Cocaine use among heroin users in Spain: the diffusion of crack and cocaine smoking

Gregorio Barrio, Luis De La Fuente, Luis Royuela, Aurelio Díaz, Fernando Rodríguez-Artalejo and, Spanish Group for the Study on the Route of Administration of Drugs

Abstract

***Study objective*—To describe the prevalence and patterns of use of crack and cocaine hydrochloride among heroin users in Spain. To explore if the expansion of heroin smoking is accompanied by a similar phenomenon for cocaine.**

***Design*—Cross sectional study in 1995. Face to face interviews using a structured questionnaire.**

***Setting*—Three cities with different prevalences of heroin use by smoking: high (Seville), intermediate (Madrid), and low (Barcelona).**

***Participants*—909 heroin users, 452 in treatment and 457 out of treatment.**

***Main results*—Last month prevalence of crack use was 62.3% in Seville, 19.4% in Madrid, and 7.7% in Barcelona. Most users in Madrid (86.5%) and Barcelona (100%) generally prepared their own crack, usually with ammonia as alkali; in Seville most users (69.7%) bought preprocessed crack. The proportion of users who began taking cocaine (crack or cocaine hydrochloride) by smoking has increased progressively since the seventies, rising to 74.1% in Seville, 61.5% in Madrid, and 28% in Barcelona in 1992–1995, with the earliest increase in Seville. The factors associated with crack use were: residence in Seville (odds ratio (OR) =16.3), cocaine hydrochloride use mainly by smoking (OR=5.0), by sniffing (OR=2.7) or by injecting (OR=2.5), heroin use mainly by smoking (OR=2.8) and weekly use of cannabis (OR=1.9).**

***Conclusions*—In Spain smoking cocaine may be progressively diffusing from the south west to the north east, similar to what has happened with smoking heroin, but beginning later in time. The factors associated with smoking cocaine are basically ecological or cultural in nature (characteristics of the available drugs and the main route of heroin administration in each city).**

(*J Epidemiol Community Health* 1998;**52**:172–180)

Delegación del Gobierno para el Plan Nacional sobre Drogas -DGPNSD-, Madrid, Spain
G Barrio
L De La Fuente
L Royuela

Universidad Autónoma de Barcelona, Spain
A Díaz

Departamento de Medicina Preventiva y Salud Pública, Universidad del País Vasco, Vitoria, Spain
F Rodríguez-Artalejo

Spanish Group for the Study on the Route of Administration of Drugs
See appendix

Correspondence to:
Gregorio Barrio, Delegación del Gobierno para el Plan Nacional sobre Drogas, Calle Recoletos 22, 28001 Madrid, Spain.

Accepted for publication
10 June 1997

In countries where cocaine is not produced, it is usually present in the form of cocaine hydrochloride (cocaine HCL), although it is sometimes found as base (crack or base). Cocaine HCL is usually sniffed or injected and base is usually smoked,[1] although some studies have described the use of cocaine HCL by smoking and of crack by sniffing or by injecting.[2–4] Nevertheless, smoking cocaine HCL or sniffing crack is not very efficient and crack can only be injected if it is previously heated in an acidic liquid to obtain a cocaine salt. The route of cocaine administration has important implications for the health of users. Although any route of administration may produce similar physiological effects,[5] injecting or smoking may produce effects that are more rapid, intense, and of shorter duration,[6] and may more often be associated with frequent or compulsive use[7 8] and a higher level of dependence than sniffing.[9–11] Furthermore, most acute toxic reactions seem to depend on the rapid attainment of high plasma concentrations of cocaine, associated largely with the use of routes of rapid absorption (smoking and injecting).[12] This fact may explain, for example, why most admissions to treatment and hospital emergencies for cocaine use in the United States occur in crack smokers,[13] despite the fact that crack is used less frequently than cocaine HCL.[14 15]

In Spain cocaine use is relatively widespread.[16] However it is generally assumed to be cocaine HCL while crack is thought to be practically non-existent, a belief that is supported by the fact that only a small amount of crack has been seized by the police (only 539 grams in 1994, for example).[16] The limited spread of crack use and the predominance of cocaine HCL patterns of use, characterised by the sporadic use of moderate amounts by sniffing, have been considered important factors in explaining the negligible health repercussions of cocaine in Spain.[17] But the truth is that few studies have been made of the type of cocaine in use (cocaine HCL or crack). The few reports in this respect generally focus on users of other illegal drugs and suggest that there is a strong association in some areas between heroin and crack use.[18] For example, it is known that users treated for heroin dependence in 1990–1991 in a Málaga drug treatment centre very frequently smoked a mixture of heroin and crack heated on aluminum foil,[19] and that the prevalence of last month crack use in 1993 was 13.4% among users in a Madrid syringe exchange programme (almost all heroin users)[20] and 9.2% among a group of heroin and cocaine users recruited in the community in 35 Spanish cities.[21] In contrast, crack use seems to be quite rare[22] among other groups of illegal drug users, such as cocaine users who do not use heroin, only 1.8% of whom used crack in the

aforementioned study of users recruited in the community.[21]

The previously mentioned studies do not report the geographical distribution of crack use or the factors associated with its use. It is important to know these factors, however, because events are occurring in Spain that could considerably influence them. For example, the use of heroin by smoking is increasing in all regions.This phenomenon began in the south west (the Canary Islands and west Andalucía) and spread progressively northeast, resulting in three distinct areas of use by smoking: a high prevalence area in the south west (Andalucía, for example,), another of intermediate prevalence in the centre (Madrid, for example), and a third area of low prevalence in the northeast (Cataluña, for example).[19 23–25] Considering the experience of other European countries[1 26–29] and the results of the Spanish studies mentioned previously, a parallel phenomenon may be occurring with respect to cocaine use among heroin users, in which case the prevalence of crack and cocaine HCL use by smoking would be higher in areas and groups of heroin users who adopt this same main route for heroin use. To explore this hypothesis and to describe the prevalence and patterns of use of crack and cocaine HCL among heroin users in Spain, we studied data on the use of crack and cocaine HCL that were included in a cross sectional study designed to study changes in the routes of heroin administration in three cities (Seville, Barcelona, and Madrid), each of which is located in one of the three aforementioned areas.

