

ORIGINAL ARTICLE

## Volatile Substance Misuse in Mexico: Correlates and Trends

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**This paper analyzes volatile substance misuse in Mexico since the 1980s. Data were collected from national household and school surveys, epidemiological surveillance systems, and studies among special populations. Volatile substance misuse begins at 12–14 years. Prevalence is approximately 1% in the general population, 7% among high school students, and higher for street children. Toluene is the main solvent used, but preferences vary within population groups. Volatile substance misuse has increased among youngsters that live in families and attend school. Marijuana and volatile substances are now the drugs of choice among Mexican female high school students. The study's limitations are noted.**

**Keywords** inhalants, solvents, toluene, epidemiology, Mexico, trends, specific products

### INTRODUCTION

Mexico is a highly populated country with more than 110 million inhabitants. Among them, 76.9% live in urban areas, 23.1% in rural communities, and approximately 51 million are under 25 years of age INEGI [Instituto Nacional de Estadística y Geografía], 2010). Volatile substance misuse (VSM) has been documented in Mexico since the 1960s, with systematic epidemiological research beginning in 1973. The first national household survey on addictions was conducted in 1988 and epidemiological surveillance systems have operated since 1986. In addition, qualitative research has been conducted to study the significance and magnitude of VSM in special populations. The aim of this study is to provide a comprehensive

description of correlates and trends associated with VSM in Mexico based on some of the available epidemiological data.

### METHOD

Data were gathered through regular household surveys of the general population, school surveys and studies among special populations, as well as continuous epidemiological monitoring systems. Household surveys allow for estimates and analysis of cohorts derived from cumulative incidence. School surveys allow for in-depth analysis of some variables, as they include larger samples of youth populations where the problem is concentrated. Studies among special populations complement general population household surveys and school surveys because a considerable proportion of youth drop out after elementary school and some marginalized groups are hard to reach. All surveys reviewed in this paper are cross sectional.

The instruments used in the various surveys reviewed were derived from a World Health Organization (WHO) project that aimed to increase comparability on drug use research, in which the Instituto Nacional de Psiquiatría (INP, Mexico) participated (Hughes et al., 1980). The developed guides were later updated by the National Institute on Drug Abuse (WHO, 2000). Additional questions also were added that resulted from special studies investigating substance use risk and protective factors<sup>1</sup> (Medina-Mora, Cravioto, Ortíz, Kuri, & Villatoro, 2003). The INP ethics committee approved the protocols and care was taken to avoid informants being identified in the databases.

Both Silvia L. Cruz and Jorge A. Villatoro contributed equally to this work.

<sup>1</sup>The reader is asked to consider that concepts and processes such as “risk” and “protective” factors are often noted in the literature, without adequately delineating their dimensions (linear, nonlinear), their “demands,” the critical necessary conditions (endogenously as well as exogenously, micro to macro levels) which are necessary for them to operate (begin, continue, become anchored and integrate, change as de facto realities change, cease, etc.) or not to operate and whether their underpinnings are theory driven, empirically based, individual and/or systemic stakeholder bound, historically bound, based upon “principles of faith,” or what. This is necessary to clarify, if possible, if these terms are not to remain as yet additional shibboleths in a field of many stereotypes. Editor's note.

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### National Household Surveys on Addiction

Five national household surveys on addiction have been conducted among people 12–65 years old: in 1988 ( $n = 12,581$ ), 1993 ( $n = 18,737$ ), 1998 ( $n = 9,600$ ), 2002 ( $n = 11,252$ ), and 2008 ( $n = 51,227$ ). The response rate was under 76% in all cases. The first three surveys included only urban populations (areas with more than 2,500 inhabitants), while the last two incorporated rural communities. The sample design was multistage and stratified. Validated questionnaires sharing the same core questions in all surveys were used (Secretaría de Salud, Consejo Nacional contra las Adicciones, Instituto Nacional de Psiquiatría Ramon de la Fuente, & Instituto Nacional de Salud Pública, 2009). Informed consent was obtained from all persons in the sample through a written form letter to all persons interviewed. A signed consent form was obtained from minors (i.e., under 18 years of age) and their parents.

### School Surveys

Twelve surveys have been conducted in public and private schools in Mexico City and the surrounding metropolitan area between 1976 and 2009. Random samples ( $n = 2,000$ – $3,500$  for surveys conducted from 1976 to 1991;  $n = 10,000$ – $12,000$  for those conducted after 1991) were selected from the Mexican Board of Education registers, including high schools (grades 7–12) and technical schools. The sample design was stratified (by county), with two stages (by school) and clustered (by groups). Validated questionnaires, with standard questions across all surveys, were used (Medina-Mora, Gómez-Mont, & Campillo, 1981; Villatoro et al., 2009).

