Original article

Estimating trends in the prevalence of problematic cocaine use (1999-2008)

Albert Espelt[a,b,c], Antònia Domingo-Salvany[b,d,*], Albert Sánchez-Niubó[d], Marc Marí-Dell'Olmo[a,b], M. Teresa Brugal[a,b]

[a] *Agència de Salut Pública de Barcelona, Barcelona, Spain*
[b] *CIBER de Epidemiología y Salud Pública (CIBERESP), Spain*
[c] *Departament de Psicobiologia i Metodologia de les Ciències de la Salut, Universitat Autònoma de Barcelona, Bellaterra (Barcelona), Spain*
[d] *Drug Abuse Epidemiology Research Group, Institut Municipal d'Investigació Mèdica (IMIM-Hospital del Mar), Barcelona, Spain*

ARTICLE INFO

ABSTRACT

Objective: To examine trends in the prevalence of problematic cocaine use in a large city and describe the problems encountered when estimating these trends using capture-recapture techniques based on secondary data

Methods: We used clinical data on accident and emergency department episodes at four university hospitals in Barcelona (Spain) between 1999 and 2008 (3 capture periods per year). Users were categorized into two subgroups depending on concomitant heroin use (cocaine plus heroin, cocaine without heroin).

Results: The mean age of users was 34 years and 25% were women (2008). The mean number of episodes per user differed between drug subgroups and over time. The estimated total number of cocaine users increased from 6,028 (95% confidence interval [95%CI]: 4,086-9,327) in 1999 to 22,640 (95%CI: 14,001-37,500) in 2006, but decreased thereafter. The prevalence of problematic use of cocaine plus heroin was stable throughout the study. Thus, trends in the prevalence of problematic cocaine use differed depending on concomitant heroin use.

Conclusion: Our results are consistent with those provided by health surveys and treatment registries. They also highlight the pitfalls of applying the capture-recapture approach to secondary data, and the need for a better understanding of how information is collected and changes over time.

Estimación de la tendencia de la prevalencia del consumo problemático de cocaína (1999-2008)

RESUMEN

Objetivo: Explorar la tendencia de la prevalencia del consumo problemático de cocaína en una gran ciudad y describir los problemas encontrados cuando se estiman estas tendencias mediante técnicas de captura-recaptura utilizando datos secundarios.

Métodos: Se utilizaron los datos de los servicios de urgencias de cuatro hospitales universitarios de Barcelona entre 1999 y 2008 (tres capturas por año). Las personas se clasificaron en dos subgrupos según el uso concomitante de heroína (cocaína junto con heroína, cocaína sin heroína).

Resultados: La edad media fue de 34 años (2008) y el 25% eran mujeres. El número medio de episodios por paciente fue distinto según el subgrupo y el año. La estimación del número total de consumidores/as problemáticos/as de cocaína aumentó de 6028 (intervalo de confianza del 95% [IC95%]: 4086-9327) en 1999 a 22.640 (IC95%: 14.001-37.500) en 2006, y disminuyò a partir de entonces. La prevalencia del consumo problemático de cocaína más heroína se mantuvo estable durante el período. Por lo tanto, las tendencias de prevalencia diferían dependiendo del consumo de heroína concomitante.

Conclusión: Los resultados concuerdan con los de las encuestas de salud y con los registros de tratamiento. Los resultados también ponen de relieve ciertos peligros en la aplicación de la captura-recaptura para datos secundarios, y la necesidad de un conocimiento profundo de cómo se recopila la información y los posibles cambios en el tiempo.

Introduction

The capture-recapture approach is an indirect method of generating prevalence estimates based on the degree of overlap (the appearance of a case/individual in more than one sample)[1] between

* Corresponding author.
E-mail address: adomingo@imim.es (A. Domingo-Salvany).

two or more distinct samples of the study population, and has been used to estimate prevalence in many epidemiological scenarios,[2] including hard to reach populations[3,4] such as illegal drug users.[5] Surveys designed to estimate the prevalence of illegal drug use have the important limitation that illegal drug users are hard to detect because they are a small fraction of the population and often conceal themselves due to the illegal and highly stigmatized nature of drug-taking.[6] Thus, the capture-recapture technique has been used in distinct geographical areas, including cities of different sizes, to estimate the prevalence of illegal drug use, mainly of opiates and cocaine.[5,7–10] While capture-recapture has proven to be adequate for estimating prevalence in incomplete epidemiological data,[2,11] it involves certain assumptions: *1)* the target population must be closed; *2)* false-positive subjects should not be present on any list; *3)* capture sources should be independent; and *4)* each case in the population should be equally likely to be captured in each source.[11] In addition to these assumptions,[11] this approach has other limitations: the specific application of the method, especially when using secondary data that is susceptible to changes in the data collection protocol, as well as on professional criteria in identifying relevant characteristics.[12]

Cocaine is one of the most widely used illegal drugs in Europe, and Spain has one of the highest prevalence rates.[13] To assess the consequent burden on health care services and the need for preventive interventions, it is important for public health officials to have a clear picture of the magnitude of problematic cocaine use and trends in consumption.

