ochealth CARE AGENCY

NITROUS OXIDE

Assessment of Misuse and Policy Recommendations

OC HEALTH CARE AGENCY SPECIAL REPORT

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Santa Ana, CA 92701

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CONTEXT FOR THIS SPECIAL REPORT

This report was created under the direction from the Orange County Board of Supervisors (Board) on February 11, 2025, when the Board approved an ordinance, which bans the sale or distribution of nitrous oxide for recreational use. The report contains local background information about nitrous oxide misuse, availability, and impact throughout Orange County (OC). Information in the report is the result of a collective effort by healthcare leaders at the OC Health Care Agency (HCA) as well as information gathered from other agencies, organizations, and businesses across the county. This report was written in a comprehensive manner to help inform a wide range of stakeholders in the community, including healthcare professionals, first responders, community organizations, and lawmakers of this emerging issue, despite limitations in data.

EXECUTIVE SUMMARY

Illicit use of nitrous oxide ("laughing gas") is an emerging public health concern in Orange County, reflecting anecdotal and documented trends observed both nationally and globally in recent years. Traditionally used for medical and commercial purposes, nitrous oxide has been increasingly misused for its short-term euphoric effects. Reports from community stakeholders, law enforcement, first responders and clinical providers in Orange County suggest a rise in illnesses associated with this misuse, particularly among adolescents and young adults. Nitrous oxide misuse has led to documented neurological harm, impaired judgement, and traffic accidents.

Comprehensive data on the prevalence and health impacts of nitrous oxide in California and Orange County remains limited. Data from emergency department visits, hospitalizations, and poison control center calls related to nitrous oxide misuse are currently limited and/or unavailable - whether due to lack of systematic collection, underreporting, or absence of mechanisms specifically designed to capture this information. This gap in data creates challenges in fully understanding local trends which is helpful in the development of effective, evidence-based interventions.

Several states and jurisdictions - including Orange County - have only recently begun enacting ordinances restricting the sale or possession of nitrous oxide cartridges outside of legitimate uses. We are in our infancy in understanding the full long-term effects of this substance on the residents of Orange County.

As Orange County continues to prioritize the health and safety of its residents, a more coordinated and comprehensive response is needed. This includes raising awareness among providers and the public, exploring potential policy and regulatory strategies to curb misuse, and strengthening local data collection and surveillance systems to better monitor emerging substance use trends.

Gaining a better understanding of the scope of this emerging issue is the first step we can all take to creating a comprehensive response tailored to our community's needs.

BACKGROUND

Misuse of nitrous oxide - commonly known as "laughing gas," "whippets," or "NOS" is a growing public health and safety concern. Originally used for medical and industrial purposes, nitrous oxide is increasingly misused by adolescents and young adults for its euphoric and dissociative effects.

Recent accounts from the community regarding the misuse of nitrous oxide illustrate the negative impacts of its increasing use and availability. Nitrous intoxication has been linked to vehicle accidents in Orange County, most notably the fatal collision among 7 young people, killing three.[1] More recently, Tustin police arrested a driver who was actively inhaling nitrous oxide behind the wheel and seized nearly 90 canisters of nitrous oxide from the vehicle in late August 2025.[2]

> *"Nitrous Oxide is prevalent in the community. It's at party scenes and planned social media meet ups." Deputy Chief Julian Rodriguez, Santa Ana Police Department.*
>
> *"As a neurologist, it is concerning that more recently I have seen more young adults in their 30's and 40's who now have difficulty walking because of significant degeneration of the spinal cord related to nitrous oxide use" Dr. Joey Gee, local neurologist.*
>
> *"Some stories are memorable and haunting. A 17-year-old patient flatly told me his story. He and his best-friend were sitting on a roof, using nitrous, when his friend lost consciousness and rolled down and off the edge. His friend would never walk again but his nitrous use continued." - Dr. Jonathan Watson, Correctional Health Medical Director, OC Health Care Agency.*

Local medical professionals have also cited increases in the number of people using nitrous illicitly and developing serious complications, including memory issues, worsening mood disorders, psychosis, hallucinations, neurologic deficits, and spinal cord degeneration. These providers describe their patients were under the impression that nitrous oxide use is safe and cannot lead to health problems.[3]

This report provides an overview of local trends, associated risks, community impact, and a look at the ordinances enacted or considered by lawmakers for reducing harm and improving enforcement.

Nitrous oxide (N_2O) is a colorless, nonflammable gas that has legitimate use in health care, culinary, automotive, and electronics industries. Nitrous oxide has long been used in the medical community for its analgesic and anesthetic properties.[4,5,6] Its commercial use in the automotive industry includes enhancing engine performance, and in the electronics industry in the assembly of semiconductors.[7] In the culinary industry, it has been used to create light and whipped textures, among other uses.[8,9,10,11,12]

Alongside its legitimate applications, nitrous oxide has become an increasing public health concern due to the growing misuse for purposes of getting high. The widespread availability of canisters designed for non-medical use has made it easier to obtain the gas. Since 2010, manufacturers have increasingly marketed colorful and visually appealing canisters - often with branding that appears to target younger audiences. These canisters are usually marked for food-grade use but are in larger containers and infused with flavors that are not typical of use in the culinary industry. These marketing efforts have been further amplified by social media platforms, where pop stars and rap artists have glamorized misuse of this substance.