Methods

SOURCE OF INFORMATION

The source has been described in more detail in another article.[30] Nine hundred and nine heroin users (305 from Seville, 304 from Madrid, and 300 from Barcelona) were interviewed between March and December 1995. In each city, about half of heroin users were recruited in drug treatment centres before beginning treatment for heroin dependence (treatment-users), and the rest were recruited outside of these centres (street-users). All persons had lived in the city where they were recruited for at least six months during the previous year and had used heroin during the previous month and at least 15 times in their lifetime. None of the street-users had been treated for heroin dependence between 1 January 1995 and the interview date.

In selecting the treatment-users, all treatment centres reporting to the State Information System on Drug Abuse (SEIT in Spanish) during 1994 were included in the sample,[24] except for prison programmes. The total included 25 centres. These centres mainly carry out outpatient treatments, and for the vast majority of users they are the entry to the network of services for drug dependence treatment. In each city the sample in each centre was assigned proportionally to the number of treatments reported to the SEIT in the second quarter of 1994.

The street-users were selected by a process combining targeted sampling[31] and snowball sampling.[32 33] Some 65.4% (299) were recruited directly by the interviewers in places where it was supposed that the probability of finding them was relatively high; 19.3% were introduced or named by key informants, and 15.3% were named by other persons interviewed (snowball sampling). Users were recruited in the following types of targets: meeting places for users (68.9%), areas where drugs are sold (22.7%), and others (8.4%). Not included were places or services that might result in selection bias by route of drug administration (syringe exchange programmes, AIDS patient services, etc). Key informants who named users were friends or acquaintances of the interviewers (42.0%), friends of the persons interviewed (3.4%), workers in treatment services (15.9%), and other persons who worked with drug users (38.6%). Snowball sampling was used in an attempt to make the sample more representative by including persons who might not be found in traditional target areas (those more integrated into mainstream society) as well as "hidden" networks of users. For this purpose, each person interviewed who was selected by targeted sampling or named by key informants was asked to name a maximum of four heroin users who met the inclusion criteria, and who, if possible, were not present in the same target area where the interviewee was recruited. The efficiency of this technique, however, did not completely meet expectations as most users did not name anyone (only 182 persons were named) and when they did, the persons named were often present in the same place or it was difficult to interview them because they could not be located or they did not keep their appointments.

Data collection was carried out by means of a structured questionnaire, which included variables on sociodemographic characteristics, drug use, changes in main route of heroin administration, and other factors. The administration routes of cocaine HCL and heroin that were investigated are: (a) injecting, (b) smoking in cigarettes, (c) chasing, defined as a smoking technique whereby the drug is heated on aluminum foil so that it vaporises and can be breathed in with a straw or the cartridge of a ball point pen, which is generally known in Spain as "fumar chinos" (chinesing) or "fumar en plata" (smoking in silver), (d) sniffing, defined as the breathing in of the powdered drug into the nose, and (e) others. The term "inhaling" was not included because for some users it is a synonym for sniffing, while for others it means chasing.

The questions about crack included: any lifetime use, age at first use, changes in frequency of use after the last change in main route of heroin administration, use in the past 12 months and, for the same period, smoking techniques such as chasing, smoking in a pipe (basing) or other, how obtained, how prepared and ingredients used, use in the last 30 days, and frequency of weekly and daily use during that period. In the pilot study it was found that

in Spain cocaine base is generally called "base" or "basuco" and that many users do not identify it as crack; some persons were even annoyed or puzzled when an attempt was made to establish the relation. Consequently, in the questionnaire crack was called "base", "basuco", "crack" or "cocaína cocinada" (cooked cocaine). With respect to cocaine HCL (powdered cocaine in the questionnaire), variables were included on: any lifetime use, route and age of first use, changes in the frequency and route of use after the last change of main route of heroin administration, use in the past 12 months and the past 30 days and, for the same period, the most frequent route of use, use by injection, frequency of use and mean dose on days when it was used. The interviewers were 28 persons who had privileged access to the target areas and centres where they worked because of their personal and professional contacts.[34] In 95.8% of the interviews no third persons were present who could hear the replies.

DATA ANALYSIS

Most questions were precoded. The question on the way crack is prepared and the ingredients used was an open-ended question, and only the alkali used was coded while the rest of the information was analysed qualitatively. Types of consumption in which the substance is absorbed into the lung, such as smoking in cigarettes, chasing or basing, were called pulmonary administration or simply smoking. Injecting was considered the same as intravenous administration because we assume that in Spain the great majority of heroin or cocaine injectors are intravenous users and that injection other than into a vein is very rare, although this issue has not been investigated. Finally, sniffing was considered the same as intranasal administration. Most users (78.9%) expressed the dose of cocaine HCL in grams, but some stated it in units such as papers (6), packets (9), lines (35) or micros (9), which had to be translated into grams. The respective dose equivalents of these units were 0.25, 0.25, 0.08, and 0.001 g, which were established with the aid of information from the users in the study, clinicians, and anthropologists.The proportion of non-responses was zero for most questions in the three cities and less than 5% for all questions, except for the alkali used to make crack (8.1% in Seville and 8% in Barcelona), which was not precoded, and the age of first crack use (5.0% in Barcelona), the route of first cocaine HCL use (9.5% in Seville, 6.3% in Madrid and Barcelona) and the change in frequency of injecting cocaine HCL after the last change of main route of heroin administration (13.8% in Barcelona and 6.5% in Madrid), all of which are questions requiring a significant effort of memory.

The statistical significance of the differences was analysed by the χ^2 test for heterogeneity or the χ^2 test for trends in the case of qualitative variables, and by analysis of variance in the case of quantitative variables. The null hypothesis was rejected for values of $p<0.05$. The association between current crack use and other variables was analysed by a non-conditional logistic regression analysis, using the adjusted prevalence odds ratio (OR) as a measure of the strength and direction of the association. The statistical analysis was made using SPSS/PC for Windows, version 6.0.[35]

Results

SOCIODEMOGRAPHIC CHARACTERISTICS

These issues have been described in more detail previously.[30] Most users were male (81.8%), single (72.6%), between 25 and 35 years of age (68.1%) and had less than nine years of education (77.7%), lived in a family setting (83.2%), and did not have regular work (79.2%). Some 2.4% were foreigners and 6.7% were gypsies. For many users, most of their income came from small scale criminal activities such as robbery or the sale of stolen goods (15.6%) and the sale of drugs (10.5%), or marginal activities such as street vending (6.3%), prostitution (5.9%), parking cars (4.2%, all in Seville), and others (6.9%).

