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ANALYSIS OF THE CHEMICAL COMPOSITION OF SMOKABLE COCAINE SUBTANCES

SUBREGIONAL COMPENDIUM

MAY 2016

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ISBN: 978-0-8270-6586-4

Authors

ARGENTINA: Eng. Cristina Raverta. Director of the Legal Chemical Directorate. Superintendency of Scientific Police. Ministry of Security of the Province of Buenos Aires.

BRAZIL: Dr. Alice A. M. Chasin. Regional Representative of the TIAFT, Department of Clinical and Toxicological Analysis, School of Pharmaceutical Sciences of the University of Sao Paulo. Oswaldo Cruz School of Pharmaceutical Sciences.

CHILE: Dr. Boris Duffau. Chief Chemical Expert of the Drug Analysis Section of the Institute of Public Health of Chile.

PARAGUAY: Dr. Fanny Barboza. Chief of the Specialized Forensic Directorate (DFE) of SENAD.

URUGUAY: Dr. Cecilia Scorza. Director of the Department of Experimental Neuropharmacology of the Clemente Estable Biological Research Institute (IIBCE).

Project Managers

ARGENTINA: Gabriela Sosa. Project focal point. Directorate of Technical Evaluation and Control of Chemical Precursors. SEDRONAR.

BRAZIL: Dr. Cejana Passos. Project focal point. Chief of Drug Observatory of Brazil. SENAD.

CHILE: Lic. Alvaro Castillo. Project focal point. Chief of Evaluation and Research Area of SENDA.

PARAGUAY: Dr. César Arce. Project focal point. SENAD.

URUGUAY: Héctor Suárez. Project focal point. Chief of the Uruguayan Drug Observatory of the JND.

OID-CICAD-SMS-OAS
Dr. Francisco Cumsille. Chief of OID. Project Director.
Graciela Ahumada. OID Consultant for Coordination of Smokable Cocaines Project
Marya Hynes. OID Researcher
María Demarco. Project management and administrative monitoring. OID-CICAD
Ana Lemos. Project management and administrative monitoring. OID-CICAD

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EXECUTIVE SUMMARY

This ***Compendium of the Chemical Composition of Smokable Cocaines*** is part of the Project on Smokable Cocaines in Argentina, Brazil, Chile, Paraguay, and Uruguay, coordinated by the Inter-American Observatory on Drugs of the Inter-American Drug Abuse Control Commission of the Secretariat for Multidimensional Security of the Organization of American States (OID-CICAD-SMS-OAS) with financing from INL-USA. It is the result of the work carried out by the National Drug Commissions and the technical teams responsible for different areas and organizations specializing in the chemical composition analysis of seized drugs in the participating States.

The **general objective** of the compendium as a project is to design a systematic process that organizes and carries out, in terms of knowledge, the analysis of data produced in order to generate relevant information intended for programs related to prevention and treatment and the control of drug traffic and chemical precursors.

The activities are developed based on the following **specific objectives**:

- To know the chemical composition of the smokable cocaines used by populations in the Southern Cone countries, establishing similarities and differences among the countries.
- To know and describe for each country the legal and institutional aspects determining the method and magnitude of the chemical composition of smokable cocaines.
- To know and describe for each country the methodological procedures and equipment used for composition analysis, what information is produced and how is it systematized.
- To know and describe for each country the information developed based on chemical analyses: scopes, limitations, and potentialities.

Sample and methodology

The information provided by the countries is not homogenous in terms of the quantity and representativeness of the samples analyzed, but it is homogenous in terms of the unit of analysis, in that the smokable cocaine samples analyzed were defined on the

basis of different procedures and sources (visual and/or handling of reagent kits or field tests).

The chemical composition results from the following samples are presented:

Argentina: analysis of samples from 28 judicial expert reports corresponding to La Matanza, Lomas de Zamora, and La Plata containing a total of 4,590 units that were sampled for chemical analysis and formed into 90 lots on which the analysis was performed. The samples were seized between October 2014 and February 2015.

Brazil provides information on 642 samples of street cocaine seized between 2011 and 2014 in five Brazilian states, in conjunction with the states' Criminalistics Institutes, within the framework of the Project on the Chemical Profile of Cocaine (PeQui Project) of the Brazilian Federal Police. In addition, it analyzes a total of 50 hair samples selected from crack users between the ages of 25 and 54 being treated in clinics in the country.

Chile analyzed samples of smokable cocaine seized throughout the country over the period 2009-2014, for a total of some 25,175 samples. The analysis was done by region in all years.

Paraguay analyzed all the samples from seizures throughout the country that were positive for cocaine over the period 2009-2014. A total of 3,175 samples were analyzed, 56% of which (1,766 samples) are base (smokable) cocaine and 44% of which (1,409 samples) are cocaine hydrochloride.

Uruguay analyzed a total of 306 samples of smokable cocaine from seizures during 2014 and 2015 (62 and 244 samples, respectively). They do not represent all samples seized but rather a random selection.

Principal results:

- Each country presents a particular method in terms of procedure, level of centralization, systematic approach, and the utilization of chemical composition analyses of smokable cocaines.
- Of the total samples of smokable cocaine analyzed for this compendium, the percentage of adulterated samples is higher in Argentina, Brazil, and Uruguay

(82.3%, 57.2%, and 89.5%) than in Chile and Paraguay (28.2% and 30.4%), countries with national level samples.

- ❖ For every 100 samples of smokable cocaine on the street, in Argentina, 35 have caffeine, 32 have lidocaine, and 29 have phenacetin. In Chile, about 3 samples have phenacetin and 2 have caffeine. In Brazil, 54 have phenacetin, 11 have aminopyrine, and 4 have caffeine. In Paraguay, 13 samples have phenacetin, 8 have paracetamol, and 7 have lidocaine. In Uruguay, 76 have phenacetin, 64 have caffeine, and 27 have aminopyrine.
- ❖ Of the total number of adulterated samples of smokable cocaines, phenacetin is present in all of them, while its relative weight is different depending on the country: in Argentina it is in third place (36.9%); in Brazil, Paraguay, and Uruguay it is in first place, with 94.5%, 43.7%, and 84.3% respectively of samples adulterated with this substance; and in Chile it is in third place with a low percentage of 1.9%. In addition, paracetamol, caffeine, lidocaine, and aminopyrine are adulterating substances present and falling at least among the three most important adulterants in the countries analyzed.

- ❖ Some of the evidence collected in the course of this project is presented below:

- The team in **Argentina** maintains that according to the chemical profile obtained from the samples and assays performed, cocaine intended to be used in smokable form falls under the category of smokable freebase cocaine**.** According to the established concentrations of cinnamoylcocaine these are highly purified cocaines and the temperatures reached with metal foam pipes exceed the boiling point.
- The researchers in **Brazil** conclude that, in terms of the material analyzed, the purity level of smokable street cocaine is higher than that of hydrochloride salt street cocaine. It is estimated that in most cases freebase or free paste cocaine, in smokable form, is sold without adulterants, and when it is adulterated, phenacetin is the most frequent adulterant and present in 53% of cases. As for another set of conclusions, the investigations that led to this project indicate that the chemical composition analyses are insufficient, most of the samples are classified as cocaine so that it is impossible to make a distinction between

smokable cocaine and cocaine hydrochloride, and when the analysis is performed the adulterants controlled by current regulations are reported, apart from additional substances such as aminopyrine, benzocaine, caffeine, phenacetin, lidocaine, levamisole, and procaine.

- The presence of adulterants in hair samples reflects the problem of users' exposure to those contaminated samples that are found and seized by the police. Given the toxicity of those substances, the public health problem related to this is clear, i.e., those substances are being absorbed by the organism and are having a toxic effect on it. It is interesting to note that all the samples analyzed showed the presence of adulterants, the most common being phenacetin, levamisole, aminopyrine, and lidocaine based on frequency.
- The professionals at the Institute of Public Health of **Chile,** based on their experience, conclude that most of the cocaine samples seized and sold in Chile correspond to smokable cocaine and contain adulterants that are added in order to emulate the effects of cocaine. To be noted is the ever-increasing presence of caffeine as the main adulterant at the expense of others such as phenacetin or aminopyrine, substances that are added by those who sell cocaine and that may be even more harmful that cocaine itself.
- The team in **Paraguay** maintains that at the national level the level of (smokable) cocaine base has fluctuated over the course of six years, with notable peaks in 2012 and 2014. The analysis performed on the samples confirm that in the case of cocaine base the average purity level varies between 45% and 70%, while for cocaine HCL the average is between 50% and 80%.
- The conclusions of the researchers in **Uruguay** regarding the samples analyzed reflect what users consumed over the period 2014-2015 and contain a mix of cocaine, phenacetin, and caffeine, in similar proportions. This fact reveals the relevance of the adulterants in the pharmacological and/or toxicological effect of smokable cocaine.

❖ The evidence regarding which chemical components are contained in the substances consumed by drug users in the countries and their regions provides input for other fields of knowledge and interventions:

- ✓ To focus treatment in acute emergency and chronic situations by having information on drug interactions.
- ✓ To identify substances with specific patterns of use and abuse, specifying how taken, required doses, effects.
- ✓ To provide information for the control of chemical precursors and adulterants.
- ✓ To adapt laws and regulations on the sale of substances.
- ✓ To provide information for policies on control of supply and trafficking, facilitating knowledge on the smokable cocaine preparation stage, origin, changes according to trends and zones.
- ✓ To provide information for adjusting indicators of use in epidemiological studies.
- ✓ To provide information for identifying causes of mortality and morbidity.

Recommendations

- ❖ Chemical composition analyses of smokable cocaines should be expanded to include more representative samples and additional (from across the entire country e.g., by state, provice or regions). The potential knowledge gained from analyzing different contextual variables may also be relevant.
- ❖ The quality and validity of information obtained from labarotory analyses could be improved if countries develop solid and committed institutional and inter-institutional mechanisms such as increasing the number of participants or particapating institutions at each step in the process.
- ❖ The systematic approach to analyses is essential and must be guaranteed. It was demonstrated that changes can only be observed on the basis of longitudinal, comparable, and systematic analyses.
- ❖ Create coordinated research teams that are constantly engaged in consultation and exchange, with articulated short-, medium-, and long-term objectives: chemical and toxicological analyses, clinical and pre-clinical studies, patient evaluation, epidemiological analyses, analysis of drug traffic, legislative analysis.

- It must be possible to analyze and reveal the speed of changes in adulterants in an acceptable and desirable amount of time in order to implement specific policies. The necessary actions should be taken to reduce the gap between knowledge and the problem to be resolved.
- Promote opportunities for the dissemination and discussion of results from the chemical composition analyses of drugs with the entire scientific, professional community and officials involved in policies on prevention, treatment, research, control of illicit traffic, chemical precursors, the judicial branch, legislators, and the media.
- Guarantee the budget and allocation of human resources for the implementation and development of these mechanisms (for analysis and dissemination), considering the long term and basic investment.
- The development of the project is seen as a launch pad for future actions at the regional level, such as:
    - ✓ New lines of research on synergy or potentiation mechanisms or antagonisms between adulterants and cocaine.
    - ✓ Analytical platform for the identification of new psychoactive substances (NPS).
    - ✓ Design of a regional database that can expand on the information from other countries for the development of regional analyses.
    - ✓ Development of training lines for security forces, judicial officers, health professionals (toxicologists, generalists, obstetricians) and officials in general.

Introduction

This compendium is part of the Project on Smokable Cocaines in Argentina, Brazil, Chile, Paraguay, and Uruguay, coordinated by the Inter-American Observatory on Drugs of the Inter-American Drug Abuse Control Commission of the Secretariat for Multidimensional Security of the Organization of American States (OID-CICAD-SMS-OAS) and financed by INL-USA. It is the result of the work done by the Drug Commissions and technical teams responsible for different areas and organizations specializing in the chemical composition analysis of seized drugs in the participating States.

The importance of coordinating how this type of analysis is conducted in the countries that are part of the project is based on the need to achieve certainties regarding the chemical profile of the so-called smokable cocaines, whose pattern of use expanded in the subregion during the last decade, generating great concern at various levels. This pattern of use points to many similarities as well as the socio-economic profiles of the users, according to the results from different epidemiological and qualitative studies conducted in Argentina, Brazil, Chile, and Uruguay on the population that uses smokable cocaines.[1]

In addition, the preparation of this compendium seeks to encourage the respective authorities regarding the need to develop an institutional mechanism allowing for the systematic analysis of all drug samples seized, as a permanent source of knowledge and a link in the early warning system on the chemical profile of the drugs and adulterants used.

