11	58	100	2

*Does not include 14 cases with missing information.

†Ever used beer, wine, or liquor outside of the home with friends.

‡Ever smoke regularly (daily).

Table 2.—Percentage of Respondents Who Reported Current Use of 11 Drugs by Number of Drugs Used

Drugs Used, %	No. of Drugs Reported "Currently Used"											All Respondents (N=1,030*)	
	0 (N=237)	1 (N=348)	2 (N=188)	3 (N=112)	4 (N=85)	5 (N=22)	6 (N=14)	7 (N=11)	8 (N=8)	9 (N=5)	10 (N=0)		11 (N=0)
Alcohol†	0	92	98	98	98	95	100	100	100	100	0	0	73
Cigarettes‡	0	6	64	56	87	68	93	100	75	100	0	0	32
Marijuana	0	2	36	99	100	95	100	100	100	100	0	0	32
Hashish	0	0	2	44	85	91	100	100	100	100	0	0	18
Barbiturates	0	0	1	1	15	68	93	91	100	100	0	0	6
Amphetamines	0	0	0	2	9	23	79	91	88	100	0	0	5
LSD	0	0	0	0	1	27	14	36	100	80	0	0	2
Mescaline	0	0	0	0	1	18	14	45	63	100	0	0	2
Cocaine	0	0	0	0	2	14	7	36	38	80	0	0	2
Heroin	0	0	0	0	1	0	0	0	13	40	0	0	0.3
Glue	0	0	0	0	0	0	0	0	25	0	0	0	0.2

*Does not include 64 cases with missing information.

†Ever used beer, wine, or liquor outside the home with friends.

‡Ever smoked regularly (daily).

first, we differentiated between drugs according to the age at which drug use began, and then, where there were ties (and the comparisons did not involve cigarettes or alcohol), we employed the ranking question to break ties. Sometimes both sources of data failed to differentiate priority of drug use, and we can report only that both drugs were used and both were begun at the same age.

RESULTS

As Tables 1 and 2 show, the respondents in our study reported a considerable amount of drug use. Three fourths of the population used alcohol (outside the home with friends), over half had at least tried marijuana (one third reported that they were currently using it), and one third of the population smoked cigarettes regularly. One third of the population had tried hashish (with 18% currently using it); 18% had used barbiturates; 18% had used amphetamines; 12%, LSD; 10%, mescaline; 9%, glue; 6%, cocaine; and 2%, heroin. The numbers who reported current use of these last seven drugs, however, were quite small (indeed, only two respondents reported current use of glue and only four the current use of heroin).

Multiple-drug use was also prevalent. Fifty-eight percent of the students reported that they had used more

than one drug, and 44% said that they had used three drugs or more. Although some students did not continue their drug experience, a sizable proportion of the population (43%) reported that they were still multiple-drug users at the time of survey.

The use of each of these drugs, moreover, is quite highly and positively related to the use of the other drugs (Table 3). This is true for both the "ever used" and the "currently use" dimensions and for cigarettes and alcohol, as well as for illegal drugs. All these relationships except one are statistically significant at the .001 level. The one exception is the relationship between alcohol use and heroin use "ever used", where $P = .085$.

Looking only at the pattern of associations for drug pairs, one could conclude that with the exceptions of glue sniffing and smoking cigarettes, which are only moderately associated with the use of other drugs, the use of drugs is a highly interrelated set of behavior patterns. Within this context, furthermore, it is interesting to observe that the use of alcohol is just about as strongly associated with the use of "harder" drugs as is the use of marijuana. The one notable exception is the relationship between the use of alcohol and heroin. But patterns of