CHARACTERISTICS OF HEROIN USE

These issues have been described in more detail previously.[30] Ninety one per cent of the persons interviewed were currently using heroin daily or more than three times a week. With respect to the current main route of administration of heroin, smoking predominated in Seville (76.1% of users) and Madrid (70.7%) and injecting in Barcelona (77.3%). Heroin users who had ever used cocaine began taking heroin and cocaine at the same average age (19.3 years).

PREVALENCE OF CRACK AND COCAINE HCL USE

More than 95% had used cocaine, in the form of cocaine HCL or crack, at some time in their lives. Large differences were seen among cities ($p<0.001$) with respect to prevalence of current cocaine use, for use during both the past year and the past month. The highest prevalences were seen in Seville (84.3% and 69.5%, respectively) while the lowest were in Barcelona (59.3% and 34.3%); the prevalences in Madrid were 68.4% and 41.4%. If exclusive use of crack, cocaine HCL and both substances is considered separately, large differences in monthly prevalence can be seen among cities ($p<0.001$). Crack clearly predominates in Seville, while cocaine HCL predominates in Barcelona and Madrid, although not so clearly in the Madrid (fig 1). When calculating the prevalence of past month use for each form of cocaine (crack or cocaine HCL), independently of whether the other form is also used, large differences are seen among cities with respect to crack ($p<0.001$), with the highest prevalence in Seville (62.3%) and the lowest in Barcelona (7.7%), but the use of cocaine HCL is similar in the three cities (27.5% in Seville, 32.6% in Madrid, and 32.3% in Barcelona). No significant differences were seen in the prevalence of crack use between treatment-users and street-users (29.6% and 30.2%); but treatment-users were seen to have a lower prevalence of use of cocaine HCL (27.4%) than street-users (34.1%), $p=0.03$.

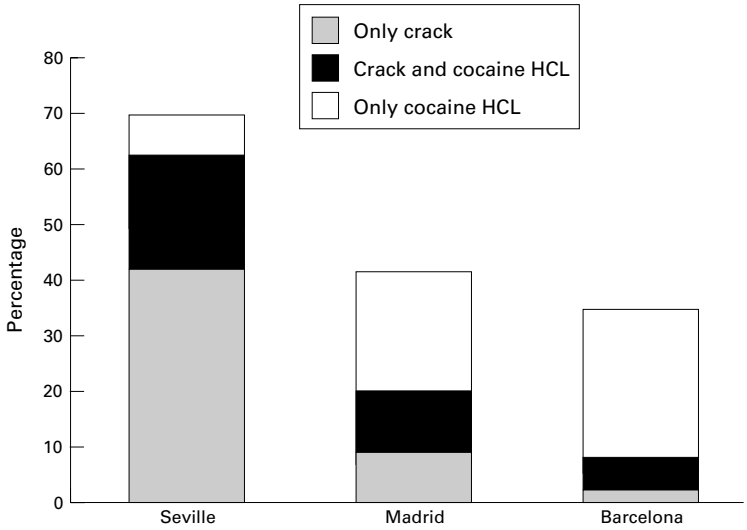

Figure 1 Prevalence of cocaine use in last 30 days among heroin users in Seville, Madrid, and Barcelona (%).

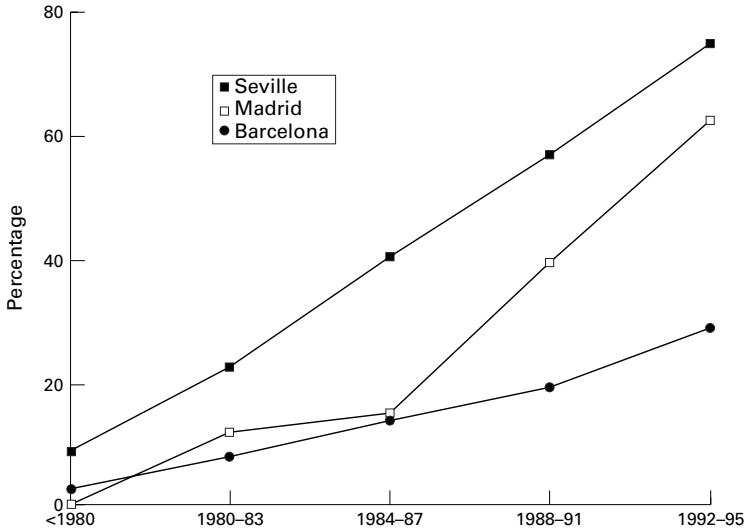

Figure 2 Proportion of heroin users who first used cocaine by smoking, by year of first cocaine use, in Seville, Madrid, and Barcelona (%). χ^2 Test for trends significant ($p<0.001$) in all three cities.

TEMPORAL TRENDS IN FIRST ROUTE OF COCAINE USE

If cocaine use is considered independently of its form (crack or cocaine HCL), it can be seen that the most frequent route of first use for the whole sample was by sniffing; but when stratifying by year of first use, it is seen that the proportion of users who began use by the pulmonary route progressively increased from the seventies to the early nineties, while the proportion of those who began by the intravenous or intranasal route was decreasing ($p<0.001$). Thus, in the seventies most users began by sniffing (71.7%) or using the intravenous route (24.8%), and very few began by using the pulmonary route (3.5%). In contrast, the situation had changed radically in the period 1992–1995 when the majority began use by smoking (53.8%) or sniffing (36.3%), while few began by using the intravenous route (9.2%). If we also stratify by cities, a clear and significant rising temporal trend in all three cities can be seen in the proportion of users who began by the pulmonary route (fig 2). In contrast, the decreasing trends among those beginning by sniffing in Madrid and those beginning by injecting in Barcelona are not statistically significant.