[1] ¨La magnitud del abuso de pasta base-paco (PBC), patrones de consumo y comercialización en villas de la CABA¨ Observatorio Argentino de Drogas. SEDRONAR. (2012). ¨Perfil dos usuarios de crack e/ou similares no Brazil¨ Fundación FIOCRUZ/Secretaría Nacional de Drogas (2013). Bastos FI, Bertoni N: Pesquisa Nacional sobre o uso de crack: quem são os usuários de crack e/ou similares do Brazil? Quantos são nas capitais Brazileiras? Rio de Janeiro: ICICT/FIOCRUZ; 2014.¨Estudio de caracterización de personas que consumen pasta base de cocaína (PBC) de forma habitual en la Región Metropolitana¨ Instituto de Sociología. Universidad Católica. Chile. 2014. Suárez H., Ramírez J., Albano G., Castelli L., Martínez E., Rossal M.:¨Fisuras. Dos Estudios sobre pasta base de cocaína en Uruguay. Aspectos cuantitativos y etnográficos¨ Universidad de la República. Junta Nacional de Drogas (2014).

The impact that this knowledge will have on the treatment of patients with problems related to smokable cocaine abuse will be directly related to the level and method of transmission and inter-relationships promoted among the various disciplines, a task that must no doubt be undertaken by a coordinating entity that ensures the viability and durability of the exchange.

The contribution made by Brazil with the analysis of hair samples from crack users in identifying adulterants indicates their presence in the human body and their corresponding toxicity and, thus, represents scientific evidence significantly increasing the relevance of studies of this kind.

Although national experts and authorities agreed on a common methodology for performing the chemical composition analyses of smokable cocaines, the information developed is presented in separate chapters for each country starting with Chapter 3 Argentina, Chapter 4 Brazil, Chapter 5 Chile, Chapter 6 Paraguay, and Chapter 7 Uruguay. Chapter 1 reports on the project and its design and execution, the questions that guided development, and the organization of the project's implementation.

Chapter 2 provides a *regional* presentation of the findings, primarily with respect to the adulterants and the analytical variables some countries developed which, no doubt, made a singular and highly relevant contribution.

Finally, although the purpose of this study was to analyze the existing adulterants, as opposed to measuring the impact of each of these substances in users, the studies did raise some particular conerns on this front. It was noted that the presence of caffeine, one of the primary adulterants, appears to increase the addictive nature of smoked cocaine. In addition, although levamisole was present in only minor amounts in most countries, similar studies have noted its high levels of toxicity. [2] Indeed, the level of toxicity of substances, such as levamisole may be a worthy area for future study.

[2] Duffau, B., Rojas, S., Fuentes, P., & Triviño, I. (2015). Perfil de Composicion de la Cocaina de Diseño en Chile: Estado de los Peligros Asociados a la Adulteracion con Levamisol. *Revista Chilena De Salud Publica, 19*(1), 78-82.

Chapter 1: General Framework and Importance of the Chemical Composition of Substances

The Project on Smokable Cocaines

In the context of the Project on Smokable Cocaines (OID-CICAD-SMS-OAS), in which Argentina, Brazil, Chile, Paraguay, and Uruguay are participating, a line of research on the chemical composition of the substances included under the name of smokable cocaines and seized in each of the countries was designed and implemented.

The first meeting of the Project on Smokable Cocaines was held on April 3, 4, and 5 in Sao Paulo, Brazil; the participants included officials, researchers, and leading experts on the subject in each country. Based on the status of knowledge attained regarding these problems in each country, future lines of work were defined.

On the subject of the chemical composition of smokable cocaines, the situation indicates that all the countries have laboratories and procedures for developing this subject as part of established protocols related to seizures, but there is not necessarily any systematic approach or analytical monitoring framework that would allow their incorporation in the descriptive epidemiological approach and connect these findings with policies on treatment and prevention.

The participants were organized into three working groups according to different subjects. Group 1 addressed the chemical composition of smokable cocaines. The findings and conclusions of this group indicate that the countries agree that the exact composition, distinctive characteristics, and precise nomenclature of smokable cocaines are still subject to debate in the countries. Thus, it again becomes necessary to have a chemical composition of the substances seized in each country even though there are different scopes or coverage levels in this information. Three lines of work were then defined:

- Develop a compendium with the information available in each of the countries participating in the project with the results of the chemical composition

analyses of seized samples. It would also be advisable to create a database so that it would be possible to incorporate the information available to date and know the procedures carried out with the samples, the equipment used, and whether or not specific reagents or standard solutions are needed. It was also recommended that the compendium include the analysis of cocaine hydrochloride samples, in order to establish a comparative framework of the state of the art of chemical composition, for purposes of establishing a reference framework protocol for the countries of the region to guide the information to be gathered in the samples seized. The final idea is to share the information from the chemical analysis of samples seized in each country and be able to compare their content and identify the possible traceability of cocaine, the impurities, the adulterants, etc.

- Second, identify and establish institutional mechanisms to ensure that laboratories or specialized institutes have systematic and complete access to the samples seized, in order to centralize analytical procedures and guarantee continuity and systematization over time. The current situation indicates that in some countries this procedure is centralized while in others it is not, thus hindering the transfer of information and the scope of that information. The proposal suggests that if a country requires more information (for example, needs to know the provenance or origin of the samples), it will be possible to call on the specialized institution that each country will define according to its needs. Also suggested was the possibility of creating a reference technical body in the region to join these countries so as to facilitate access to reagents and specific standards for the determinations to be made, relieving the red tape each country must go through when making a request of this type to the U.N. (Vienna).
- Third, the need for funds to train specialized human resources and for exchanges among the region's countries was suggested, in order to guarantee the researchers' mobility and allow access to technology and knowledge available in the countries, utilizing the experience already acquired and

collaborating by promoting the communication of knowledge on the subject matter through internships, seminars, meetings, publications.

The decision was made to begin with the compendium as the initial step needed to allow the development of the other initiatives and objectives.

Scope and objectives of the compendium

As indicated above, there is consensus regarding the need to develop a mechanism to systematize the analytical procedures for the chemical composition of smokable cocaines, in order to produce scientific evidence that, when properly coordinated with the areas of prevention, treatment, and drug traffic control, would also allow it to be used in the design of effective and specific policies for addressing these issues.

We are referring to a mechanism **to systematize the analytical procedures** and not the formal procedures, because each country has, based on its own regulations, legal and procedural mechanisms for the composition analysis of seized substances. This component of the project seeks to proceed with the **design of a systematic process that organizes and implements, in terms of knowledge, the analysis of the data produced in order to generate relevant information intended for prevention programs, treatment programs, and programs for control of drug trafficking and chemical precursors.**

As a first step, the project seeks to systematize the information from each country with regard to the following aspects:

1. What is the national entity that provides official information on the results of composition?

2. What are the steps in the police and legal procedure whereby seized substances are submitted for chemical composition analysis?
   - How is the decision made? On the basis of what criteria is the sample to be analyzed selected? How and to whom are the results reported?

- What the impacts of the results are and whether they are linked to other data.
- Principal obstacles and alternative strategies.

3. What is the unit of analysis? (have a definition) How is it determined, what are the criteria (internal or external to the substance)? Internal criteria on the substance (form, color, presentation) or police-legal criteria related to the procedures or research on routes and traffickers? How many are needed to lend consistency and/or coverage to the analysis done?

4. Determination of the sample:
   - Samples from retail or larger-scale sale.
   - Random or arbitrary selection.
   - Stratified by other variables? Such as: where seized, coexistence with other substances, size of procedure, legal or criminal relevance of case, country's entry and exit areas (borders).
   - Possible and desirable frequency.
   - Principal obstacles and alternative strategies.

5. Composition analysis:
   - What does it consist of?
   - Definition of methodological instruments and equipment.
   - Is the totality of what is being sought determined in advance? Does the methodology allow the discovery of existing new substances?
   - What does the presence of each chemical component imply? How are the combinations and relative weights of each one evaluated? Is this an important point?
   - What are the limits of knowledge in these analyses?
   - What are the potentialities of this knowledge?

6. Significance of results: different areas or aspects that can utilize these results and how:
   - Public health
   - Control of chemical precursors.
   - Toxicology and clinical and preclinical research.
   - Inputs for the design of new research studies.
   - Inputs for improving current composition procedures.
   - Inputs to incorporate in epidemiological surveys, in studies of patients in treatment, in prevention and harm reduction campaigns.

7. Communication-dissemination of results:
   - Principal actors requiring this information.

- How it should be linked to other data (seizures, consumption).

Then, the **general objective** of the compendium is:

- ❖ To design a systematic process that organizes and implements, in terms of knowledge, the analysis of the data produced in order to generate relevant information intended for prevention programs, treatment programs, and programs to control trafficking and chemical precursors.

The activities are developed based on the following **specific objectives**:

- ❖ To know the chemical composition of smokable cocaines used by populations in the Southern Cone countries, establishing similarities and differences among the countries.
- ❖ To know and describe for each country the legal and institutional aspects that determine the method and magnitude of the chemical composition of smokable cocaines.
- ❖ To know and describe for each country the methodological procedures and equipment used for composition analysis, what information is produced, and how it is systematized.
- ❖ To know and describe for each country the information developed based on chemical analyses: scopes, limitations, and potentialities.

Chemical composition analysis

The chemical composition analysis of substances is the laboratory process that uses appropriate methodologies to allow identification of the purity level of the main alkaloid that defines the substance being analyzed (methylbenzoylecgonine in the case of cocaine) and the presence of adulterants and diluents in terms of quantity and quality.

In the specific case of cocaine, one of the most widely used drugs in the world and in South America, in most cases it is adulterated or diluted with chemical substances that

are not part of the process that extracts cocaine from the coca leaf.[3.] Adulterants are chemical substances that have some pharmacological property that is similar to the drug being abused and are added to enhance the effect of the drug. In some cases, these adulterants may prove to be more dangerous than the abused drug itself. In the case of cocaine, these adulterants are caffeine, lidocaine, levamisole, phenacetin, benzocaine, and paracetamol. Diluents are organic or inorganic chemical compounds that do not have significant pharmacological properties but are added to increase the weight of the unit sold. The main diluents are carbonates, sugars, plaster, and cornstarch (flours). It is important to note that adulterants should also conform to the characteristics of the diluent in terms of looking like cocaine powder or paste or at least not altering their aspect, color, and texture significantly.

Performing chemical composition analyses of drugs, so that the magnitude and quality of the adulterants and diluents can be identified, is useful and important because it provides information that, from a toxicological and public health policy perspective, includes knowledge on the harm these components do to users' health based on how dangerous they are. From the perspective of intelligence and traffic analysis, this information can be used to determine drug trafficking and distribution network patterns and to identify the methods used in the production of illicit drugs.[4]

The adulteration of drugs is a phenomenon that is generally, as we shall see later, part of the selling process, where we find the seller – at different stages according to the volume of the sale: kilogram, ounce, or grams – and the final consumer. To the extent that resale involves smaller quantities of drugs, adulteration increases and involves substances that are more toxic and harmful to the user. For example, in the adulteration of cocaine, according to Campero and Barrancos,[5] the seller who

[3] Boris E. Duffau, Sonia A. Rojas, María E. Espinoza, Sebastián Jofré and Liliana Muñoz: ¨Estudio de la composición química de incautaciones de cocaína en Chile mediante HPTLC,GC/FID y FTIR¨. Sección Análisis de Drogas. Instituto de Salud Pública. Chile. Revista ¨retel¨Revista de toxicología en línea.

[4] Fabian M. Dayrit and Morphy C. Dumlao: ¨Impurity profiling of methamphetamine hydrochloride drugs seized in the Philippines¨. Forensic Science International. www.elsevier.com/locate/forsciint

[5] Juan Carlos Campero and Horacio Barrancos: "Alternativas a la política actual de drogas desde el eslabón de la producción"in "De la represión a la regulación: propuestas para reformar la políticas contra las drogas". Friedrich Ebert Stiftung (FES) Programa de Cooperación en Seguridad Regional. (2013)

distributes the merchandise by the kilo usually cuts it with borax, lactose, or Mannitol, leaving it with a purity of between 85% and 80%. The distributor who buys in kilos and sells by the ounce cuts the product with amphetamines and some anesthetic to leave it with a purity of between 60% and 70%. The distributor who buys by the ounce and sells by the gram cuts it with any substance, which may be chalk or talcum, procaine and novocaine, which are more toxic than borax, Mannitol, or lactose and add solubility problems that make intravenous administration more dangerous and leave the product with a purity level of only 30% to 40%. If another reseller is involved, there are additional cuts and purity is reduced to 20%. The average percentage for street samples is between 20% and 40% pure.

During 2012, the European Union's PRADICAN Project (program to combat illicit drugs in the Andean Community) conducted a chemical composition study of cocaine drugs seized in 27 cities in Bolivia, Colombia, and Peru. The report released in 2013[6] shows the results of the chemical composition of 608 samples (393 cocaine base and 215 cocaine hydrochloride).