Table 3.—Relationships (Gamma) Between Drug-Use Pairs*

	Alcohol	Marijuana	Cigarettes	Hashish	Barbiturates	Amphetamines	LSD	Mescaline	Glue	Cocaine
Marijuana										
Ever	.82	...	...	...	...	...	...	...	...	...
Current	.61	...	...	...	...	...	...	...	...	...
Cigarettes										
Ever	.71	.63	...	...	...	...	...	...	...	...
Current	.53	.59	...	...	...	...	...	...	...	...
Hashish										
Ever	.88	.92	.61	...	...	...	...	...	...	...
Current	.61	.95	.57	...	...	...	...	...	...	...
Barbiturates										
Ever	.88	.87	.63	.83	...	...	...	...	...	...
Current	.67	.92	.71	.85	...	...	...	...	...	...
Amphetamines										
Ever	.88	.83	.65	.79	.91	...	...	...	...	...
Current	.60	.93	.61	.85	.95	...	...	...	...	...
LSD										
Ever	.86	.91	.69	.86	.87	.88	...	...	...	...
Current	.61	.90	.65	.83	.92	.93	...	...	...	...
Mescaline										
Ever	.87	.91	.68	.87	.88	.90	.96	...	...	...
Current	.54	.95	.50	.87	.92	.94	.99	...	...	...
Glue										
Ever	.70	.64	.51	.53	.70	.69	.71	.64	...	...
Current	...	...	...	...	...	...	...	...	...	...
Cocaine										
Ever	.72	.89	.61	.83	.87	.84	.89	.89	.54	...
Current	.55	.98	.68	.90	.94	.91	.92	.94	...	...
Heroin†										
Ever	.49	.92	.63	.83	.90	.90	.91	.89	.80	.92
Current	...	...	...	...	...	...	...	...	...	...

*All gamma values significant at $P < .001$, except alcohol and heroin where $P = .085$.

†Too few respondents reported current use to compute meaningful relationships.

association, in and of themselves, do not tell nearly the whole story.

The "stepping-stone" hypothesis of drug use implies not only that the "ever" use of each drug will be highly associated with the "ever" use of other drugs, but that there will be a progressive pattern of drug use. As a first step in analyzing our data to see if such a progressive pattern exists, we employed scalogram analysis.¹¹ This is the same approach other researchers have used.^{1,9-11}

A progressive pattern of "ever" drug use does seem to exist in the population we studied. The coefficient of reproducibility score, which is the most common statistic used to summarize the results of scalogram analysis, is .93. The coefficient of reproducibility can be misleading, however, in those instances in which a large amount of skewness is present in the distribution of scale scores. To correct for this skewness, some researchers have suggested another measure, the coefficient of scalability.¹² The value of this score, in our study, was .65. This value is not very high. Therefore, we excluded from the list the two drugs that were contributing the most error, cigarettes and glue, and recomputed the scale scores. Without cigarettes and glue, the coefficient of scalability was .80, and the coefficient of reproducibility was .96. The scale order of the remaining nine drugs was: alcohol, marijuana, hashish, barbiturates, amphetamines, LSD, mescaline, cocaine, and heroin.

Although the "stepping-stone" hypothesis in some of its versions implies that as people progress from one drug to

the next they give up the drugs they started with, our analysis did not find this pattern. When we applied scalogram analysis to the "current" use of each of the 11 drugs we found the same pattern as we did when we analyzed the "ever" used data. For all 11 drugs the coefficient of reproducibility was .96; for the nine-drug scale it was .98. The coefficient of scalability was .67 for the 11 drugs and .86 for the nine drugs. This finding indicates that those who reported current use of the least frequently used drugs also reported that they were still using the other, more frequently used drugs as well.

Scalogram analysis demonstrates a progressive pattern in frequency of drug use in a population. It does not demonstrate, necessarily, that individuals begin using drugs in that same order. It is altogether possible, for example, that a substantial proportion of a population of multiple-drug users could begin with the less frequently used drugs, and then, within a short period of time, also use the more popular drugs. As a result, few drug users, at any particular point in time, would be likely to have used only the less frequently used drugs. Since the "stepping-stone" hypothesis posits a temporal progression from one drug to another, scalogram analysis is not a completely adequate test of the hypothesis. Since we had gathered data about the reported temporal order in which respondents began using each drug, however, we could test the temporal aspect of the progressive pattern implied by scalogram analysis.