CHARACTERISTICS OF CRACK USE AND HOW IT IS OBTAINED

History of use

Most users began taking crack after 1987, although there are notable differences among cities: the earliest users are found in Seville. Among those who have used crack sometime in their lives and who began to use heroin by smoking, the mean age of first heroin use (20.0 years) was less than that of crack use (21.8 years), $p<0.001$. Looking only at those who have used crack in the past year, no significant differences were found among cities with respect to age of first use, but there are differences with respect to time of use: Seville users have been taking crack for more years than Madrid users, and those from Madrid have used it longer than Barcelona users (table 1).

How crack is obtained

In Seville most users buy pre-processed crack while in Madrid and Barcelona they make it themselves or with the help of friends, usually at the time of use. The crack is made using cocaine HCL, water, and an alkali (generally liquid ammonia) (table 1). The preparation process described is generally as follows: a liquid solution of cocaine and alkali is prepared in a spoon; it is heated with a lighter until the solution boils and an oily drop is formed. When the drop solidifies, the remaining liquid is strained or removed with a handkerchief or paper napkin, obtaining crack that is ready for use.

Current patterns of use

There are important differences among cities in the predominant technique for smoking crack (table 1). In Madrid and Seville chasing predominates. Several users from Seville described taking crack mixed with heroin using this technique, without being explicitly asked this question. In Barcelona basing predominates. Most users use rudimentary homemade pipes made out of a receptacle (usually a glass or bottle) filled with water or hard liquor and covered with aluminum foil in which several holes have been punched; tobacco ashes and crack are placed on top, and a larger hole is made to inhale the vapour, usually with a hard plastic tube. This technique is often known as smoking "basuco" or smoking in a "basuco". Other techniques, for example, smoking powdered crack in cigarettes ("porros de base" or base joints) are much less frequent. Large differences in frequency of use were also found among cities, with Seville having much higher frequency than Madrid or Barcelona (table 1). Of the 96 cases that used crack daily, 41.8% did so once or twice a day, 29.7% three or four times a day, and 28.6% five or more times.

Differences between treatment-users and street-users

No important differences were detected between the two groups with regard to how crack was obtained or in the history and current patterns of crack use. Looking only at those who had used crack in the past year, it can be seen that the mean age at first use of this drug was higher in the treatment-users than in the street-users (23.5 and 22.3 years, p=0.04). Treatment-users also smoked crack exclusively in the form of "chasing" more often than did street-users (63.7% and 52.3%, p=0.02).

FACTORS ASSOCIATED WITH CURRENT CRACK USE

The logistic regression analysis shows that the factor most strongly associated with current crack use was residence in Seville (OR=16.3). Other positively associated factors were: use of cocaine HCL by the pulmonary (OR=5.0), intranasal (OR=2.7) or injected route (OR=2.5), preferential use of the pulmonary route to administer heroin (OR=2.8) and frequent use (at least once a week) of cannabis (OR=1.9). A non-significant association was also detected with residence in Madrid (OR=1.9), preferential use of the intranasal route to administer heroin (OR=2.3), daily heroin use (OR=1.7), and the use of amphetamines (OR=2.1) or "designer drugs" such as methylenedioxymethamphetamine (ecstasy) or other phenylethylamines derivatives (methylenedioxyethylamphetamine methylenedioxyamphetamine, etc) (OR=1.7) (table 2).

CHARACTERISTICS OF COCAINE HCL USE

History of use

Most users began taking cocaine HCL before 1988 by the intranasal route. Among those who had used cocaine HCL in the last year there were differences among cities with respect to the age of first use, which was generally lower in Seville than in Madrid or Barcelona (table 3). Those who had used both cocaine HCL and crack began to use cocaine HCL at an earlier age than crack, with differences ranging between 3.5 years in Seville and 6.3 years in Barcelona. In general, the later the age of first use of cocaine HCL, the later the age of first crack use (p<0.001).

Current patterns of use

Large differences are seen among cities with regard to the main route of administration of cocaine HCL. The intravenous route predominates in Madrid and Barcelona, while in Seville

Table 1 Method of obtaining crack, history, and current patterns of crack use among heroin users in Seville, Madrid and Barcelona (%)

	Seville	*Madrid*	*Barcelona*	*p Value*
First year of use among lifetime crack users*				
1980–83	7.3	6.8	7.9	< 0.001
1984–87	30.9	13.6	17.2	
1988–91	39.3	51.0	41.7	
1992–95	22.5	28.6	33.1	
	(275)	(206)	(151)	
Age of first use among past year crack users				
< 15	2.9	3.2	6.7	0.95
15–19	30.6	27.2	28.9	
20–24	33.1	32.8	28.9	
25–29	21.1	21.6	20.0	
30 and more	12.4	15.2	15.6	
	(242)	(125)	(45)	
Length of use (years) among past year crack users				
< 3	16.9	27.2	42.9	< 0.001
3–5	29.0	37.6	26.2	
6–8	27.3	21.6	14.3	
9–12	21.2	7.2	11.9	
> 12	5.6	6.4	4.8	
	(231)	(125)	(42)	
Way of getting crack during past year				
Always prepared by the user	9.1	73.0	80.4	< 0.001
Usually prepared by the user	4.6	13.5	19.6	
Prepared by user or purchased with about the same frequency	16.6	3.2	0.0	
Usually purchased	26.6	2.4	0.0	
Always purchased	43.2	7.9	0.0	
	(241)	(126)	(46)	
Alkali used for preparing crack during past year				
Always aqueous ammonia	90.2	85.6	75.7	< 0.001
Sometimes aqueous ammonia and sometimes sodium bicarbonate	9.8	11.7	5.4	
Always sodium bicarbonate	0.0	2.7	18.9	
	(112)	(111)	(37)	
Techniques for smoking crack during past year				
Always chasing	59.2	73.0	13.0	< 0.001
Sometimes chasing and sometimes basing	30.8	19.8	15.2	
Always basing	10.0	7.1	71.7	
	(240)	(126)	(46)	
Most frequent technique for smoking crack during past year				
Chasing	86.7	88.1	19.6	< 0.001
Basing	13.3	11.9	80.4	
	(240)	(126)	(46)	
Frequency of use during past 30 days				
< 1 day a week	12.1	32.2	36.4	< 0.001
1–3 days a week	35.3	49.1	45.4	
4–6 days a week	8.9	3.4	9.1	
Daily	43.7	15.3	9.1	
	(190)	(59)	(22)	