Regarding the dynamic of adulterants in these countries, according to the report, the evidence indicates that caffeine, phenacetin, and lidocaine are the most common adulterants. Specifically, the information for Bolivia provides less detail given the methodology used. In the case of Colombia, the high percentage of samples containing levamisole, a veterinary medication the use of which in humans is prohibited, is interesting. This situation occurs in other user countries such as the United States and Canada. In Peru, the experts point with interest to reports of orphenadrine, a muscle relaxant, used as a cocaine adulterant, although its use as such is not reported in other countries.

Based on the methodology of gas chromatographic determination using a mass selective detector, the presence of eight main adulterants was detected in the samples

[6] Final report: caracterización química de drogas cocaínicas, incautadas, en 27 ciudades de la subregión andina Bolivia, Colombia y Perú 2012 informe regional.
http://www.comunidadandina.org/DS/Inf.%20Caracterización%20Regional.pdf

studied (caffeine, phenacetin, lidocaine in Colombia and Peru, aminopyrine, levamisole, diltiazem, hidroxycine in Colombia only, and orphenadrine in Peru only). Of these, the ones most commonly used in the cities studied are: caffeine (76.7%), phenacetin (52.8%), levamisole (21.7%), and lidocaine (15.5%). The adulterant used most often in Colombia is caffeine, followed by phenacetin and lidocaine, and levamisole, a medication for veterinary use, is in fourth place. In Peru, caffeine was found in three samples (two from Lima and one from Callao), phenacetin was found in one sample from Tarapoto, lidocaine was found in three samples (two from Callao and one from Lima), and orphenadrine was found in one sample from Callao.

The study also notes that "early in this century a considerable change began to be seen in the cocaine being sold on the street, in that the use of active cutting substances was detected, meaning pharmacological substances that directly interact with cocaine, whether by increasing its stimulant effects or affecting the physiological effects and allowing more rapid and intense effects." The studies done in Colombia indicate that the drug (cocaine) is adulterated with these pharmaceutical substances directly in the laboratories that produce cocaine hydrochloride and not in the street, where inactive cutting substances such as sugars are used.

Phenacetin is one of the cutting substances of the pharmacological adulterant (stimulant) type currently used in cocaines (to imitate or enhance the effects) in basic form (cocaine base, crack, basuco, etc.).

As a result of how these drugs are sold, from the large distributors to small resellers to the final user in an accelerated process of cutting and adding adulterants, it is clear that serious harm is being done to users' health, which can be seen in the increasing demand for treatment. In this regard, it is increasingly necessary to proceed with chemical composition studies of substances in order to determine the toxicity of these drugs and guide treatment strategy, as well as to inform the public. In addition, they provide information on aspects that could be analyzed in relation to retail drug dealing, links with the use of chemical precursors, and new drug trafficking methods.

Smokable cocaines

According to Castaño's definition,[7] smokable cocaines are substances derived from the coca leaf. After chemical processing, they acquire physical and chemical characteristics that give them low melting points and they may be volatilized by sublimation or boiling with heat. Cocaine base paste (CBP) as well as crack and free base are smokable cocaines. Of them all, it is the basic form of cocaine (CBP, cocaine base or free base) that explains the appearance and establishment of consumption in the Southern Cone countries, primarily in Argentina, Chile, Uruguay, and Brazil at the start of the 21st century. In recent years, Paraguay also reports an increase in this use of cocaine in the country, where it is called crack or *chespi*.

Previously, in the 1970s, the use of CBP was confined to the Andean countries (Colombia, Ecuador, Peru, and Bolivia), but this new phenomenon in South America takes on high-impact social connotations (sectors involved, micro-trafficking, security and environmental problems) and represents a problem in terms of the governments' political and institutional agendas.

Picking up the description of smokable cocaines provided by Castaño again, "Free base and crack are two chemically equal base forms of smokable cocaine, that differ fundamentally based on their production process. Both are obtained from cocaine hydrochloride through empirical and rudimentary laboratory procedures that users themselves can perform and commonly call *patraseo* (turning back)."

"CBP is also called cocaine sulphate, base paste or simply paste and is an intermediate product in the manufacture of cocaine hydrochloride from coca leaves. It is generally obtained by dissolving the dry leaves in water and treating the solution with kerosene or gasoline, and doing this again later with alkaline substances and potassium permanganate, and finally sulphuric acid." (Castaño, G.A.)

[7] G.A. Castaño: "Cocaínas fumables en Latinoamérica" Adicciones. 2000.

CBP is adulterated to increase its volume with the addition of lactose, powder, flour, brick powder, or sugar, for example, and to compensate for the potency lost due to adulterants with the use of stimulants (amphetamines, caffeine) and cooling agents (lidocaine, benzocaine, levamisole) to imitate the anesthetic effect.

In that smokable cocaines are highly fat-soluble they quickly cross the blood-brain barrier, reaching the central nervous center in five seconds. This is one of the reasons why their use is highly addictive. The toxicity of base past is due to the cocaine alkaloid and the presence of other alkaloids, contaminants, and adulterants, as well as the thermal damage and the products of combustion (anhydrous ecgonine methyl ester derived from the pyrolysis of smokable cocaine, carbon monoxide, and other products derived from the burning of plastics and metals in handmade pipes).[8] Other researchers[9] also maintain that "Pulmonary inhalation causes the drug to be absorbed rapidly and reach the brain in little time. For this reason the route of administration (pulmonary inhalation) has been considered the most relevant factor for explaining the high level of dependency induced by the drug, in addition to other characteristics included in the users' clinical profile."

With respect to the neurobiological effects produced by the method of consumption, the adulterants present in the base paste samples are also relevant. According to the researchers cited above, the combination of cocaine and caffeine can induce a greater stimulant effect, based on the results obtained from the preclinical studies conducted in Uruguay.

It is called by different names according to the users' countries and social groups.[10] In Argentina it is called *pasta base* or *paco* and it is also called *pasta base* in Chile and Uruguay. In Brazil it is called "crack" (although this is not the same substance as that

[8] A. Pascale, M. Hynes, F. Cumsille, C. Bares: ¨Consumo de PBC en América del Sur: Revisión de los aspectos epidemiológicos y médico-toxicológicos¨. CICAD-OEA 2013.
[9] J.Prieto, M. Meikle, J. Urbanavicius, J. Abín-Carriquiry, G. Prunell. M. Scorza: ¨Relevancia del adulterant activo caffeine en la acción estimulante de la pasta base de cocaína¨Revista de Psiquiatría del Uruguay. Volumen 76 N°1. Septiembre 2012.
[10] On the names given to CBP-Paco by users in treatment, see: Obsevatorio Argentino de Drogas. SEDRONAR: ¨Aspectos cualitativos del consumo de PBC-Paco¨ 2007.

produced based on hydrochloride cocaine) and in Paraguay as well where it is also called *chespi*. In Brazil, depending on the level of adulteration of the CBP, it is called *merla* (with a high percentage of solvents and battery acids) or *oxi* (waste from the base paste mixed with gasoline, kerosene, and lime).

As indicated above, we are confronted by a variety of names and products that, despite having a common origin based on cocaine base paste and/or cocaine base, become different products based on their exposure to adulterants and/or the new names given to them by sellers and users.

Chapter 2: Principal Findings from a Regional Perspective

2.1 Institutional and legal aspects

The way that countries are politically and administratively organized determines the level of centralization and decentralization of the processes and institutions that carry out the tasks involved in the chemical composition analysis of seized drugs. In this regard, using a general overview, a distinction can be made between Argentina and Brazil on the one hand and Chile, Paraguay, and Uruguay on the other.

Argentina does not have a centralized body that carries out these functions. Powers in this area are spread throughout the Ministry of Security, the Attorney General's Office, and the Ministries or Secretariats of Security in the provinces.

Brazil is a federal republic with 26 states and a federal district, all of which have at least two toxicological analysis laboratories either for substances *in natura* or biological material given that Brazil is consolidating the terminological difference between forensic chemistry laboratories (abused drugs, medications, etc.) and forensic toxicology laboratories (biological matrices). Each state in the federation has its own terminology. The Federal Police use the term "forensic toxicology" for biological matrices only. On the other hand, there are states that refer to "chemical analyses laboratories." The power to analyze drugs and cases of intoxication involving forensic medicine is under the exclusive jurisdiction of the state (whether federal or state). In the states, these analyses are the responsibility of the forensic police forces, which are government administrative bodies present in many of Brazil's states.

In **Chile**, it is the Institute of Public Health (ISP), through the Illicit Substances Division,[11] that receives the substances that are allegedly narcotic or psychotropic drugs seized throughout the country, with the exception of those derived from cannabis, in order to analyze, preserve, and destroy them, with the express exclusion of marijuana. This allocation of functions is established in Articles 41, 42, and 43 of Law

[11] It reports to the ISP Department of Environmental Health and is divided into two independent sections: Drug Seizure and Drug Analysis.

No. 20.000 (16/02/2005) and the Agreement between the Institute of Public Health and the Health Services (Resolution 125 of 05/18/1987).[12] This agreement was renewed in 2012.

In **Paraguay,** the National Antidrug Secretariat (SENAD) Laboratory is the body that analyzes all seizures carried out nationally by the SENAD and the National Police.

In **Uruguay**, the Forensic Technical Institute (ITF), a division of the Judicial Branch, has the power to chemically analyze seized drug samples and in the case of smokable cocaines the analysis focuses on identifying whether or not cocaine is present. There are also other bodies or institutions that occasionally perform these analyses, such as the Pando Technological Hub, a division of the Chemistry Department of the University of the Republic, the Technical Police, and the Clemente Estable Biological Research Institute (IIBCE). The results are public in the case of the IIBCE.

[12] The source for all the information provided in this section is the document: "Guía de Pericias Químicas en el Marco de la Ley № 20.000." Department of Environmental Health, Illicit Substances Division. Institute of Public Health, Ministery of Health, Government of Chile. (2011).

2.2 Methodological criteria

❖ Unit of analysis and sample

The knowledge objective is to chemically characterize the drugs under the name of smokable cocaines, to know their qualitative and quantitative composition, and to the extent possible to associate these characteristics with contextual variables (where seized, where sold, country or region of origin or destination, where used).

The information provided by the countries is not homogenous in terms of the quantity and representatives of the samples analyzed, due to the different legal and institutional aspects mentioned earlier. However, the information is homogenous in terms of the unit of analysis, in that samples of smokable cocaine defined on the basis of different procedures and sources (visual and/or handling of reagent kits or field tests) were analyzed.

In Brazil and Paraguay the qualitative analysis also extends to samples of cocaine hydrochloride. In Brazil, analysis also includes the level of concentration of adulterants. In Paraguay it includes purity levels for both types of cocaine and the analysis of smokable cocaines and cocaine hydrochloride is performed in connection with the type of seizure (micro-trafficking or trafficking) and purity levels. Uruguay presents the quantitative analysis of the main adulterants analyzed in the samples, to which it adds according to the profile or method of presentation and according to whether the samples were intended for personal consumption or trafficking.

For **Argentina** this report presents the analysis of samples from 28 judicial expert reports in which the number of wrappers of cocaine material was greater than or equal to 50, corresponding to the communities of La Matanza, Lomas de Zamora, and La Plata[13] for a total of 4,590 units that were sampled for chemical analysis and were

[13] La Matanza and Lomas de Zamora are part of the suburban area of the Province of Buenos Aires and La Plata is the capital of the Province of Buenos Aires.

formed into 90 lots on which the analysis was done. The samples were seized between October 2014 and February 2015.

Brazil provides information on 642 samples of street cocaine seized between 2011 and 2014 in five Brazilian states, in conjunction with the states' Criminalistics Institutes, within the framework of the Project on the Chemical Profile of Cocaine (PeQui Project) of the Brazilian Federal Police. In addition, it analyzes a total of 50 hair samples selected from crack users between the ages of 25 and 54 being treated in clinics in the country, 90% of whom were men and 10% of who were women. The patients are from the Federal District (4 samples), Minas Gerais and Paraná (3 samples from each state), Santa Catarina (6 samples), and São Paulo (28 samples).

Chile analyzed samples of smokable cocaines seized throughout the country during the period 2009-2014, totaling some 25,175 samples, distributed as follows by year: 5,174 in 2009, 4,081 in 2010, 3,507 in 2011, 4,515 in 2012, 4,821 in 2013, and 3,077 in 2014. The analysis was done by region in all years.

Paraguay analyzed all samples from seizures throughout the country that were positive for cocaine during the period 2009-2014. A total of 3,175 samples were analyzed, 56% of which (1,766 samples) are cocaine base (smokable) and 44% of which (1,409 samples) are cocaine hydrochloride.