The aim of this study was to examine trends in the prevalence of problematic cocaine use in Barcelona (Spain) through the capture-recapture approach based on a secondary data source, namely visits to the city's four main emergency rooms (ER). We also describe problems encountered in applying this approach.

Methods

The Barcelona Drug Information System (SIDB) created in 1987 collects information about ER at the city's four university hospitals that involved patients aged 15-54 years, and where the corresponding clinical record mentioned the use of illegal drugs. A previous study found that these emergency rooms covered about 95% of drug-related emergencies in Barcelona[14]. We selected visits between 1999 and 2008 involving Barcelona city residents who visited the ER at least once in the year in question, with a medical record mentioning cocaine. ER records do not always report consumed substances[7], so we considered that all substances mentioned in the ER record(s) for each patient in a given year had been used by him/her throughout the year. Episodes for each individual were grouped using a confidential identification algorithm.

We collected data on age, gender, and drugs used. Data on drugs used were collected from clinical notes written by the physician. Individuals were categorized into two consumer profiles according to their concomitant use of opioids (mainly heroin) in any episode in a given year: either "*cocaine plus heroin"*, or "*cocaine without heroin*". A single source capture-recapture technique was applied for each individual year [2,15] to estimate the prevalence of problematic cocaine use for the entire sample and separately for each consumer profile, *cocaine with heroin* and *cocaine without heroin*.

We assumed that the prevalence did not vary within a given calendar year. To assess possible sample dependences, the ER register for a full year was divided into three 4-month periods, and each period was considered to be a distinct sample.[5,7,16] To estimate the unknown population, we fitted log-linear regression models for each year and each consumer profile. To adjust for possible dependencies between samples, we fitted models with all possible combinations of interactions (one, two or three interactions of

two 4-month periods), and evaluated the best fit using the Bayesian Information Criterion (BIC).[1,17] Models with a deviance of less than ± 2 degrees of freedom were considered well-fitted. When we found more than one model with a good fit, we computed the estimate for the unknown population by averaging BIC-weighted estimates from the adjusted models (the BIC-weighted estimates were calculated using $\hat{N}_{wIC} = \sum(\hat{N}_i \cdot e^{-(IC_i/2)}) / \sum e^{-(IC_i/2)}$, where IC_i is the BIC information considered and $\hat{N}_i$ is the population estimate associated with each model i)[18]. When dependence between the three capture periods was not rejected, we fitted the saturated model to estimate the unknown population.[11] Finally, 95% confidence intervals (95%CI) were calculated according to Cormack.[15,19]

All analyses were performed using STATA version 11 and R 2.8.

Results

Over the period of this study, we observed an increase in the number of patients who received emergency treatment with a mention of cocaine in their medical record: from 1,282 in 1999 to 2,161 in 2008 (Table 1). This increase was statistically significant (p-value for trend <0.05) in patients who consumed *cocaine without heroin*, but not those who consumed *cocaine with heroin*. The number of emergency episodes also increased during this period, from 2,235 in 1999 to 4,358 in 2008. The number of overlaps (when an individual appears in more than one trimester) remained constant between 1999 and 2006, but increased in 2007 and 2008. The mean proportion of patients in the *cocaine with heroin* and *cocaine without heroin* groups who received emergency treatment once in a year was 67.3% and 92.0% between 1999 and 2006, respectively, and 45.8% and 79.0% in 2007-2008. The percentage of female patients remained constant at around 25%, while the average age of patients increased over time in both groups (*cocaine with heroin* and *cocaine without heroin*) (Table 1).

The estimated annual prevalence of problematic cocaine use is shown in Table 2. The estimated number of users in Barcelona increased from 6,028 (95%CI: 4,086-9,327) in 1999 to 22,640 (95%CI: 14,009-37,500) in 2006, and decreased to 6,645 by 2008 (95%CI: 5,329-8,457), comparable to the initial rate in 1999. The use of *cocaine without heroin* was the most common consumer profile, and its prevalence increased rapidly and then decreased during the study period (1.21% in 1999, 2.93% in 2005, and 0.64% in 2008). In contrast, the prevalence of cocaine use with heroin was lower and remained stable during the study period (0.10% in 1999, 0.15% in 2005 and 0.09% in 2008).

Discussion

The prevalence of problematic cocaine use in the city of Barcelona increased between 1999 and 2006, and decreased rapidly in the following two years; in contrast, the number of emergency room visits involving cocaine use increased continuously during this period. This prevalence trend differed between the two consumer profiles analyzed, remaining stable in the *cocaine plus heroin* group, and following the overall trends described above in the *cocaine without heroin*.

A strength of the study is the fact that the prevalence of problematic cocaine use was estimated in a large sample from a well-defined geographical area over a period of several years, and using the same capture-recapture approach with the same source of information. Overall trends (including confidence intervals) for the period 1999-2006 are consistent with those reported by other studies using indirect indicators (treatment demand data and mortality) in Barcelona,[20,21] and with others in Spain and other European countries.[13,22] However, the decrease observed after 2006 was unexpected, especially given the increase in the