* Fifteen cases who reported beginning use before 1980 were excluded from the analysis, as this was considered very unlikely. † Four persons who used base by chasing or basing stated that they sometimes also took it in cigarettes mixed with tobacco ("base joint"). In one case, crack was used only by the intravenous route. The number of subjects for which information was available for each variable is shown in parentheses.

the intranasal route is more frequent, although quite a few users in Seville used the pulmonary route (table 3). All those who smoked cocaine HCL, except for one person, used the chasing technique. The proportion of monthly users of cocaine HCL who had injected this drug sometime in the past month was 33.3% in Seville, 60.6% in Madrid and 68.0% in Barcelona ($p<0.001$). Most users took this drug less than four times a week, and the mean dose on the days they used it was less than 1 g. The mean dose differed significantly among cities: it was highest in Barcelona and lowest in Seville, but no significant differences in frequency (days a week) of use were detected.

Differences between treatment-users and street-users

Treatment-users tended to use cocaine HCL more days a week than street-users ($p=0.01$), with no significant differences with respect to other variables regarding patterns of cocaine HCL use.

CHANGE IN CRACK AND COCAINE HCL PATTERNS OF USE AFTER CHANGING THE MAIN ROUTE OF HEROIN ADMINISTRATION

Most users did not change these patterns, and those who did usually changed them in the same way as for heroin. Those who changed from injecting to smoking heroin tended to increase the level of crack use and decrease the frequency of cocaine HCL use by injection, and those who changed from smoking to injecting tended to decrease the level of crack use and increase the use of cocaine HCL by injection, especially in Barcelona (table 4).

Discussion

It is well known that heroin users in Spain frequently use cocaine,[19 36] but to date almost no studies have been made of the form of presentation of this drug (cocaine HCL or crack), or of its patterns of use. This study provides new information on these factors and suggests that in some regions, principally in the south, the use of crack has spread extensively among heroin users, to the point that, in some areas such as Seville, it has displaced cocaine HCL as the main form of cocaine use. Many users, especially in Seville, experimented with this drug before 1988, the year in which the police reported the first crack seizure.[16] The presence of a geographical gradient in the prevalence of cocaine use by smoking (high in Seville, intermediate in Madrid, and low in Barcelona), similar to that of the prevalence of heroin use by the pulmonary route, and of a temporal gradient in the spread of use (earlier in Seville, intermediate in Madrid, and later in Barcelona) leads us to think that we could be facing a progressive diffusion of crack use from the south west to the north east, similar to the spread of heroin smoking, although later in time. This phenomenon should be considered when planning preventive and health care actions targeting this population, because the spread of crack could partly offset the benefits derived from the progressive abandonment of heroin administration by injection, including

Table 2 Factors associated with current crack use among heroin users in Seville, Madrid, and Barcelona

	Past 30 days prevalence of crack use (%)	*Adjusted odds ratio†*	*95% Confidence intervals*
City			
Seville	62.3***	16.3	(8.6, 30.7)
Madrid	19.4	1.9	(1.0, 3.5)
Barcelona	7.7	1	
Age (y)			
35 and above	27.2	0.7	(0.4, 1.4)
25–34	29.7	0.9	(0.5, 1.4)
< 25	33.1	1	
Years of education			
< 8	35.8*	0.8	(0.5, 1.2)
8	25.7	0.9	(0.5, 1.4)
> 8	28.7	1	
Currently working			
Yes	27.0	0.7	(0.5, 1.1)
No	30.6	1	
Daily use of heroin during past 30 days			
Yes	32.5***	1.7	(0.9, 3.2)
No	15.0	1	
Main route of administration of heroin during past 30 days			
Smoking	44.5***	2.8	(1.7, 4.5)
Sniffing	13.3	2.3	(0.9, 5.8)
Injecting	14.5	1	
Cocaine HCL use during past 30 days			
Yes, mainly by smoking	70.0***	5.0	(2.2, 1.3)
Yes, mainly by sniffing	49.0	2.7	(1.6, 4.8)
Yes, mainly by injecting	23.5	2.5	(1.4, 4.5)
No	25.6	1	
Frequency of cannabis use during past 30 days			
Weekly	34.5*	1.9	(1.3, 2.9)
< Once a week	24.7	1.2	(0.6, 2.3)
Never	25.4	1	
Designer drug use during past 30 days			
Yes	37.0	1.7	(0.7, 3.7)
No	29.5	1	
Amphetamine use during past 30 days			
Yes	50.0**	2.1	(0.9, 5.0)
No	29.1	1	

† The odds ratio for each variable is adjusted by logistic regression for all variables included in the table. The number of persons included in the analysis was 900. Statistical significance of differences of crack use prevalence among different categories of each variable: NS: not significant; *: $p < 0.05$; **: $p < 0.01$; ***: $p < 0.001$.

Table 3 History and current patterns of use of cocaine hydrochloride among heroin users in Seville, Madrid, and Barcelona (%)

	Seville	*Madrid*	*Barcelona*	*p Value*
First year of use among lifetime users of cocaine HCL				
< 1975	3.3	1.4	1.4	0.47
1975–79	12.4	15.2	12.9	
1980–83	24.1	23.3	24.5	
1984–87	32.8	23.2	28.1	
1988–91	20.4	23.3	24.5	
1992–95	6.9	4.6	8.6	
	(274)	(283)	(278)	
First route of administration				
Injecting	17.0	27.7	21.7	0.02
Smoking	3.3	4.2	2.1	
Sniffing	79.7	68.1	76.2	
	(276)	(285)	(281)	
Age at first use among past year users of cocaine HCL				
< 15	9.8	10.8	6.7	0.04
15–19	53.1	58.7	70.1	
20–24	25.9	22.8	15.2	
25–29	7.7	4.2	6.1	
30 and more	3.5	3.6	1.8	
	(143)	(167)	(164)	
Length of use (y) among past year users of cocaine HCL				
< 3	2.8	2.4	6.1	0.22
3–5	12.6	14.4	18.9	
6–8	20.3	28.1	24.4	
9–12	26.6	20.4	20.1	
> 12	37.8	34.7	30.5	
	(143)	(167)	(164)	
Main route of administration during past 30 days				
Injecting	21.4	55.6	64.9	< 0.001
Smoking	27.4	16.2	1.0	
Sniffing	51.2	28.3	34.0	
	(84)	(99)	(97)	
Frequency of use during past 30 days				
< 1 day a week	25.0	32.3	38.1	0.14
1–3 days a week	44.0	44.5	42.6	
4–6 days a week	11.9	5.1	10.3	
Daily	19.0	18.2	8.2	
	(84)	(99)	(97)	
Average daily dose during past 30 days (each day of use)				
< 0.25 g	36.9	16.3	13.4	0.006
0.25–0.49 g	20.2	24.5	25.8	
0.5–0.99 g	23.8	33.7	30.9	
1–1.99 g	14.3	14.3	23.7	
2 g and more	4.8	11.2	6.2	
	(84)	(98)	(97)	