Uruguay analyzed a total of 306 samples of smokable cocaine from seizures during 2014 and 2015 (62 and 244 samples, respectively). The Forensic Technical Institute provided these samples to the Clemente Estable Biological Research Institute to be analyzed in the context of this multi-center project and exclusively for research purposes. They do not represent all samples seized but rather a random selection.

Paraguay and Chile, the two countries that have centralized the process of chemical analysis of seized drugs, have established specific procedures and protocols for the recording and analysis thereof.

In both countries, the initial classification of a drug as smokable cocaine by the securities forces that initially come into contact with it is based on its physical appearance: powder or paste; white, coffee-colored, or beige; oily with a pasty consistency; and a very pungent characteristic odor. In the opinion of experts, it would be desirable for security personnel to be trained in the handling of reagent kits or field tests.

The central laboratory, the ISP in Chile, receives all seizures from the metropolitan region and a sample from the other regions, with the exception of marijuana. According to Ministry of Health regulations, the procedure is followed to take samples from each seizure (this regulation is known as NTG 7 and is based on current U.N. recommendations). The sampling done in the seizure of an alleged drug is a rigorous procedure meant to ensure that the sample, the subject of the expert report, is representative of the total amount of the substance seized and retains traceability through the so-called chain of custody. Chapter 5 describes these aspects of sampling for purposes of analysis in greater detail.

In Paraguay, with regard to the quantity of the sample taken for analysis and because most of the qualitative and quantitative methods at the Forensic Laboratory for examining drugs require very small aliquots, it is vitally important that these small aliquots be entirely representative of the mass from which they have been properly extracted, based on the principles of analytical chemistry.
The samples analyzed at the Forensic Laboratory are from small-scale (micro-dealers) and larger-scale sales and the selection is made randomly taking into account the basic principles of sampling. The sample is stratified according to its chemical form (smokable or HCL), place of origin or seizure, as well as the substances used as adulterants or cutting agents (lidocaine, caffeine, etc.). This is not true with regard to the size of the seizure or the legal or criminal relevance of the case.

The frequency with which substances reach the Forensic Laboratory is not desirable as the seizure occurred years ago in some cases. This situation has been improving in some jurisdictions following meetings held with the authorities on the importance of

performing the chemical analysis properly and on a timely basis, as indicated by the experts.

In the states of the federation of Brazil, when the substances or products leading to physical and/or psychic dependence are seized, with the exception of seizures conducted by the Federal Police, which has its own laboratories, must be immediately routed for analysis by the public security bodies belonging to the states for issuance of the "Findings Report" on the nature of the substance, signed by the Official Criminal Expert. Without this report, it is impossible to prepare the Order to Seize and Order to Detain in flagrante delicto, nor can a complaint be filed for trafficking in or using controlled drugs. That report is generally issued after rapid analytical methods are used, such as color or precipitation tests (spot tests). The material must be submitted to other chemical analyses to confirm the finding, supporting the issuance of the Final Report. The Final Report, also called the toxicology report, or the Substance Review Report (cocaine) as it is called in the Federal Police, is actually the test of the materiality of the crime. It must be submitted either to the requesting authority or directly to the competent court, the criminal court where the respective proceeding is being heard by the date of the trial and sentencing hearing signed by one or two experts, one of whom may be the expert who prepared the findings report. In those reports, the experts must document the tests done, indicating the chemical analysis equipment used to determine the nature of the material seized. Both the findings and the final report must mention the weight of the substances seized, the amount retained for analysis and repeat analysis and the results obtained in the analysis.

❖ Composition analysis: methodology and equipment

Depending on the nature of the sample, the quantity, and the ability to identify it, substances may be analyzed using one or more different methods. This is consistent with the current standards of the U.N. and Europe's Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG), establishing as a minimum criterion for reporting a sample as positive, the use of type A confirmatory techniques, notably the IR, NMR and RAMAN mass spectrometry methods. If these techniques are not available, the

suggestion is to use at least two analytical techniques whose main physical and chemical principles are different, catalogued as type B and C, including different types of chromatography and color tests.

All the countries use the following equipment and/or analytical techniques according to their classification by the U.N. and SWGDRUG:

TYPE A Confirmatory Test	**TYPE B separation test and confirmation with standards**	**TYPE C Screening test**
Gas chromatography with mass spectrometry detector	Gas chromatography with flame ionization detector (GC/FID)	Modified Scott's test
Spectrophotometer or infrared FTIR and ATR	High performance thin layer chromatography (HPTLC) instrument with automatic sampler and densitometer photo	Coloration tests for diluents (Lugol, Fehling, Phenolphthalein)
	High performance liquid chromatography with ultraviolet diode array detection (HPLC-UV-DAD)	
	Thin layer chromatography (TLC)	
	Capillary melting point meter	

2.3 Principal findings

1) Adulterants

The identification of adulterants is one of the principal objectives of this compendium and the quantification thereof is an additional but very important datum in that it indicates the level or quantity of the adulterants found in samples.

First, it is important to understand the percentage of adulterated samples out of the total number of smokable cocaine samples analyzed. The following table presents this ratio, which is different depending on the country, but the level of coverage or representativeness of the samples analyzed must be kept in mind. In Paraguay and Chile, countries where the ratio is low, the samples are national totals and of every 100 samples of base paste, 28 in Chile and 30 in Paraguay have at least one adulterant. In Argentina and Uruguay, where the number of samples is lower, 8 and nearly 9 out of every 10, respectively, are adulterated and in Brazil this ratio is 57 samples out of every 100.

Table 2.1: Percentage of adulterated smokable cocaine samples out of the total number of samples analyzed, by country.

Country	No. of samples of SC analyzed	No. of adulterated samples	% adulteration
Argentina	96	79	82.3
Brazil	411	235	57.2
Chile	25.175	7086	28.2
Paraguay	1.766	536	30.4
Uruguay	306	274	89.5

The following table shows the three main adulterants found in the total number of samples analyzed, by country.

Table 2.2: Percentage of the three main adulterants out of the total number of samples of smokable cocaines analyzed, by countries +.

Country	First adulterant	Second adulterant	Third adulterant
Argentina	Caffeine 35.4%	Lidocaine 32.3%	Phenacetin 29.2%
Brazil	Phenacetin 54%	Aminopyrine 11%	Caffeine 4%
Chile++	Phenacetin 2.6%	Caffeine 2.4%	Lidocaine 0.1%
Paraguay+++	Phenacetin 13.3%	Paracetamol 8.2%	Lidocaine 7%
Uruguay	Phenacetin 76%	Caffeine 64%	Aminopyrine 27%

+ See tables reference at the end of this chapter (Tables 2.4 to 2.9)
+ +Data for 2014
+++ The data were recalculated according to the original table (Table 6.8 in Chapter 6).

For every 100 of the samples of smokable cocaine in the street:

- In Argentina, 35 have caffeine, 32 have lidocaine, and 29 have phenacetin.
- In Chile nearly 3 samples have phenacetin and 2 have caffeine.
- In Brazil, 54 have phenacetin, 11 have aminopyrine, and 4 have caffeine.
- In Paraguay, 13 samples have phenacetin, 8 have paracetamol, and 7 have lidocaine.
- In Uruguay, 76 have phenacetin, 64 have caffeine, and 27 have aminopyrine.

Table 2.3: Percentage of the three main adulterants out of the total number of samples of adulterated smokable cocaines, by country.

Country	First adulterant	Second adulterant	Third adulterant
Argentina	Caffeine 44.8%	Lidocaine 40.9%	Phenacetin 36.9%
Brazil+	Phenacetin 94.5%	Aminopyrine 19.1%	Caffeine 6.8%
Chile	Caffeine 29.5%	Lidocaine 3.1%	Phenacetin 1.9%
Paraguay	Phenacetin 43.7%	Paracetamol 26.9%	Lidocaine 22.9%
Uruguay	Phenacetin 84.3%	Caffeine 71.5%	Aminopyrine 29.9%

+ The numbers for each adulterant and its corresponding percentage in adulterated samples were recalculated according to Table 5, which has the country data.

The preceding table shows that for every 100 adulterated samples of smokable cocaines, phenacetin is present in all of them, while the relative weight is different according to the country: in Argentina it is in third place (36.9%); in Brazil, Paraguay, and Uruguay it is in first place, with 94.5%, 43.7%, and 84.3% respectively of samples adulterated with this substance; and in Chile it is in third place with a low percentage of 1.9%. In addition, paracetamol, caffeine, lidocaine, and aminopyrine are adulterating substances present, and are at least among the three most important adulterants in the countries analyzed.

The longitudinal analysis of the types of adulterants present in the smokable cocaine samples in the period 2009-2014 is possible in Chile and Paraguay, with findings as follows:

- ✓ In **Chile**, the number of samples analyzed falls by 40% during the period, from 5,174 samples in 2009 to 3,077 samples in 2014. All the adulterants and even the carbonates decrease during the period. Phenacetin, the adulterant with the highest weight throughout the period, falls from 7% to 2.6% and caffeine peaked in 2010 at 12.7% and then fell gradually to the 2014 values. (See Table 6 in this chapter)

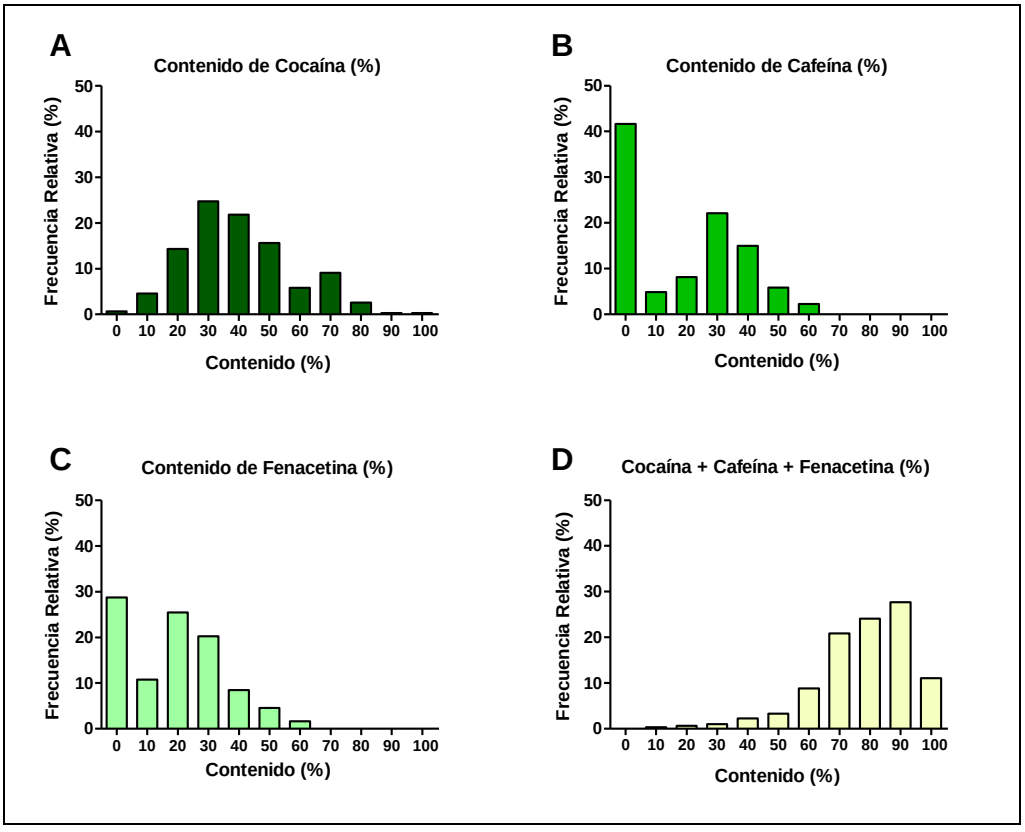
- ✓ In **Paraguay** the number of cocaine base samples multiplied nearly five times, from 65 samples to 321. The principal adulterant changes from year to year: in 2009 it was lidocaine (52%), in 2010 it was caffeine (39%), in 2011 and 2012 it was paracetamol (78% and 66%), and appears (because it practically didn't exist in previous years) to be phenacetin in the samples from 2013 and 2014, with 54% and 68% respectively. Lidocaine and caffeine are less present, but are part of all the adulterants throughout the period, unlike paracetamol, phenacetin, and benzocaine that were used most in some years and are nearly non-existent in other cases. The average purity level increased over time, going from 45.23% to 64.65% toward the end of the period. (see Table 2.8 of this chapter)

Quantitative analysis of the adulterants

Uruguay advanced in the quantitative analysis of the adulterants present in the samples analyzed, the results of which are presented below:

The figure below shows the ranges of concentrations of cocaine, caffeine, and phenacetin in the analyzed samples of cocaine base paste. Quantitative analysis showed that cocaine base appears in a broader range of concentrations, exceeding even 90% in one sample (Figure A), while phenacetin and caffeine have been detected up to a maximum of 60% (Figure B and C, respectively), and levamisole and lidocaine did not exceed 30% in any case (not shown in the figure). Although the range of concentrations of cocaine, caffeine, and phenacetin is broad, their content in the samples averages 40%, 30%, and 26 %, respectively (Figure A-C). Analysis of the sum of these three components indicates that the sum of these represents more than 50% of the composition in most of the samples analyzed and that on average, for the total number of samples analyzed, these three components represent 80% of the content of the samples (Figure D).