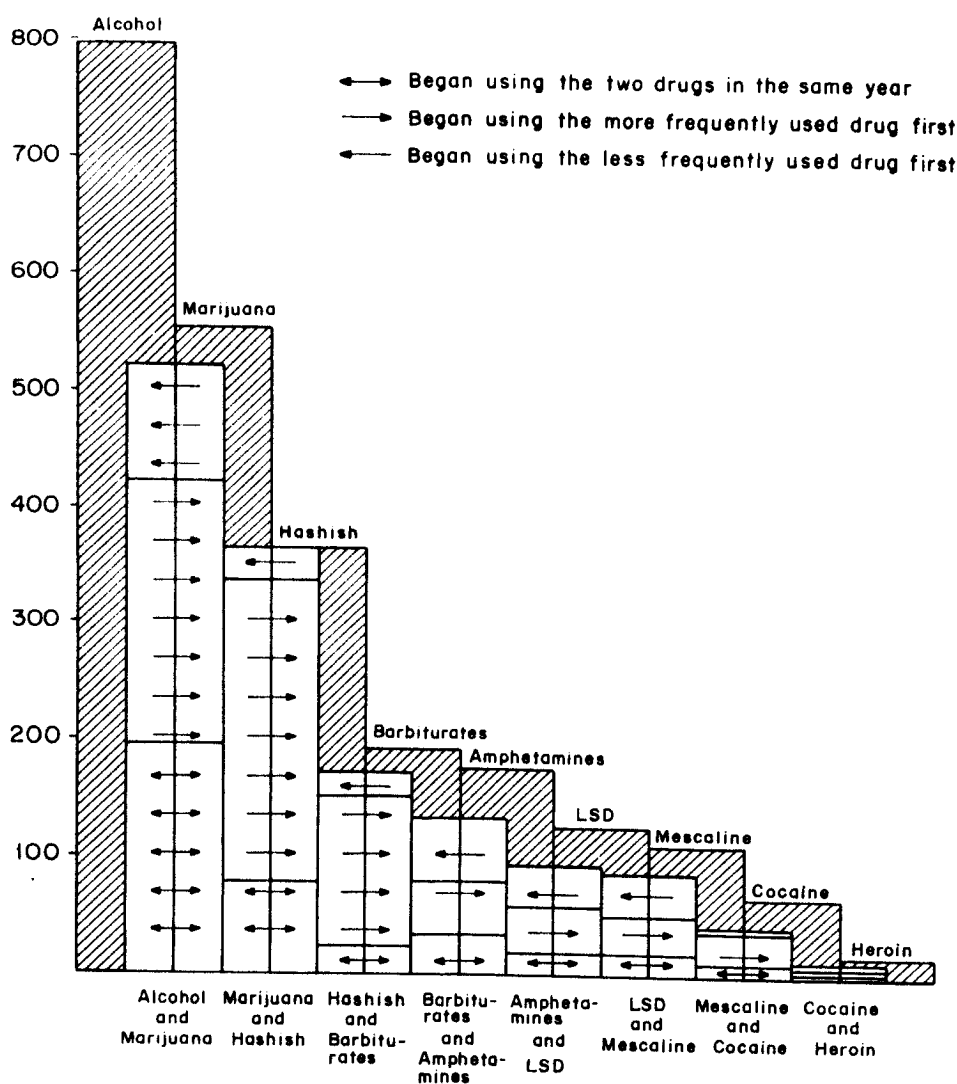
To do this we examined which drug in each multiple-