### Information Reporting System on Drugs (IRSD)

This system relies on two, 30-day cross-sectional evaluations (in June and November) that have been conducted since 1986 among drug users admitted to 44 health and justice institutions in metropolitan Mexico City. Participating facilities and institutions include emergency rooms, drug user treatment centers, psychiatric wards, the Red Cross, and correctional facilities (Ortiz, Martínez, Meza, 2009; Grupo Interinstitucional para el desarrollo del Sistema de Reporte de Información en Drogas, 2009; Ortiz, Romano, & Soriano, 1989).

## RESULTS

### Volatile Substances Misused and Exposure Methods

Solvents, paint thinner, and glues are the products most frequently misused by the general population, students, and special populations. Use of “activo,” a toluene-enriched formulation distributed by drug dealers, is common in Mexico. Activo, which is sometimes almost pure toluene, is considered by users to be less harmful and to produce milder hangovers than other solvents (Lara, Medina-Mora, Romero, & Domínguez, 1998). Users commonly soak a rag with a solvent or pour glue into small plastic bottles or bags to facilitate inhaling the vapors through the mouth and nose. The soaked rag is called “mona,” and the related verb “monear” is used synonymously with volatile substance intoxication. Children also are reported to dampen their sleeves with thinner, thus making it easy to inhale the fumes by holding their sleeves close to their nose and mouth (Gutiérrez & Vega, 1995).

### VSM in the General Population

According to the National Household Surveys, less than 1% of the general population has ever misused volatile substances, with consistently higher levels of use among males. First use of volatile substances usually occurs at an early age. Table 1 shows trends during the past 20 years. The prevalence in the general urban population has remained stable with a slight decrease in the number of male users and a significant increase in female users. Thus, in 1988, only 5.2% of users were females, while 14.4% were female in 2008 (Secretaría de Salud et al., 2009).

### VSM Among High School Students

In 1976, school surveys documented that high school students were most likely to misuse, in order of frequency, alcohol, tobacco, volatile substances, and marijuana. “Ever use” of volatile substances among students increased in 1978 and remained relatively stable until 1997, when drug preferences shifted to cocaine and marijuana. In 2006, volatile substances were the second choice among misused substances (prevalence: 6.7%) (Figure 1a). Past year VSM among females increased in 2006 to levels similar to those in males, with a prevalence (4.1%) like that of marijuana (4%) (Figure 1b) (Villatoro et al., 2009). Preliminary data from the 2009 school survey indicate that VSM continues to increase in both genders.

TABLE 1. National trends of volatile substance misuse among urban population from 12 to 65 years old in Mexico (frequency and percentage of total population)

	1988		1998		2008	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Males	259,635	1.5	350,331	1.7	425,666	1.5
Females	14,352	0.1	30,883	0.1	71,886	0.2
Total	273,987	0.76	381,214	0.8	497,552	0.8
Age of first use <17 years	171,352	62.5	294,974	77.4	323,240	63.3

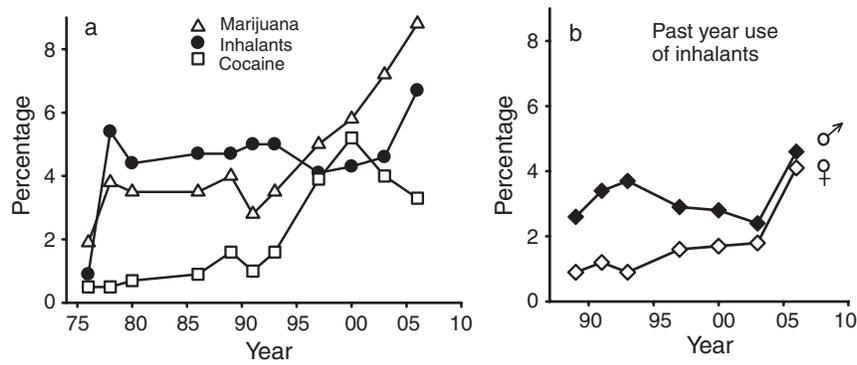


FIGURE 1. Trends in volatile substance misuse among high school students in Mexico City. (a) Ever use in the total sample. (b) Past year use in males and females ( $\sigma$  = male,  $\varphi$  = female).