Figure 2.1: Content of cocaine, phenacetin, and caffeine in samples analyzed



Quantitative analysis does not show a substantial variation according to the different forms of base paste analyzed: tear, package, chip of rock, *chasqui*, rock, chalk, or brick. In addition, no obvious differences were found according to whether the samples were ultimately intended for consumption or trafficking.

Brazil analyzes the average level of adulterants present in the samples (see Table 2.5), and the results found in 57% of the positive samples (in terms of the presence of adulterants) indicate that phenacetin averages a concentration of 15.2%, caffeine averages 16.9%, and aminopyrine averages 4.1%.

Description of the adulterants with the highest presence:[14]

CAFFEINE

Caffeine is the most popular psychoactive drug in the world because of its psychostimulant property combined with the absence of severe secondary effects. Caffeine is found in various commonly consumed beverages and foods such as coffee, *mate*, tea, soft drinks, energy drinks, and chocolate. The psychostimulant property of caffeine is due to its ability to interact with the brain's chemical neurotransmission, in various areas and affecting different neurotransmitter systems, promoting functions such as wakefulness, attention, mood, and motor excitation. It exerts those effects primarily by acting in the brain by blocking specific receptors for adenosine (endogenous substances of the brain), classified as subtypes of A1 and A2a receptors. Some authors consider caffeine an "atypical drug of abuse" in that strictly speaking it meets some but not all of the dependence criteria of the DSM-IV (*Diagnostic and Statistical Manual of Mental Disorders, fifth edition*). Caffeine actually has weak reinforcing properties and there is little evidence of clinical dependence. However, there is various scientific evidence showing its ability to potentiate the psychostimulant and reinforcing actions of cocaine.

[14] Reviewed by: Martín Galvalisi, José Pedro Prieto, Juan Andrés Abin-Carriquiry, Cecilia Scorza. "Adulterants utilizados comúnmente en drogas de abuso." 2015. Sistema de Alerta temprano, http://www.infodrogas.gub.uy

PHENACETIN

Phenacetin has analgesic (relieving muscular pain) and antipyretic properties. Its primary metabolite is acetaminophen, which contributes to phenacetin's effects. An overdose of phenacetin can produce methemoglobinemia and hemolysis, due to its oxidizing nature. It also produces renal tubular necrosis. It presents clinically as cyanosis and loss of consciousness, due to tissue hypoxia. Methemoglobinemia is a rare disorder, characterized by increased amounts of hemoglobin in which the haem iron is oxidized to the ferric (fe3+) state. There are some cases of recreational use of cocaine and the appearance of methemoglobinemia. In this case it is thought to be due primarily to the presence of cocaine adulterants, among which consideration is given to phenacetin. It is considered probably carcinogenic in humans (group 2a).

The reason for its addition as an adulterant is to enhance the bitter taste of (hydrochloride) cocaine and improve its appearance. Phenacetin gives a shine to the mix and simulates the appearance of *alita de mosca* [purer form of cocaine]. However, it may be added because it has motivational effects itself. In this regard, there is a single study that shows that phenacetin, at a dose that produces antinociceptive effects, also produces an increase in the motivation of test animals.

It is important to emphasize that to date there are no studies evaluating the bioavailability of phenacetin when administered via inhalation, its toxic effects, or its behavioral effects.

AMINOPYRINE

Aminopyrine or its synonyms amidopyrine, aminophenazona, and others, is a pyrazolone with analgesic, anti-inflammatory, and antipyretic properties. It was commonly used to relieve pain and reduce fever (as an analgesic and antipyretic) until it was observed to produce agranulocytosis (disorder characterized by a severe reduction in the number of leukocytes) in some people. It has a long-lasting effect in the treatment of pain and fever without producing gastric irritation or cyanosis. It comes in the form of a crystalline, white, odorless, nearly tasteless powder that is freely soluble in water.

To date there are no studies evaluating its effects after being administered via inhalation.

LIDOCAINE

Lidocaine or xylocaine is a drug belonging to the family of local anesthetics, specifically of the amino-amide type. It acts as an anesthetic by blocking sodium channels by altering the transmission of action potentials along the axons, thus blocking the nerve fibers that transmit touch, motor impulses, or kinesthesia (sensation of movement in muscles, tendons, and joints). Based on the same sodium channel blocking property, cocaine is a powerful local anesthetic. It is for this reason that lidocaine is used as an adulterant, given that it imitates this property of cocaine. Unlike cocaine, lidocaine does not block the dopamine transporters and does not have any psychostimulant properties. In addition, there are no studies evaluating its effects following administration via inhalation.

LEVAMISOLE

Levamisole has been identified as an adulterant of illicit cocaine for several years. It is an imidazothiazole with anthelmintic and immunostimulant properties. It was previously used as an immunomodulator in rheumatoid arthritis and as adjuvant therapy in the treatment of colorectal cancer. It is no longer available in North America for human use. It is possible that cocaine producers or suppliers believe that levamisole improves the effects of cocaine or attenuates its secondary effects. Cocaine produces its psychoactive effects by increasing dopamine concentrations in the euphoric centers of the brain, and animal studies have also found that levamisole increases dopamine levels in these regions. It may be that levamisole enhances the euphoric effects of cocaine by boosting dopamine in the brain. However, there is no concrete evidence regarding this action. Cocaine (hydrochloride) adulterated with levamisole may be the cause of fever and agranulocytosis in some patients. Clinics are advised to consider the possibility of cocaine use and specifically the use of levamisole-adulterated cocaine in patients suffering from agranulocytosis for no apparent reason.

PARACETAMOL, also known as acetaminophen[15]

Paracetamol is one of the most popular and most widely used medications for the treatment of pain and fever. Despite this, its exact mechanism continues to be a subject of debate, and substantially unknown. While it is not considered an NSAID (nonsteroidal anti-inflammatory) in that it has very little anti-inflammatory effect, various data suggest the possibility that the site of action of its antinociceptive effect may be the central nervous system. It acts by inhibiting the synthesis of prostaglandines, cellular mediators responsible for the appearance of pain. In addition, it has antipyretic effects. It is frequently an ingredient in a group of products used to treat the common cold and flu. The standard dose is quite safe, but its low price and wide availability have resulted in frequent cases of overdosage. In the indicated doses paracetamol does not affect the gastric mucosa or blood clotting or the kidneys. However, slightly more than the normal dose can severely damage the liver. Acetaminophen is the principal metabolite of phenacetin.

In all cases, to date there is no published scientific evidence showing that all the actions induced by these adulterants is maintained or enhanced following a rapid route of administration like that used in the case of smokable cocaine. It is also important to consider the frequency of appearance in seized samples, the amount as well as the combination of adulterants.

[15]Reviewed by Cecilia Scorza. References: Clissold SP. Paracetamol and phenacetin. Drugs. 1986;32 Suppl 4:46-59. Ottani A, Leone S, Sandrini M, Ferrari A, Bertolini A. The analgesic activity of paracetamol is prevented by the blockade of cannabinoid CB1 receptors. Eur J Pharmacol. 2006, 531(1-3):280-1. Duggin GG, Mudge GH. Analgesic nephropathy: renal distribution of acetaminophen and its conjugates. J Pharmacol Exp Ther. 1976;199 (1):1-9.

DEFINITION AND RISKS INDUCED BY ADULTERANTS

ADULTERANT	DEFINITION/FUNCTION	RISKS
CAFFEINE	PSYCOSTIMULANT	BOOSTS THE REINFORCING EFFECT OF COCAINE
PHENACETIN	ANTIPYRETIC AND ANALGESIC	METHEMOGLOBINEMIA AND RENAL NEPHROPATHY
AMINOPYRINE	ANTIPYRETIC AND ANALGESIC	AGRANULOCYTOSIS
LIDOCAINE	LOCAL ANESTEHTIC	
LEVAMISOLE	ANTIPARASITIC	AGRANULOCYTOSIS

Table 2.4: ARGENTINA: Adulterants in samples of adulterated smokable cocaines. October 2014 to February 2015.

Cutting substance	No. of samples †	Percentage†
Caffeine	34	35.4%
Lidocaine	31	32.3%
Phenacetin	28	29.2%
Dipyrone	20	20.8%
w/o adulterants	17	17.7%
Benzocaine	8	8.3%

†One or more adulterants may be present in each sample.

Table 2.5: BRAZIL: Adulterants identified in free base samples. 2011-2014

Adulterants identified*

		Without Adulterant	Ben	Phe	Caf	Lid	Ami	Lev	Pro
Free base (N=411)	Frequency (%)	43	2	54	4	2	11	0	0
	Ave. Level (%)	-	14.6	15.2	16.9	2.8	4.1	0	0

*Ben=benzocaine, Phe=phenacetin, Caf=caffeine, Lid=lidocaine, Ami=aminopyrine, Lev=levamisole, Pro=procaine

†One or more adulterants may be present in each sample.

**Average level in samples that contain the adulterant.

Table 2.6: CHILE: Quantity and percentage of adulterants identified in samples of SC. 2009-2014

Parameter	2009	2010	2011	2012	2013	2014
Quantified Samples	**5174**	**4081**	**3507**	**4515**	**4821**	**3077**
Carbonates	1702 33%	283 6.9%	648 18.5%	782 17.3%	606 12.6%	334 10.9%
Caffeine	170 3.3%	517 12.7%	169 4.8%	262 5.8%	159 3.3%	74 2.4%

Phenacetin	363 7%	283 6.9%	207 5.9%	183 4.1%	68 1.4%	80 2.6%
Aminopyrine	10 0.2%	3 0.1%	3 0.1%	6 0.1%	3 0.06%	1 0.03%
Levamisole	0	1 0.02%	0	3 0.07%	0	2 0.06%
Procaine	32 0.6%	7 0.2%	12 0.3%	0	1 0.02%	0
Lidocaine	40 0.8%	14 0.3%	19 0.5%	15 0.3%	6 0.12%	3 0.1%

Table 2.7: PARAGUAY: Adulterants present in samples of cocaine base. 2009-2014

Caffeine	Lidocaine	Benzocaine	Phenacetin	Levamisole	Paracetamol	Total adulterated samples
96 17.9%	123 22.9%	22 4.1%	234 43.7%	23 4.3%	144 26.9%	536

Table 2.8: PARAGUAY: Adulterants present by year in samples of cocaine base. 2009-2014

Year	Caffeine	Lidocaine	Benzocaine	Phenacetin	Levamisole	Paracetamol
2009	21 32%	34 52%	6 9%	0 0%	0 0%	4 6%
2010	20 39%	19 37%	11 22%	0 0%	0 0%	1 2%
2011	8 10%	7 9%	2 3%	0 0%	0 0%	62 78%
2012	11 11%	17 17%	3 3%	2 2%	2 2%	67 66%
2013	4 17%	2 8%	0 0%	13 54%	1 4%	4 17%
2014	32 10%	44 14%	0 0%	219 68%	20 6%	6 2%

Table 2.9: URUGUAY: Quantity of samples according to content of cocaine and adulterants. 2014-2015.