The number of persons with information for each variable is shown in parentheses.

those related with HIV infection, as high risk sexual behaviour seems to be more frequent among crack users.[9 37]

The assumption to date, based on data from police seizures, has been that the crack market in Spain has barely evolved.[16] Our results confirm that, indeed, in the areas of low prevalence of use such as Madrid or Barcelona, there is little buying and selling of this substance, and most users make it themselves. In contrast, in the areas of high prevalence, such as Seville and probably other cities of Andalucía, most users buy pre-processed crack. The market for this substance is probably based on home or "cottage industry" production, as the amounts seized in recent years have been very small. A crack market has also been detected in other European areas, such as the United Kingdom,[3] Paris,[38] and Rotterdam.[28]

Perhaps one of the newest contributions of this work, in relation to others carried out previously in Europe, is the finding of large geographical differences among heroin users within the same country in the prevalence of crack and cocaine HCL use by smoking. Our study also suggests that the most important factors explaining the use of crack at the individual level are probably not personal characteristics of users themselves, but rather supra-individual factors that are ecological or cultural in nature and linked to the place of residence, such as the predominant routes of heroin use in the area, characteristics of the local drug market, and the influence of social networks in which the user is immersed. Two arguments support this assertion: (1) The factor most strongly associated with crack use is the city of residence, and this association persists after adjusting for other individual variables, including routes of use of heroin and cocaine HCL, and (2) most users do not change their patterns of cocaine use after changing the main route of heroin administration. The importance of ecological and cultural

Table 4 Changes in use of crack and cocaine hydrochloride after last change of main route of heroin administration among heroin users in Seville, Madrid, and Barcelona (%)

	Change from injecting to smoking (n)	*Change from smoking to injecting (n)*
Number	145	92
Changes in level of crack use		
No change	79.3	77.8
Increase	13.1	7.8
Decrease	7.6	14.4
Changes in level of cocaine HCL use		
No change	68.3	69.7
Increase	10.3	11.2
Decrease	21.4	19.1
Changes in frequency of injecting cocaine HCL		
No change	54.0	71.8
Increase	5.0	22.4
Decrease	41.0	5.9

factors in starting or maintaining some usage behaviours has been shown by analysing the distribution of crack use among different ethnic or racial groups,[39] factors associated with use of the intravenous route for heroin administration[23 25 40] and risk behaviours for HIV infection.[41]

A clear association seems to exist between the predominant forms of using heroin and cocaine within an area. For example, users in Seville, who take heroin mainly by chasing, use more crack than cocaine HCL and generally use crack by chasing and cocaine HCL by sniffing — although 27.4% use it by chasing. Users in Barcelona, on the other hand, who mainly inject heroin, use much more cocaine HCL than crack, they use crack mainly by basing and cocaine HCL by injecting, with no users taking it by chasing—and Madrid users, who mainly take heroin by smoking, but where the transition from injecting to chasing occurred later than in Seville, are in an intermediate situation. Furthermore, at the individual level, crack consumption is associated with the use of heroin and cocaine HCL by the pulmonary route. It is difficult to know if the way heroin is used shapes the way cocaine is used, or if it is the other way around, or if both phenomena are independently determined by other factors. However, there is evidence to suggest that the diffusion of heroin use by smoking occurred before the diffusion of crack use. In this study, for example, it was seen that the age of first heroin use by smoking averages 1.8 years less than the age of first crack use. In addition, most heroin users in Madrid in 1995 took this drug mainly by smoking, however the use of crack was not yet widespread.

The predominant technique for smoking crack where use is most widespread (Seville and Madrid) is chasing. Chasing is well adapted to use when mixed with heroin,[1 28] which must explain its popularity among Spanish heroin users. The fact that various users in Seville spontaneously mentioned the use of crack mixed with heroin, as well as evidence from other studies,[19] suggests that this behaviour may be comparatively widespread in some areas in the south of the country.

Although to date crack users in Spain have rarely been found outside of heroin user circles,[21 22] in the near future experimental use of this drug could spread outside these circles. The groups most affected could be young socially disadvantaged people, circles of prostitution and drug trafficking, and possibly regular users of cocaine HCL, cannabis, amphetamines or "designer drugs" outside of the heroin world. In this regard, it should be pointed out that crack use in this study was associated with use of these drugs, although some of these associations were non-significant. Among the conditions that could facilitate the diffusion of crack use are: (a) the already initiated development of the market for this substance, especially if cheap crack comes on the market; (b) the spread of HIV infection among drug injectors, which would induce users to switch from the intravenous route to other routes of drug use; (c) greater social acceptance of smoking than of sniffing or injecting; and (d) the fact that cannabis—paradigm of the smokable drug—is generally considered less dangerous than other drugs, which could lead some persons to believe that little harm results from smoking any drug. Some of these factors are certainly similar to those that have facilitated the change to the pulmonary route of administration in the case of heroin. It could be argued that in, the case of crack, the bad image derived from the wide dissemination of the negative consequences of the crack epidemic in the United States could act as a dissuading mechanism to brake its spread. But unfortunately many users in Spain do not know they are consuming crack, because it is used and sold under the name of "base" or "basuco". The name "basuco" probably comes from the use of "vasos" (glasses) in its processing, together with the incorrect use of the South American term "basuco", which is used there to refer to coca paste or cocaine sulphate.[42]

It is necessary to design studies and strategies of action to monitor the spread of crack use and curb its consequences, because the US experience shows that it can become an important public health problem.[2] Linguistic issues (mainly, the different terms used for crack and cocaine base) need to be considered to adequately monitor this phenomenon.