### VSM Among Drug Users in the Mexico City Metropolitan Area

Trends of “ever use” of volatile substances, marijuana, and cocaine are shown in Figure 2. VSM has been consistently high in this population. From 1986 to 1997, volatile substances were the second-most misused substance. The use of volatile substances decreased from 1997 to 2006, when cocaine use increased, but VSM rebounded in recent years and is still high (Ortiz et al., 2009). Past year VSM data show that prevalence has consistently been much higher in males than females, but the gender gap was narrower in 2009, (76.3% vs. 27.3%) in comparison to a decade before (89.7% vs. 10.3% in 1999).

### VSM Among Specific Populations

VSM is more common among children who work and live in the streets than among students. At the beginning of the 1980s, 27% of minors working in a low-income sector of the capital, Mexico City (downtown), reported ever use; 22% reported daily use of volatile substances. Ten years later, a more complete sample showed a lifetime prevalence rate of 14.7% among children who lived in the streets (Medina-Mora, Gutiérrez, & Vega, 1997).

Urban migrants can become victims of human trafficking. Once in the cities, children easily can become engaged in VSM. Several Indigenous female sexual workers reported that when they first arrived in Mexico City, they were pressured by traffickers to use volatile substances and/or drink alcohol in order to accept their situation (Vega, Gutiérrez, Juarez, & Rendon, 2008).

On the basis of ethnographic studies conducted in the Mexico City metropolitan area, amyl-nitrites (“poppers”) have been used since the 1980s, primarily—but not exclusively—by homosexuals. According to the IRSD, mentions of poppers began in 1994 and have remained rare (<1%) and relatively stable since then.

Table 2 shows specific volatile substances of choice among males and females from two different populations at two time points. Solvents and toluene-based products are, by far, the preferred products in all groups. An interesting gender difference is that high school girls use more spray paints and school products than boys. In the urban population contacted by the IRSD, the preferred drug was activo. In the last evaluation, paint thinner use was more common among males than females. Gases, including PC cleaner, have appeared only recently.

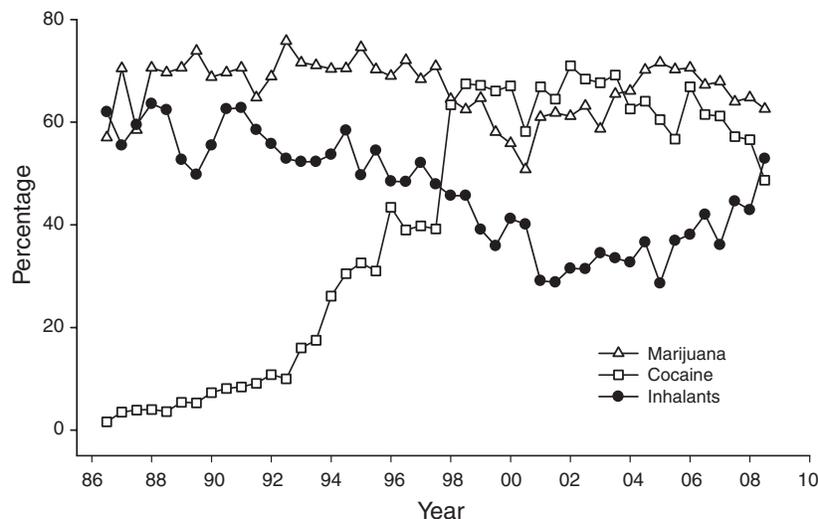


FIGURE 2. Ever use of illegal drugs among users admitted to health and justice institutions in the Mexico City metropolitan area.

TABLE 2. Percentage of mentions of volatile substances used by different Mexican populations

	Schools (2000)			Schools (2006)			IRSD (2000)			IRSD (2009)		
	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total
Paint thinner	50.3	50.6	50.3	45.9	48.6	47	17.3	20	17.5	6.3	1.9	8.7
Glues <sup>a</sup>	27.2	25.5	26.5	18.1	14.7	16.4	37.1	40	37.3	15.1	17.5	17.6
Activo	17	11.3	15	27.7	22.2	25.1	45.5	40	44.9	71.1	75.2	72.4 <sup>e</sup>
Spray paints	2.7	8.8	4.8	2	8.4	5	0	0	0	1	0.9	1
Other solvents <sup>b</sup>	2.1	3	2.5	2.8	3	2.8	NA	NA	NA	NA <sup>e</sup>	NA <sup>e</sup>	NA <sup>e</sup>
School supplies <sup>c</sup>	0	1	0.3	1.1	1.8	1.4	0	0	0	0	0	0
Gases <sup>d</sup>	0	0.5	0.2	0.5	1.2	0.9	0	0	0	0.2	1.4	0.5

<sup>a</sup>Glues include rubber cement (called “chemo”) and other proprietary brands of adhesives-containing solvents.