Quantity of samples (n=274)				
Cocaine	**Caffeine**	**Phenacetin**	**Aminopyrine**	**Others***
274 (100 %)	196 (71.5 %)	231 (84.3 %)	82 (29.9%)	26 (9.5 %)

* Lidocaine, levamisole, pseudococaine, benzocaine, and procaine

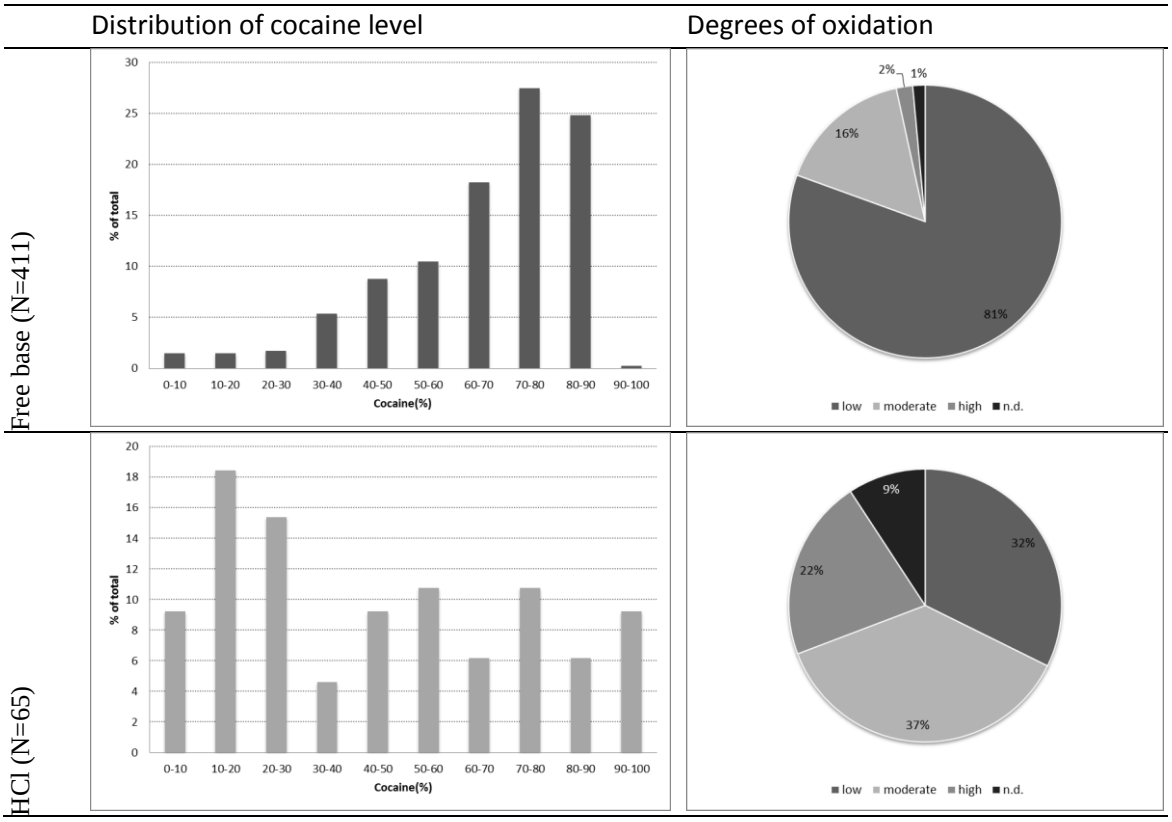
2) Purity-concentration levels

In the free base samples analyzed in **Brazil** the level of cocaine reaches a percentage between 60% and 90% in more than 50% of the samples analyzed, yielding an average purity level of 66%. (See Figure 2.2).

In **Chile**, the national average concentration of cocaine base increases from year to year (2009-2014), reaching its highest value of 45.8% in 2014. This amounts to an increase of 16.4 percentage points over the period, as the average started at 29.4%. (Table 2.10).

Something similar happens in **Paraguay**, where the average purity level of cocaine increases over the period 2009-2014 by 19.4 percentage points. At the start of the series, the value was 45.26%, reached a peak of 71% in 2013, and then fell to 64.6% in 2014 (Table 2.11).

Figure 2.2: BRAZIL: Distribution of cocaine level and degrees of oxidation.



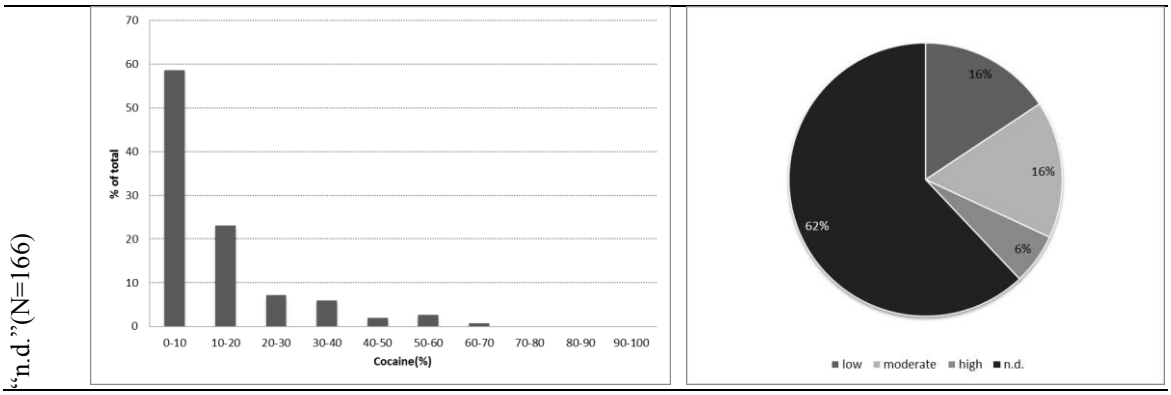


Table 2.10: CHILE: Levels of concentration in samples of SC. 2009-2014

Parameter	2009	2010	2011	2012	2013	2014
Samples Quantified	**5174**	**4081**	**3507**	**4515**	**4821**	**3077**
National average concentration, cocaine base	29.4%	31.7%	34.5%	34.6%	35.2%	45.8%
Standard deviation	7.9	12.2	13.3	10.2	9.4	17.5
Coefficient of variation	26.9%	38.6%	38.6%	29.3%	26.7%	38.1%
Maximum concentration	96%	98%	95%	99%	98%	99%
Minimum concentration	2%	2%	2%	2%	2%	2%

Table 2.11: PARAGUAY: Measures of central tendency and dispersion for the purity of cocaine by type and year.

	YEAR	N	Min	Max	Ave.	SD
BASE	2009	105	1,2	99.4	45.23	34.97
	2010	189	1	97.4	55.19	24.69
	2011	291	2	98.2	58.34	28.81
	2012	302	2	95.0	66.64	24.78
	2013	276	2	96.8	71.57	17.79
	2014	603	1	99.0	64.65	23.22
HCL	2009	187	2	100	73.64	23.35
	2010	114	2	100	68.09	26.58
	2011	151	5,4	100	80.36	20.17
	2012	293	2	100	71.61	22.69
	2013	430	2	98.7	53.18	27.11
	2014	230	1	100	56.94	30.94

3) A comparison with samples of cocaine hydrochloride

The data available for this compendium on samples of cocaine hydrochloride come from Brazil and Paraguay and we draw the following analysis from them.

- ✓ In **Brazil**, 87% (100 - 23%) of the samples of cocaine hydrochloride contained adulterants and this percentage is higher than for cocaine base at 57% (110-43%). The smokable cocaine forms showed an average purity level of 66% while purity was 44.5% in the hydrochloride salt form. This means that the samples considered smokable cocaines (base) are less adulterated (43% have no adulterants) and where there is adulteration phenacetin has the highest presence while caffeine and lidocaine were the most frequent adulterants in the hydrochloride samples. (Table 2.12). An interpretation here is that these adulterants are not under the control of Resolution SVS 344/98 and are thus sold freely throughout Brazil.

- ✓ In **Paraguay**, 44.8% of the samples of cocaine hydrochloride have adulterants, higher than for cocaine base. The main adulterants are phenacetin (28.8%), lidocaine (26.6), and caffeine (26.5%). Phenacetin is less present than in the samples of cocaine base while lidocaine and caffeine are more present. As in the base samples, the main adulterants change according to the year: lidocaine in 2009 (like base), caffeine and lidocaine in 2010, caffeine in 2011, paracetamol in 2012 and 2013 (like base) and lidocaine in 2014. The number of samples of cocaine hydrochloride multiplied slightly more than three times over the period 2009-2014, but there was less growth than for cocaine base, where seizures grow and gain weight within the cocaines. The total number of analyzed seizures of cocaine that correspond to cocaine hydrochloride fell from 64% in 2009 to 28% in 2014 (See Table 4 in Chapter 6). In addition, the average purity level in the hydrochloride samples falls over time, from 73.64% to 56.94%, unlike cocaine base where the purity level increases. (Tables 2.13 and 2.14).

Table 2.12: BRAZIL: Adulterants identified in all samples and in each form of presentation. 2011-2014

Adulterants identified*

		Without Adulterant	Ben	Phe	Caf	Lid	Ami	Lev	Pro
All (N=642)	Frequency (%)†	34	7	47	19	13	8	3	0
	Ave. Level (%)**	-	13.7	12.2	21.9	9.7	4.4	10.8	2.5
Free base (N=411)	Frequency (%)	43	2	54	4	2	11	0	0
	Ave. Level (%)	-	14.6	15.2	16.9	2.8	4.1	0	0
HCl (N=65)	Frequency (%)	23	0	18	58	37	3	23	0
	Ave. Level (%)	-	0	2.4	30.3	10.4	16.6	13.2	0
"n.d." (N=166)	Frequency (%)	9	23	44	43	32	4	2	2
	Ave. Level (%)	11	13.5	4.8	18.5	3.0	0,0	1.5	2.5

*Ben=benzocaine, Phe=phenacetin, Caf=caffeine, Lid=lidocaine, Ami=aminopyrine, Lev=levamisole, Pro=procaine

†One or more adulterants may be present in each sample.

**Average level of samples that contain the adulterant.

Table 2.13: PARAGUAY: Adulterants present according to form of cocaine. 2009-2014

Form of cocaine	Caffeine		Lidocaine		Benzocaine		Phenacetin		Levamisole		Paracetamol		All adulterated samples
Base	96	17.9%	123	22.9%	22	4.1%	234	43.7%	23	4.3%	144	26.9%	536
HCL	167	26.5%	168	26.6%	29	4.6%	182	28.8%	128	20.3%	121	19.2%	631
Total	263	22.5%	291	24.9%	51	4.4%	416	35.6%	151	12.9%	265	22.7%	1167

Table 2.14: PARAGUAY: Adulterants present by year according to form of cocaine. 2009-2014

Form of cocaine	Year	Caffeine	Lidocaine	Benzocaine	Phenacetin	Levamisole	Paracetamol
BASE	2009	21 32%	34 52%	6 9%			4 6%
	2010	20 39%	19 37%	11 22%			1 2%
	2011	8 10%	7 9%	2 3%			62 78%
	2012	11 11%	17 17%	3 3%	2 2%	2 2%	67 66%
	2013	4 17%	2 8%		13 54%	1 4%	4 17%
	2014	32 10%	44 14%		219 68%	20 6%	6 2%
HCL	2009	19 38%	25 50%	3 6%	0 0%		3 6%
	2010	9 38%	9 38%		0 0%		6 25%
	2011	7 33%	6 29%	2 10%	0 0%		6 29%
	2012	15 8%	18 10%	2 1%	1 1%	61 32%	91 48%
	2013	72 21%	55 16%	20 6%	144 42%	34 10%	15 4%
	2014	45 26%	55 32%	2 1%	37 22%	33 19%	

4) Origin of seizures

An interesting topic for analysis and exploration regarding the types of adulterants is their association with other variables such as where the analyzed samples come from and whether the seizures there were part of large sale trafficking or micro-trafficking, i.e., substances intended for direct consumption.

As mentioned in the preceding section when describing the units of analysis, the origins of the samples analyzed are different according to the country. Chile and Paraguay analyze all samples seized in the country while in Argentina, Brazil, and Uruguay the samples come from specific areas, but in all cases they are areas of high consumption and/or circulation of smokable cocaines: suburban areas of the province of Buenos Aires and La Plata, samples of street cocaine seized between the years 2011 and 2014 in five Brazilian states (Manaus, Acre, Mato Grosso, Mato Grosso do Sul, Paraná, Río de Janeiro, Sao Paulo, Distrito Federal), and in the southern departments of the country, Montevideo, Canelones, and San José in Uruguay.

It is possible to determine that samples were intended for consumption based on how they were divided up and prepared for sale at the time they were seized. For example, in Argentina, the analyzed lots of cocaine substances that weighed less than one gram were divided up into various types of wrappers such as: glazed paper in different colors and sealed by folding the paper, folded paper napkins, nylon in different colors (usually transparent, white, and black), sealed with a knot or heat sealed at one end, and wrappers made of cellophane and nylon in the shape of chalk (see images in Chapter 3).

In **Uruguay**, 97.7% of the samples analyzed correspond to forms intended for consumption such as tear, package, chip of rock, *chasqui,* rock, chalk, or brick, while the remaining 2.3% would be part of traffic at another scale, in brick or capsule form in the experts' opinion (See Chapter 7).

This means that the analysis of the presence of adulterants in the samples from Argentina, Brazil, Uruguay corresponds entirely to substances that are being used by the population and this aspect should be studied in greater depth in future research.