Certain study limitations must be kept in mind when interpreting these results. As in many epidemiological studies of illegal drugs, there may be problems with how representative the sample is, deriving mainly from two factors: the non-probabilistic nature of the subsample of street-users and ignorance of the proportion of treatment-users in the whole population of heroin users. To minimise the problems derived from the first factor, we worked with a rather large sample, seeking to include as diverse a selection of users as possible. The second factor is unlikely to introduce important biases because the differences between treatment-users and street-users were small. In addition, the fact that half of the users in the sample were street-users could reduce the biases derived from the tendency of samples based on treatment services to over-represent users who have been taking drugs for a longer time and who have greater health problems. In

KEY POINTS

- Crack use has spread among heroin users in Seville, displacing cocaine hydrochloride as the main form of cocaine use.
- In Barcelona and Madrid cocaine smoking is probably rising among heroin users, while injecting remains as the main route of cocaine use.
- A crack market has developed in Seville, whereas in Madrid and Barcelona most users make the crack themselves.
- In Spain cocaine smoking could be diffusing from the south west to the north east, similar to what happened with heroin smoking.

any case, it is highly probable that users who began drug use more recently and those who are more integrated into mainstream society are still under-represented in the whole sample. The fact that all the data are self reported may give rise to some problems of data validity. Furthermore, the data on events that occurred a long time ago (for example, first use of a drug) may by affected by biases of memory aand survival.

We appreciate the work and dedication of all the interviewers and the field work coordinators in Seville (Francisco Campuzano) and Madrid (Margarita Pérez). We also thank Ángeles Rodríguez for her suggestions regarding the study design; the people in charge of the Drug Transitions Study, Maudsley Hospital, London, for sending the documentation used in preparing the questionnaire; Valentín Márquez (Seville) and Juan Gamella (Madrid), for their collaboration in defining the targets and selecting the interviewers; the treatment centre coordinators, for facilitating access to their centres; Carmen Rodríguez, for her help in data processing; and Kathryn M Fitch, for translation and suggestions.

Appendix

The Spanish Group for the Study on the Route of Administration of Drugs is composed of: Julián Vicente (European Monitoring Centre for Drugs and Drug Addiction, Lisboa), María J Bravo and Casto López (DGPNSD, Madrid), Emiliano Martín (Plan Municipal sobre Drogas, Madrid), Juana Matía (Plan Regional sobre Drogas, Madrid), Mila Barruti (Grup Igia, Barcelona), Luis Torralba (Pla Municipal d'Acció sobre Drogodependències, Barcelona), Josep M Suelves (Òrgan Tècnic de Drogodepèndencies, Barcelona), Fernando Arenas (Comisionado para la Droga, Seville), and José Santacreu (Universidad Autónoma de Madrid).

Funding: this research was supported by a grant from the Fondo de Investigación Sanitaria (FIS), Nº 94/1527.
Conflicts of interest: the views expressed in this work are solely the responsibility of the authors and are not necessarily shared by the institutions in which they work.