Table 4.—Order in Which Respondents Started Using Drugs

Drug Pairs		No. of Respondents	Respondents, %, Who Reported Using				% Using Both Drugs Who Reported Using		
A	B		Neither	A Only	B Only	Both	A First	B First	Same Time
Alcohol	Marijuana	1,071	22	26	3	49	43	19*	38
Alcohol	Cigarettes	1,073	23	38	3	36	29	43*	28
Alcohol	Hashish	1,076	24	42	1	33	54	13*	33
Alcohol	Barbiturates	1,077	25	56	0.4	18	76	9*	15
Alcohol	Amphetamines	1,070	25	58	0.4	17	67	11*	22
Alcohol	LSD	1,078	25	63	0.3	12	65	10*	25
Alcohol	Mescaline	1,074	25	65	0.3	10	67	13*	20
Alcohol	Glue	1,073	25	66	1	8	42	30	28
Alcohol	Cocaine	1,081	25	69	0.3	6	83	5*	12
Alcohol	Heroin	1,084	25	73	0.2	2	56	19	25
Marijuana	Cigarettes	1,063	41	20	7	32	19	49*	32
Marijuana	Hashish	1,070	48	18	0.0	34	72	7*	21
Marijuana	Barbiturates	1,069	48	34	0.2	18	89	5*	6
Marijuana	Amphetamines	1,060	48	35	1	16	83	10*	7
Marijuana	LSD	1,068	48	40	0.1	12	87	4*	9
Marijuana	Mescaline	1,066	48	42	0.0	10	90	3*	7
Marijuana	Glue	1,064	47	45	1	7	41	48	11
Marijuana	Cocaine	1,071	48	46	0.0	6	93	2*	5
Marijuana	Heroin	1,073	48	50	0.0	2	94	6*	0
Cigarettes	Hashish	1,065	51	15	11	23	59	13*	28
Cigarettes	Barbiturates	1,066	56	25	5	14	77	3*	20
Cigarettes	Amphetamines	1,059	58	25	4	13	75	6*	19
Cigarettes	LSD	1,068	59	29	2	10	75	3*	22
Cigarettes	Mescaline	1,064	60	30	2	8	72	5*	23
Cigarettes	Glue	1,062	59	33	2	6	45	31	24
Cigarettes	Cocaine	1,071	61	33	1	5	89	2*	9
Cigarettes	Heroin	1,074	61	37	1	1	92	0.0*	8
Hashish	Barbiturates	1,073	65	17	2	16	77	11*	12
Hashish	Amphetamines	1,065	64	19	2	15	72	19*	9
Hashish	LSD	1,074	66	22	1	11	74	11*	15
Hashish	Mescaline	1,069	66	24	0.3	9	83	6*	11
Hashish	Glue	1,069	65	28	2	5	31	52	17
Hashish	Cocaine	1,076	65	18	1	6	90	0.0*	10
Hashish	Heroin	1,078	66	32	0.0	2	83	6*	11
Barbiturates	Amphetamines	1,068	79	5	4	12	36	40	24
Barbiturates	LSD	1,074	49	9	3	8	36	45	19
Barbiturates	Mescaline	1,071	80	10	2	8	39	42	19
Barbiturates	Glue	1,070	49	13	3	5	13	77*	10
Barbiturates	Cocaine	1,077	81	13	1	5	68	13*	19
Barbiturates	Heroin	1,079	81	17	0.1	2	53	29	18
Amphetamines	LSD	1,068	80	8	3	9	42	40	18
Amphetamines	Mescaline	1,063	82	8	2	8	40	39	21
Amphetamines	Glue	1,064	80	12	4	4	18	71	11
Amphetamines	Cocaine	1,069	82	12	1	5	73	6*	21
Amphetamines	Heroin	1,072	83	15	0.1	2	68	13†	19
LSD	Mescaline	1,072	86	4	2	8	41	40	19
LSD	Glue	1,072	84	8	5	3	24	67*	9
LSD	Cocaine	1,075	88	6	2	4	66	15*	19
LSD	Heroin	1,082	89	10	0.2	1	80	13*	7
Mescaline	Glue	1,065	86	7	5	2	19	73*	8
Mescaline	Cocaine	1,075	88	6	2	4	72	5*	23
Mescaline	Heroin	1,078	89	9	1	1	64	0*	36
Glue	Cocaine	1,073	87	7	5	1	75	25	0
Glue	Heroin	1,075	91	7	1	1	83	0.0†	17
Cocaine	Heroin	1,085	93	5	1	1	27	55	18

*P < .01.