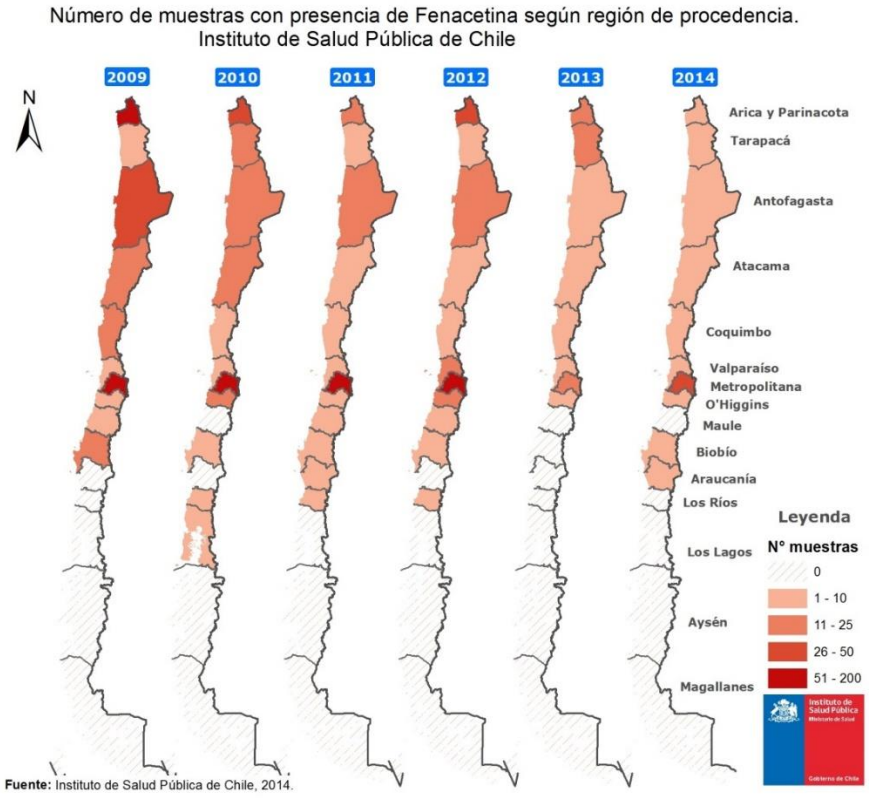
Chile proceeds to analyze the presence of adulterants in samples of cocaine base paste in 15 regions of the country and over the period 2009-2014 (See Chapter 5). The first notable datum is that the largest quantity of samples received throughout the period, i.e., the seizures, were taken in the north of the country, which is where the drug enters, to be sold later most frequently in the Metropolitan Region. In contrast, as we move further south the number of seizures decreases dramatically. Thus, the largest number of samples comes from Arica and Parinacota, Tarapacá and Antofagasta, which are three regions of the north and the Metropolitan region.

In the analysis of the concentration of cocaine base by regions and in the period under observation, the data show that the highest concentration of cocaine is found in the northern area of the country. However, in 2014 some seizures found in the southern area exceeded the national average in a context of an increase in the average concentration of seizures of slightly more than 10 percentage points compared to 2013.

The use of carbonates, the main diluent of cocaine base used to increase its volume, observed by regions, is an indicator of the place there this process is likely occurring. The highest frequency in the use of carbonate in recent years is seen in the Metropolitan Region, indicating that cocaine base is adulterated in the center of the country prior to being sold and is no longer arriving with this substance from the north of the country as happened in earlier years.

As the main adulterants of cocaine base are caffeine and phenacetin, the following figures show their distribution in seizures in the period 2009-2014 in the various regions of the country.

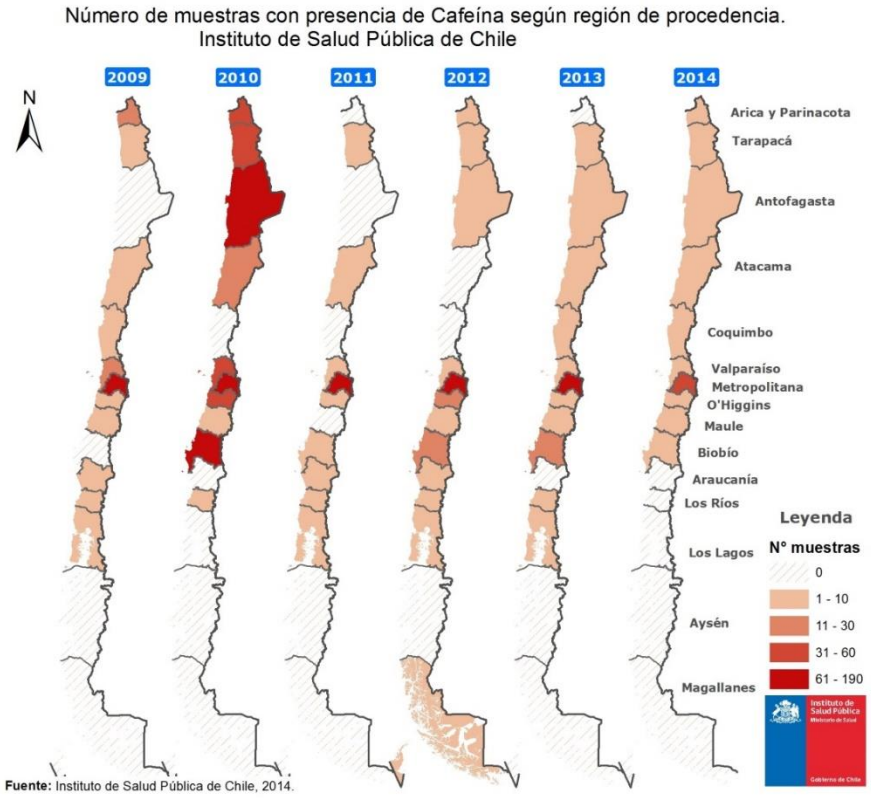
Figure 2.3: CHILE: Phenacetin in samples according to region of origin.



A marked decline is seen in the appearances of phenacetin, which is related to the increase in the concentration of cocaine base in 2014. There was also a change starting in 2010, when phenacetin ceased to be found in large amounts in the north of the country, to appear in the Metropolitan Region.

The following figure indicates that in the case of caffeine there is also evidence of a decline in this adulterant in the northern regions of the country and a continued and increased presence to the south of the Metropolitan Region, which may be explained by the fact that this substance can be purchased by anyone without much trouble, making it the substance of choice as an adulterant in Santiago because it is easily accessed and has a stimulant effect.

Figure 2.4: CHILE: Caffeine in samples according to region of origin.



In **Paraguay** it is possible to identify the departments or regions of origin of the samples analyzed, for both cocaine base and cocaine hydrochloride. On the whole, 90.5% of the samples come from the departments of Asunción (73.9%), Central (10%), and Alto Paraná (66%) (See complete distribution in Table 6.5 in Chapter 6). When base is distinguished from hydrochloride, we can see that in the central department there are more seizures of cocaine base than cocaine hydrochloride (12% versus 7.4%).

As can be seen in the following table, seizures conducted in Asunción have a higher average purity level, whether they are cocaine base or cocaine hydrochloride.

Table 2.15: PARAGUAY: Measures of central tendency and dispersion for cocaine purity by type and region.

Type of cocaine	Region	N	Min	Max	Ave.	SD
BASE	Alto Paraná	119	2	98	48.20	26.50
	Asunción	1228	1	92	64.99	25.07
	Central	212	1,2	99.2	62.29	23.82
	Other	207	1,4	95	59.30	26.82
HCL	Alto Paraná	90	2	100	45.07	29.67
	Asunción	1119	1	100	68.09	25.25
	Central	104	1	99.8	53.12	32.69
	Other	96	2	100	52.72	31.28

Another variable of analysis is the origin of the samples according to whether they come from micro-traffic or traffic. Of the total number of cocaine base samples, 75% comes from micro-trafficking, while this percentage falls to 43% when the seizures are cocaine hydrochloride, in a general context in which retail seizures predominate (61%). It is interesting to find that the purity level of cocaine base is similar, regardless of the trafficking level and is about 63%. This is not true for cocaine hydrochloride, which shows a higher purity level when it corresponds to trafficking, as shown in the following table.

Table 2.16: PARAGUAY: Measures of central tendency and dispersion for cocaine purity according to type and distribution method.

Type of cocaine	Method	N	Min	Max	Media	SD
BASE	Micro-trafficking	1320	1	98.0	62.81	25.36
	Trafficking	446	1	99.5	63.04	26.29
HCL	Micro-trafficking	605	1	96.0	53.48	28.48
	Trafficking	804	1	100	72.74	23.57

The data on the presence of adulterants in the samples according to whether they correspond to micro-trafficking or trafficking are shown in the following table:

Table 2.17: PARAGUAY: Adulterants according to type of drug and trafficking level of total adulterated samples.

ADULTERANTS	MICRO-TRAFFICKING			TRAFFICKING		
	Base (n=449)	HCL (n=421)	Total (n=870)	Base (n=87)	HCL (n=210)	Total (n=297)
Caffeine	77 17.1%	99 23.5%	176 20.2%	19 **21.8%**	68 **32.4%**	87 **29.3%**
Lidocaine	106 **23.6%**	106 **25.2%**	212 **24.4%**	17 **19.5%**	62 29.5%	79 **26.6%**
Benzocaine	21 4.7%	12 2.9%	33 3.8%	1 1.1%	17 8.1%	18 6.1%
Phenacetin	191 **42.5%**	166 **39.4%**	357 **41.0%**	43 **49.4%**	16 7.6%	59 19.9%
Levamisole	14 3.1%	40 9.5%	54 6.2%	9 10.3%	88 **41.9%**	97 **32.7%**
Paracetamol	133 **29.6%**	104 **24.7%**	237 **27.2%**	11 12.6%	17 8.1%	28 9.4%

First, the presence of adulterants in the samples for direct consumption is characterized by a higher presence of phenacetin (41%) and paracetamol (27.2%), followed by lidocaine (24.4%) and caffeine (20.2%). When samples are more related to large-scale trafficking, they contain higher levels of levamisole (32.7%), caffeine (29.3%), and lidocaine (26.6%).

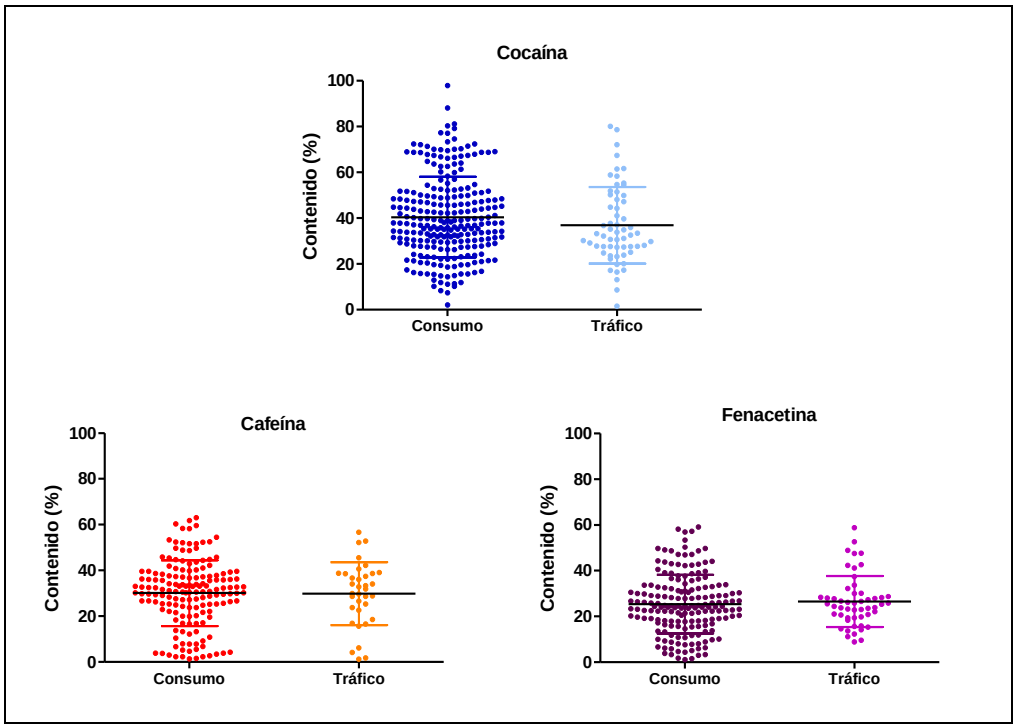
Secondly, when samples of **cocaine base** are observed according to whether they are related to retail trafficking or larger-scale trafficking, in both cases phenacetin is the main adulterant and present in 42.5% of the samples from micro-trafficking and 49.4% of the samples from larger-scale trafficking. The differences according to the type of seizures indicate that paracetamol is the second most common adulterant in micro-trafficking and caffeine is the second most common adulterant in larger-scale seizures. Lidocaine is present as the third adulterant of cocaine base, regardless of the type of seizure.