<sup>b</sup>Other solvents comprise gasoline, varnishes, and turpentine.

<sup>c</sup>School supplies include filter pens, markers, and correction fluid.

<sup>d</sup>Gases usually refer to computer duster and commercial products with butane and propane as propellant gases.

<sup>e</sup>In the SRID database, mentions of “solvents” are in the same category as “activo.”

## DISCUSSION

VSM is potentially fatal and can have significant adverse health consequences (Bowen, in this issue; Dingwall & Cairney, in this issue; Cruz, in this issue). As such, it has been recognized as a prevention challenge in Mexico for several decades (Medina-Mora et al., 1997; Ortiz et al., 2009). VSM was originally more prevalent among marginalized populations (Gutiérrez & Vega, 1995), but it has increased among youth who live with their families and attend school (Cruz & Domínguez, in this issue; Villatoro et al., 2009). VSM is more common among males in comparison to females in the general population with a 6:1 ratio (Secretaría de Salud et al., 2009). In spite of this, volatile substances are now, together with marijuana, the drugs of preference among female high school students (Villatoro et al., 2009).

Solvents are the most commonly misused volatile substances and some differences in specific product preferences exist among users. Paint thinner is the most frequently used solvent within high school students, but users in the Mexico City metropolitan area prefer activo. A comparison of VSM in Mexico and other countries exceeds the limits of this work; however, two aspects appear to be common: VSM is a widespread practice among children and adolescents and there is an increase in prevalence among females (Medina-Mora & Real, 2008).

### Study Limitations

Findings from both quantitative and qualitative studies are necessary to develop a comprehensive understanding of VSM because consistency of information from different sources adds credibility to self-report information. At the same time, each data source has its own limitations. For example, household surveys reach a high number of people but not hidden populations. Qualitative studies contact a limited number of people but provide valuable contextual information about drug users, their characteristics, and their sociocultural circumstances. For instance, qualitative studies show that VSM plays an important role

in very distinct sociological phenomena such as sexual exploitation and group identity. Further, the IRSD alert system provides information on key emerging drug use trends in the metropolitan area of Mexico City but does not estimate the magnitude of VSM in the country. On the other hand, high school students in Mexico represent only about 65% of the youth population (under 20 years of age). Therefore, these surveys do not accurately represent drug use among young people in general, as is the case in many developed countries (Medina-Mora, 1991).

In spite of these intrinsic limitations, the different epidemiological studies conducted in Mexico during the last several decades provide comprehensive and complementary information that constitutes a background for the planning, implementation, and evaluation of prevention and treatment programs. Studies conducted among children working or living on the streets have served in developing research strategies to meet children’s needs. With this information, several intervention programs have been developed, tested, and later disseminated in different parts of Mexico (Gutiérrez & Vega, 2009).

### Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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**Dr. Silvia L. Cruz, Ph.D.**, received her doctorate degree in pharmacology from Cinvestav, Mexico, in 1990, and spent a year as an NIDA/INVEST fellow at the Medical College of Virginia, Virginia Commonwealth University. Dr. Cruz has served as graduate program coordinator and chairman of the Department of Pharmacobiology at Cinvestav, where she is currently a full-time

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**Arturo Ortiz, Ph.D.**, has been a psychologist and researcher in the Mexican Institute of Psychiatry since 1978. He is in charge of the project Sistema de Reporte de Informacion en Drogas (Information Reporting System on Drugs), which twice a year since 1986 has provided a diagnostic evaluation of substance use in the metropolitan area of Mexico City. His research interest areas

are substance misuse and other addictions such as gambling, extreme sports, migration, and mental health. He has been a lecturer in different countries, a teacher at major universities in Mexico City, and has published scientific papers and chapters of books in the area of substance misuse. He is advisor to several agencies on substance misuse prevention and treatment. His hobby is ultra distance cycling.



**Maria Elena Medina-Mora, Ph.D.**, was born in Mexico City in 1951. She obtained her doctorate degree in social psychology at the UNAM. She is the General Director of National Institute of Psychiatry, México. She is also a member of the National College (Colegio Nacional), the National System of Researchers, level III (highest possible). She is part of the Board of Government of the

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## GLOSSARY

**Activo:** A toluene-enriched formulation commonly inhaled in Mexico and distributed by drug dealers.

**Mamilas:** Small plastic bottles in which a product (solvent, glue) is poured to inhale its fumes.

**Mona:** A rag soaked with a solvent.

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