1 Grund JP, Blanken P. *From chasing the dragon to chinezen. The diffusion of heroin smoking in the Netherlands*, Rotterdam: IVO, Erasmus Universiteit, 1993:4–13.
2 National Institute on Drug Abuse -NIDA-. *Epidemiologic trends in drug abuse. Community Epidemiology Work Group. December 1995. Volume I: Highlights and executive summary.* Rockville, Maryland: NIDA, 1996:3–27. NIH Publication Nº96–4128.
3 Hunter GM, Donoghoe MC, Stimson GV. Crack use and injection on the increase among injecting drug users in London. *Addiction* 1995;**90**:1397–400.
4 Siegel RK. New patterns of cocaine use: changing doses and routes. In: Kozel NJ, Adams EH, eds. *Cocaine use in America: epidemiological and clinical perspectives*. Rockville, Maryland: NIDA, 1985:204–220. NIDA Research Monograph Series 61.
5 Gawin FH, Ellinwood EH. Cocaine and other stimulants. *N Engl J Med* 1988;**318**:1173–82.
6 Fischman MW. The behavioral pharmacology of cocaine in humans. In: Grabowski J, ed. *Cocaine: Pharmacology, effects and treatment of abuse*. Rockville, Maryland: NIDA, 1984:72–91. NIDA Research Monograph Series 50, DHHS Publication number (ADM)84–1326.
7 Adams EH, Durell J. Cocaine: a growing public health problem. In: Grabowski J, ed. *Cocaine: Pharmacology, effects and treatment of abuse*. Rockville, Maryland: NIDA, 1984: 9–33. NIDA Research Monograph Series 50, DHHS Publication number (ADM)84–1326.
8 Siegel RK. Changing patterns of cocaine use: longitudinal observations, consequences and treatment. In: Grabowski J, ed. *Cocaine: pharmacology, effects and treatment of abuse*. Rockville, Maryland: NIDA, 1984: 92–110. NIDA Research Monograph Series 50, DHHS Publication number (ADM)84–1326.
9 Washton AM. *Cocaine addiction. Treatment, recovery and relapse prevention*. London: W Norton, 1989.
10 Gossop M, Griffiths P, Powis B, Strang J. Severity of dependence and route of administration of heroin, cocaine and amphetamines. *Br J Addict* 1992;**87**:1527–36.
11 Gossop M, Griffiths P, Powis B, Strang J. Cocaine: patterns of use, route of administration and severity of dependence. *Br J Psychiatry* 1994;**64**:660–4.
12 Jones RT. The pharmacology of cocaine. In: Grabowski J, ed. *Cocaine: Pharmacology, effects and treatment of abuse*. Rockville, Maryland: NIDA, 1984:34–53. NIDA Research Monograph Series 50, DHHS Publication number (ADM)84–1326.
13 National Institute on Drug Abuse -NIDA-. *Epidemiologic trends in drug abuse. Community Epidemiology Work Group. June 1995. Advanced report.* Rockville, Maryland: NIDA, 1995.
14 Johnston LD, O'Malley PM, Bachman JG. *National survey results on drug use from the Monitoring the Future study, 1975–1994. Volume I. Secondary school students*. Rockville, Maryland: NIDA, 1995. NIH Publication number 95–4026.
15 National Institute on Drug Abuse -NIDA-. *National Household Survey on Drug Abuse. Population estimates 1991. Revised, November 20, 1992*. Rockville, Maryland: NIDA, *1992.* DHHS Publication number (ADM) 92–1887.
16 Delegación del Gobierno para el Plan Nacional sobre Drogas -DGPNSD-. *Plan Nacional sobre Drogas. Memoria 1995.* Madrid: Ministerio de Justicia e Interior, 1996.
17 Barrio G, Vicente J, Bravo MJ, De la Fuente L. The epidemiology of cocaine use in *Spain. Drug Alcohol Depend* 1993; **35**:45–57.
18 Barrio G, De la Fuente L, Bravo MJ, Colomo C. Está extendiéndose en España el hábito de fumar crack entre los consumidores de heroína? *Med Clin (Barc)* 1997;**108**:517–18.
19 Lacoste JA, Valverde E, González JM, *et al.* Cambio en los hábitos de administración de la heroína y la cocaína. Estudio comparativo entre 1990 y 1991. *Adicciones* 1993;**5**:339–47.
20 Bravo MJ, Barrio G, De la Fuente L, Colomo C, Royuela L, Estébanez P. Conductas de riesgo para la transmisión del VIH entre los usuarios recientes de un programa de intercambio de jeringas en Madrid. *Gac Sanit* 1996;**10**:261–73.
21 Barrio G, De la Fuente L, Royuela L, Vicente J, Santacreu J. Patrones de uso de drogas en dos grupos comunitarios de consumidores de cocaína: uno que consume también heroína y otro que no la consume. In: XII Reunión Científica de la Sociedad Española de Epidemiología (Comunicaciones). *Gac Sanit* 1994;**8**:42–3.
22 Díaz A, Barruti M, Doncel C. *The lines of success? A study on the nature and extent of cocaine use in Barcelona*. Barcelona: Ajuntament de Barcelona, 1992.
23 De la Fuente L, Barrio G, Vicente J, Bravo MJ, Lardelli P. Intravenous administration among heroin users having treatment in Spain. *Int J Epidemiol* 1994;**23**:805–11.
24 Delegación del Gobierno para el Plan Nacional sobre Drogas -DGPNSD-. *Sistema Estatal de Información sobre Toxicomanías (SEIT). Informe 1995* . Madrid: Ministerio de Justicia e Interior, 1996.
25 De la Fuente L, Lardelli P, Barrio G, Vicente J, Luna JD. Declining prevalence of injection as main route of administration among heroin users treated in Spain, 1991–1993. *Eur J Public Health* 1997;**7**:421-6.
26 Bieleman B, Díaz A, Merlo G, Kaplan CD. *Lines across Europe. Nature and extent of cocaine use in Barcelona, Rotterdam and Turin.*Amsterdam: Amsterdam, Swets and Zeitlinger BV, 1993.
27 Hartgers Ch, Van den Hoek A, Krijnen P, Van Brussel GHA, Coutinho RA. Changes over time in heroin and cocaine use among injecting drug users in Amsterdam, The Netherlands, 1985–1989. *Br J Addict* 1991;**86**:1091–7.
28 Grund JP, Adriaans NFP, Kaplan CD. Changing cocaine smoking rituals in the Dutch heroin addict population. *Br J Addict* 1991;**86**:439–48.
29 Strang J, Johns A, Caan W. Cocaine in the U.K.-1991. *Br J Psychiatry* 1993;**162**:1–13.
30 De la Fuente L, Barrio G, Royuela L, Bravo MJ and the Spanish Group for the Study of the Route of Heroin Administration. The transition from injecting to smoking heroin in three Spanish cities. *Addiction* 1997;**92**:1733-47.
31 Watters JK, Biernacki P. Targeted sampling: options for the study of hidden populations. *Soc Probl* 1989;**36**:416–30.
32 Biernacki P, Waldorf D. Snowball sampling: problems and techniques in chain referral sampling. *Sociol Methods Res* 1981;**10**:141–63.
33 Hartnoll R, Balsa C, Griffiths P, *et al*. *Handbook on snowball sampling (2nd Draft, April 1995)*. Strasbourg: Pompidou Group, Council of Europe, 1995. P-PG/Epid (95)3.
34 Griffiths P, Gossop M, Powis B, Strang J. Reaching hidden populations of drug users by privileged access interviewers: methodological and practical issues. *Addiction* 1993;**88**: 1617–26.
35 Norusis MJ, SPSS Inc. *SPSS for Windows: Advanced Statistics, Release 6.0*. Chicago: SPSS Inc, 1993.
36 Torrens M, San L, Peri JM, Ollé JM. Cocaine abuse among heroin addicts in Spain. *Drug Alcohol Depend* 1991;**27**:29–34.
37 McBride DC, Inciardi JA, Chitwood DD, McCoy CB. Crack use and correlates of use in a national population of street heroin users. The National AIDS Research Consortium. *J Psychoactive Drugs* 1992;**24**:411–16.
38 Institut de Recherche en Epidémiologie de la Pharmacodependance -IREP-. *Approche ethnographique de la consommation de cocaine à Paris*. Paris: IREP, 1992.
39 Lillie-Blanton M, Anthony JC, Schuster ChR. Probing the meaning of racial/ethnic group comparisons in crack cocaine smoking. *JAMA* 1993;**268**:993–7.
40 De la Fuente L, Saavedra P, Barrio G, Royuela L, Vicente J, Spanish Group for the Study of the Purity of the Seized Drugs. Temporal and geographic variations in the characteristics of heroin seized in Spain and their relation with the route of administration. *Drug Alcohol Depend* 1996;**40**:185–94.
41 Des Jarlais DC, Friedman SR, Friedmann P et al. HIV\AIDS-related behavior change among injecting drug users in different national settings. *AIDS* 1995;**9**:611–17.
42 Velásquez de Pabón E. La basuca. Qué se sabe hasta el momento *Revista del Hospital Mental de Antioquia* 1983;**10**: 13–25.