The samples of **cocaine hydrochloride** intended for direct consumption are adulterated with phenacetin at a rate of 39.4%, followed by lidocaine (25.2%) and paracetamol (24.7%). In contrast, in those corresponding to larger-scale trafficking phenacetin has less weight and levamisole is in first place (41.9%), followed by caffeine (21.8%) and lidocaine (19.5%).

Thus, chemically analyzing the composition of the drugs according to place or territory and whether they are part of a larger trafficking shipment or already prepared for personal consumption is very important in that the adulterants used differ in importance. In any case, further analysis of the presence of each of these adulterants in the samples and the oxidation levels is necessary in order to determine their quantitative importance in the samples.

In **Uruguay** the result of quantitative analysis of the adulterants in samples grouped according to their intended use, whether for consumption or for trafficking, indicates the absence of obvious differences according to sample types, as seen in the figure below.

Figure 2.5: Content of cocaine, caffeine, and phenacetin in samples for consumption and for trafficking



2.4 Perspectives and questions

The chemical composition analysis of the substances seized emerges as an key topic in recent years in the context of new problems related to consumption, new substances, as well as new challenges to the knowledge.

The new questions indicate the complexity and interrelationship between the different facets of the problem and the observations and considerations allowed by analysis of the chemical composition of drugs or psychoactive substances of abuse. These facets refer to the methods for manufacturing the drugs, the use of chemical precursors, pre-precursors and other legal or illegal chemical substances, sale methods and scales, the existence of adulteration and storage centers, the additional effects caused by consumption, the damages to physical and mental health associated with specific products, treatment required to address acute episodes of intoxication or chronic consumption, the information users need in order to control or at least know the risks, the information needed by prevention areas to raise awareness of and issue warnings about the dangerousness of certain substances, the adjustments that current

legislation requires on control of substances, the regionalization levels of the problem, and other aspects.

The set of problems related to the consumption and abuse of smokable cocaines in the countries involved in this project succeeded in making the problem of the lack of knowledge regarding the substance itself tangible. The first big questions is: What are smokable cocaines? What type of cocaine is it? How is it produced? What products does it contain?

There are questions that were answered in earlier research and were reiterated at the start of this compendium. There are questions that are continuously asked because consumption has not diminished, because the answers given have empirical support that was difficult to generalize, because the substances are known to be changing due to the sales strategies of their producers, or because chemical precursors are subject to restrictions and have to be replaced. Perhaps there are questions that lead us to other questions that are more institutionally and politically sensitive.

The data produced on the basis of these studies, i.e., a description of the adulterants and diluents involved and the purity levels of the substances intended for consumption, open up a wide range of considerations regarding aspects relating to the reduction of harm and risk factors. For example, this means that reducing harm involves other actors such as the pharmaceutical and chemical industry, current legislation regarding the regulation of the market for chemical precursors, pharmaceutical products, and even drugs of abuse. Similarly, the concept of the issue of risk is altered not only in relation to consumption and abuse, exposure and permeable attitudes toward consumption, but also the risk of contracting diseases that are not those typically linked to the drug, and the risk affecting other actors who are not users, such as those who divide up and adulterate the product and come into contact with chemical substances that entail risks to health and who are legally and socially vulnerable while they carry out illicit tasks.

By analyzing national samples to produce a regional or local level description, it is possible to identify different patterns of adulteration and/or routes for trafficking, selling, and dividing up the drugs. Some questions arise such as what does it mean that a specific adulterant has been detected in northern Chile or in the metropolitan area or that it has changed location over time? What does it mean or imply that the purity levels of cocaine base are higher in Asunción than in other departments of Paraguay?

The analysis of not just smokable cocaine base but cocaine hydrochloride as well has opened up another series of questions linked to production and sale as well as consumption. The information provided in this compendium indicates that despite having the same origin, the coca plant and its initial maceration process and the active ingredient itself would seem to travel along different trajectories. The uneven presence of adulterants, the preeminence of some over others, the greater homogeneity of cocaine base compared to cocaine hydrochloride, in terms of purity level, seem to be indicating an uneven path. Is this so? How does it happen? Are there different laboratories, different experts? Can we consider dissimilar marketing channels?

With regard to these questions, the initial analysis done by Paraguay with regard to the origin of the drugs, of micro-trafficking or trafficking, showed that the composition of cocaine base does not undergo significant changes depending on whether it is for direct consumption or part of a larger shipment or intended for larger scale trafficking. Are they divided into consumption territories? Or is access to paracetamol easier than access to caffeine in those territories? And immediately the next question arises: how are large quantities of these substances obtained? Are they controlled substances?
The longitudinal analysis done in Paraguay indicates the strong appearance of a new adulterant starting in 2013, phenacetin, which is also one of the main adulterants of cocaine base in all the countries as well as of cocaine hydrochloride in Paraguay. How is this substances accessed? Who provides or manufactures it? Is it incorporated from the outset in the production of cocaines, as the Andean Community study indicates, or can the cocaine also be adulterated in other areas (countries or regions within a country)?

2.5 The evidence for public policies

In recent years, all the multilateral organizations concerned with the problem of drugs have presented statements, strategic plans, and action plans promoting and seeking **evidence** on the different aspects of the problem. Ultimately, it is the call for scientific knowledge, which subordinates intuitive perspectives regarding the problem and makes it possible to achieve clear and manifest certainties that cannot be doubted or at least assertions that cannot be distorted or challenged by new research studies. What is important is how that knowledge or evidence is obtained. This assumes a search process based on the scientific method that complies with and respects a series of standards that are well-defined, public, transparent, and agreed upon by the scientific community.[16]

Aware of the epistemological and philosophical debate regarding the concept, scopes, and possibility of *scientific evidence*, this commentary seeks to hold up scientific evidence against intuitive knowledge or knowledge based on perceptions and data that do not meet the aforementioned conditions, which have so often prevailed in the decision-making on drug policies.

Another important question related to evidence is that it should also be assessed as the result of a question or a series of questions or problems and not just as knowledge achieved. The agency that poses the question or the definition of the problem is central and is in part the responsibility of policy or research management. In that sense, it becomes essential when considering the evidence for public policies to address the subject of the context in which the evidence is produced and developed.

Some evidence obtained in the development of this project is presented below:

The team from **Argentina** maintains that according to the chemical profile obtained from the samples and the assays done, cocaine intended to be used as smokable

[16] Domingo Comas Arnau: ¨Qué es la evidencia científica y como utilizarla? Una propuesta para profesionales de la intervención. Madrid. 2014

cocaine falls under the category of **Smokable Freebase Cocaine.** According to the established concentrations of cinnamoylcocaine these are highly purified cocaines and the temperatures reached with metal foam pipes exceed the boiling point.

The researchers in **Brazil** conclude that, as regards the material analyzed, the purity level of smokable street cocaine is higher than that of cocaine hydrochloride. It is estimated that in most cases freebase or free paste cocaine, in smokable form, is sold without adulterants, and when it is adulterated, phenacetin is the most frequent adulterant and present in 53% of cases. As for another set of conclusions, the investigations that led to this project seeking information available in the country on the analysis of samples or seizures of smokable cocaines indicate that chemical composition analyses are insufficient and most of the samples are classified as cocaine so that it is impossible to make a distinction between smokable cocaine and cocaine hydrochloride, and when the analysis is performed the adulterants controlled by current regulations are reported, leaving aside important substances such as aminopyrine, benzocaine, caffeine, phenacetin, lidocaine, levamisole, and procaine.

A separate paragraph is merited for the results found by the Brazilian team, which incorporated in the project an analysis of hair samples from 50 patients who were problem crack users. The presence of adulterants in hair samples reflects the problem of users' exposure to those contaminated samples that were found and seized by the police. Given the toxicity of those substances, the public health problem related to this exposure is clear, i.e., those substances are being absorbed by the organism and are having a toxic effect on it. It is interesting to note that all the samples analyzed showed the presence of adulterants, the most common being phenacetin, levamisole, aminopyrine, and lidocaine based on frequency. The authors maintain that this evidence found in hair samples shows the need to improve the laboratories' ability to conduct this composition given that adulterants are present in low concentrations (ppm). Without conducting these analyses on biological material it is impossible to establish a real diagnosis of the public health problem related to the use of smokable cocaines and the exposure to adulterants based on the use of this method.

The professionals of the Institute of Public Health of **Chile,** based on their experience, conclude that most of the cocaine samples seized and sold in Chile represent smokable cocaine and contain adulterants that are added to emulate the effects of cocaine. To be noted is the ever-increasing presence of caffeine as the main adulterant at the expense of others such as phenacetin or aminopyrine, substances that are added by those who sell cocaine and that may be even more harmful than cocaine itself.

Reports from the United Nations and SENDA indicate that the use of cocaine fell in Chile over the two-year period 2008-2010 (from 1.8% to 0.7%). However, they add that the use of this substance continues to be high, as can be seen in the constant increase in cocaine seizures in the country. As in many countries, the cocaine sold in Chile stands out for the low percentage of cocaine in each of the samples analyzed, revealing extensive adulteration of the drug.

The team in **Paraguay** maintains that at the national level the quantity of (smokable) **cocaine base** has fluctuated over the course of six years, with two notable peaks in 2012 and 2014. The analyses performed on the samples confirm that in the case of cocaine base the average purity level determined varies between 45% and 70%, while for cocaine HCL the average is between 50% and 80%.

The conclusions of the researchers in **Uruguay** regarding the samples analyzed reflect what users consumed over the period 2014-2015, with samples containing a mix of cocaine, phenacetin, and caffeine in similar proportions. This fact reveals the relevance of the adulterants in the pharmacological and/or toxicological effect of smokable cocaine.

Based on the results found and included in this compendium as well as the institutional and research process that carried out the process, the following considerations are possible regarding the evidence for public policies:

- The evidence regarding which chemical components are contained in the substances consumed by drug users in the countries and their regions provides input for other fields of knowledge and interventions:
  - ✓ To focus treatment in acute emergency and chronic treatment situations by having information on drug interactions.
  - ✓ To identify substances with specific patterns of use and abuse, specifying how taken, required doses, effects.
  - ✓ To provide information for the control of chemical precursors and adulterants.
  - ✓ To adapt laws and regulations on the sale of substances.
  - ✓ To provide information for policies on control of supply and trafficking, facilitating knowledge on the smokable cocaine preparation stage, origin, changes according to trends and zones.
  - ✓ To provide information for adjusting indicators of use in epidemiological studies.
  - ✓ To provide information for identifying causes of mortality and morbidity.

- The evidence produced in the context of this compendium has made it possible to achieve certainties regarding its importance and its potential in terms of comprehensive knowledge of drug problems, indicating the analytical lines that must be studied in greater depth and others that should be explored and developed.

2.6 Conclusions and recommendations

The implementation of this project, the visible result of which is this compendium, has revealed a series of considerations and recommendations for those who execute and decide on public policies with regard to the "drug problem," as described below.

- These chemical composition analyses of smokable cocaines must be expanded to include all substances seized and more representative samples (all of national territory or by regions or departments). The relevance of knowledge obtained based on analyzing different contextual variables has become evident.
- Solid and committed institutional mechanisms must be constructed that involve as many as possible of those involved in each stage of the process, from seizure to the analytical laboratory, in order to improve the quality and validity of the information and the agility of the process.
- The systematic nature of the analyses must be ensured. It was demonstrated that changes can only be observed on the basis of longitudinal, comparable, and systematic analyses.
- Create coordinated research teams that are constantly engaged in consultation and exchange, with articulated short, medium, and long-term objectives: chemical and toxicological analyses, clinical and pre-clinical studies, patient evaluation, epidemiological analyses, analysis of drug traffic, legislative analysis.
- It must be possible to analyze and reveal the speed of changes in adulterants in an acceptable and desirable amount of time in order to implement specific policies. The necessary actions should be taken to reduce the gap between knowledge and the problem to be resolved.
- Promote opportunities for the dissemination and discussion of results from the chemical composition analyses of drugs with the entire scientific, professional community and officials involved in policies on prevention, treatment, research, control of illicit traffic, chemical precursors, the judicial branch, legislators, and the media.

- Guarantee the budget and allocation of human resources for the implementation and development of these mechanisms (for analysis and dissemination), considering the long term and basic investment.
- The development of the project is seen as a launch pad for future actions at the regional level, such as:
  - ✓ New lines of research on synergy or potentiation mechanisms or antagonisms between adulterants and cocaine.
  - ✓ Analytical platform for the identification of new psychoactive substances (NPS).
  - ✓ Design of a regional database that can expand on the information from other countries for the development of regional analyses.
  - ✓ Development of training lines for security forces, judicial officers, health professionals (toxicologists, generalists, obstetricians) and officials in general.