†P < .05.



Patterns of temporal priority among reported use of nine drugs (total sample size, 1,094).

drug use pair was reported as being used first. The results of this analysis are shown in Table 4. Alcohol, the drug used by most people, was not the drug that was most often used first; regular cigarette smoking was first. The use of alcohol did, in most cases, however, precede the use of all other drugs, although the temporal relationships with glue and heroin are not statistically significant.

The use of marijuana, the second most frequently used drug, was preceded by alcohol use in about twice as many cases as it preceded alcohol use, and was preceded by regular cigarette use in an even larger proportion of the cases. Marijuana was clearly the prior drug in all other cases except glue, which was about evenly divided with marijuana.

Hashish use, which in almost all cases followed marijuana use, preceded other drug use, again with the exception of glue sniffing, which came first for a majority of respondents (this relationship, however, was not statistically significant). But from here on, the picture becomes

unclear. The next four drugs in descending order of overall reported use are barbiturates, amphetamines, LSD, and mescaline. In terms of which drug is used first, however, there is no clear differentiation. All four of these drugs are used typically before cocaine or heroin, but cocaine use begins more often than not after heroin use, though cocaine is used by more people than heroin. (The temporal order of cocaine and heroin, however, is not statistically significant.)

This overall pattern, at least for the more frequently used drugs, can be seen somewhat more easily and schematically in the Figure. Excluding the use of cigarettes and glue, which are generally the first used drugs but by no means the most frequently used, the Figure presents each drug in order of overall reported use and then compares the pattern of temporal precedence for each adjoining drug pair. As the Figure illustrates, most people who used marijuana also reported using alcohol, and most people who used both reported that they either began using the drugs

in the same year or that they used alcohol first. All those who used hashish reported using marijuana, and most reported that they had used marijuana first. Similarly, almost everyone who reported using barbiturates also reported using hashish, and in most cases the use of hashish came first.

Amphetamines and barbiturates were used by nearly the same number of respondents but, as the Figure indicates, quite a few people used one drug and not the other. Among those who used both (a larger number than used one or the other), about equal numbers used either drug first. This same pattern holds for amphetamines and LSD (although somewhat more people used amphetamines than LSD) and LSD and mescaline. Although most people who used both mescaline and cocaine used mescaline first, quite a few used cocaine who did not report using mescaline. In the case of cocaine and heroin, the numbers are small (and the differences not statistically significant), but of those reporting the use of both drugs, heroin was used before cocaine in the majority of cases.

COMMENT

A large proportion of the respondents in this study indicated that they were drug users, and over half indicated that they were multiple-drug users. To be sure, some of this multiple-drug use involved only alcohol and cigarettes, but a fairly substantial amount involved other drugs as well. The use of each of the drugs, moreover, was positively associated with the use of the other drugs, although these associations were not strong in the case of glue and cigarettes.

This lack of strong associations suggests that cigarettes and glue probably play little role in an orderly progression of drug use, a conclusion that was strengthened further by scalogram analysis. Furthermore, given that the order in which these two drugs were first used was inconsistent with the progression indicated by scalogram analysis, it seems reasonable to conclude that cigarettes and glue do not fit into any "stepping-stone" pattern of multiple-drug use.

But what about the remaining nine drugs? The use of each was highly associated with the use of all others, and the pattern of use, according to scalogram analysis, formed the following progression: alcohol, marijuana, hashish, barbiturates, amphetamines, LSD, mescaline, cocaine, and heroin. Our analysis of the order in which respondents began using drugs revealed, however, that this was not in all cases the order in which our respondents started using drugs. While our temporal analysis is consistent with the scalogram pattern of order for the first three drugs—alcohol to marijuana to hashish—it is not consistent thereafter. The next four drugs in order by scalogram analysis—barbiturates, amphetamines, LSD, and mescaline—although all typically used after alcohol, marijuana, and hashish, are not themselves used in any particular temporal sequence. Heroin and cocaine, although both typically used later than the other seven drugs, do not in our sample show the temporal sequence implied by scalogram analysis, although our findings in the case of these two drugs could have resulted fairly easily from sampling error.

To the extent, then, that our data are consistent with the

"stepping-stone" hypothesis of multiple-drug use, the steps would have to be as follows: first comes alcohol, next marijuana, and then hashish. Those who progress beyond hashish are about equally likely to go next to barbiturates, amphetamines, LSD, or mescaline. The respondents in our sample did not in most cases progress beyond these four drugs, however, unless they had used all four of them. Then, the progression was to heroin and cocaine, in that order, for those who used heroin, or directly to cocaine for those who did not use heroin.

Although our data are consistent, in some cases, with the notion that multiple-drug users progress from certain drugs to other drugs, our study is not a test of the proposition put forth by some advocates of the "stepping-stone" hypothesis, that the use of certain drugs "leads to" the use of other drugs. Such notions of causality cannot be tested with cross-sectional survey data. We can say, however, for those who still wish to entertain such notions, that the emphasis most people have given in the past to marijuana as the starting point in a career of drug use may well have been misplaced. At least so far as our data are indicative, alcohol seems to play as significant a role in multiple-drug use as marijuana, and its use, at least within the population we studied, preceded the use of marijuana. If there is anything that comes before alcohol, it is hard for us to imagine what it might be. Glue sniffing and cigarettes smoking, according to our findings, are unlikely candidates. Some researchers have suggested that the first step may be mothers' milk, but we did not include questions about the use of this substance in our questionnaire.

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References

1. Musto DF: *The American Disease: Origins of Narcotic Control*. New Haven, Conn, Yale University Press, 1973.
2. Lucas WC, Grupp SE, Schmitt RL: Single and multiple drug opiate users: Addicts or non-addicts? *HSMHA Health Reports* 87:185-192, 1972.
3. Glassco RM, Sussex JN, Jaffe JH, et al: *The Treatment of Drug Abuse: Programs, Problems, Prospects*. Washington, DC, American Psychiatric Association and the National Association for Mental Health, 1972.
4. Gould LC, Kleber HD: Changing patterns of multiple-drug use among applicants to a multimodality drug treatment program. *Arch Gen Psychiatry* 31:408-413, 1974.
5. Blum RH, Braunstein L, Stone A: Normal drug use: An exploratory study of patterns and correlates, in Cole JO, Wittenborn JR (eds): *Drug Abuse: Social and Psychopharmacological Aspects*. Springfield, Ill, Charles C. Thomas Publishers, 1969.
6. Johnson BD: *Marijuana Users and Drug Subcultures*. New York, John Wiley & Sons Inc, 1973.
7. Johnston L: *Drugs and American Youth*. Ann Arbor, Mich, Institute for Social Research, 1973.
8. Whitehead PC: Multidrug use: Supplementary perspectives. *Int J Addict* 9:185-204, 1974.
9. Loiselle P, Whitehead PC: Scaling drug use: An examination of popular wisdom. *Can J Behav Sci* 3:347-356, 1971.
10. Sinnett ER, Wampler KS, Harvey WM: Consistency of patterns of drug use. *Psychol Rep* 31:143-152, 1972.
11. Single E, Kandel D, Faust R: Patterns of multiple drug use in high schools. *J Health Soc Behav* 15:344-357, 1974.
12. Kaplan J: *Marijuana—the New Prohibition*. New York, World Publishing Co, 1970.
13. Weppner RS, Agar MH: Immediate precursors to heroin addiction. *J Health Soc Behav* 12:10-18, 1971.
14. Edwards AL: *Techniques of Attitude Scale Construction*. New York, Appleton-Century-Crofts, 1957.
15. Menzel H: A new coefficient for scalogram analysis. *Public Opinion Quart* 17:268-280, 1953.