Reflecting these mounting concerns, the US Food and Drug Administration (FDA) issued an advisory on March 14, 2025, warning consumers against inhaling or misusing nitrous oxide from any size canister, tank, or charger, citing the risk of severe health consequences, including death. This warning was updated on June 4, 2025, to include an extended list of brand name nitrous oxide products.

The ease of access to nitrous oxide and the widespread perception of it as a "safe high" have contributed to its rising illicit use—locally, nationally, and globally. In response to these growing concerns and the associated risks to individual and public safety, interest is mounting in strategies to restrict access and prevent misuse of this substance. This report is meant to provide a review of current data on the misuse of nitrous oxide in Orange County. Of note, nitrous oxide is only one of many other easily accessed substances that can be inhaled for to achieve a high. Other substances include spray paints, correction fluids, glues, cleaning fluids, and other substances like amyl nitrate (poppers). The misuse and negative effects of other inhalants are beyond the scope of this report. Readers should know that like nitrous oxide, these are also easily accessed over the counter and when misused, can also contribute to severe health problems and even death.

Adverse Effects and Toxicology

Nitrous oxide, when inhaled over prolonged periods or used repeatedly, can be extremely harmful. Nitrous oxide interferes with vitamin B12, which is essential for nerve and blood health. Inappropriate use can cause:

- Damage to the nervous system that can lead to numbness, tingling, trouble walking, memory issues or mood changes, and the onset of bizarre behavior, psychosis or mood disorders.
- Severe cases can lead to the condition called subacute combined degeneration (SCD) of the spinal cord and death.
- Blood problems such as low red blood cell counts or anemia, and even heart disease. [13,14,15,16]
- Adverse reproductive effects that are toxic to the developing fetus.

People with underlying conditions or impaired vitamin B12 metabolism (Example: MTHFR deficiency - methylenetetrahydrofolate reductase gene) can be more vulnerable to its harmful effects.

Additionally, the method of inhalation, level of ventilation, and other factors can pose a risk. For example, higher concentrations of nitrous oxide exposure without adequate oxygenation or ventilation, can increase the risk of suffocation, while exposure to freezing temperatures upon contact of freezing depressurized tanks can cause thermal, burn injuries, whereas direct inhalation from pressurized tanks can lead to soft tissue injury or collapsed lung. [17]

SUBSTANCE MISUSE AND DEPENDENCE POTENTIAL

The misuse of nitrous oxide, where people intentionally seek to use the substance for the purpose of experiencing the rapid, short-lived euphoric high, is meeting growing concern with reports of increased misuse. This calls into question where individuals may be accessing nitrous oxide when not being used appropriately in the medical, automotive, electronics, or culinary fields.

Nitrous oxide is easily accessed and can be purchased online, at smoke shops, retail stores and specialty stores. It is known as “whippits,” “whip-its,” “whippets,” “hippie crack,” “nangs,” “funky balls,” and “galaxy gas.”

Misuse is commonly done by inhaling the gas by utilizing a “cracker” (small handheld flashlight-sized item that allows the user to quickly transfer gas into a balloon), or an adaptor. Escaping gas is captured in a balloon and inhaled to get a short-lasting euphoric sensation, typically several minutes, depending on the amount of gas inhaled.

The euphoria and dissociation caused by inhalation of nitrous oxide is often referred to as a “legal high.” Referring to its availability for legitimate use in medical, food, automotive settings. Once inhaled, nitrous oxide dissolves rapidly in the bloodstream, reaching the brain within seconds, and causing a sensation of well-being. [18] Laboratory studies with healthy adults have confirmed the presence of this dose-dependent sensation of pleasure at concentrations of 10 to 50%. The sensation peaks at two to three minutes and subsides within 15 to 20 minutes. [19,20,21]

Nitrous oxide use can cause intense vasodilation, which is an extreme widening of the blood vessels leading to a significant decrease in blood pressure, potentially causing circulatory shock, which is where the body’s circulatory system fails to deliver enough oxygen and nutrients to the body’s tissues and organs, low blood pressure, and rapid heart rate within seconds of inhalation. Effects are brief and estimated to last less than five minutes.

In some cases, individuals inhale the gas directly through cartridge nozzles or adaptors. When inhaled in this manner, contact from direct spraying or spilling of liquified gas or from the decrease in temperature of the depressurized canister can lead to contact burn injury around the mouth, face, or extremities. Several case reports have demonstrated cryogenic burn injury as well as barotrauma (injuries caused by a difference in pressure between the body and its surroundings) to the airway and lungs. [22,23] Illicit users of nitrous oxide gas are also more susceptible to asphyxiation and oxygen deprivation depending on the purity of the gas and the absence of oxygen-mixing.

Those who misuse nitrous oxide has presented to emergency departments with a range of neurologic symptoms including numbness or electric sensations, weakness in the legs and difficulty walking, genitourinary problems, confusion and personality changes, and other neuropsychiatric symptoms. [24,25]

Nitrous oxide has been linked in some studies to addiction, development of tolerance, and withdrawal. [26,27,28,29,30,31,32,33] A recent systematic review of the nitrous oxide studies found that while literature was limited and the body of evidence is still emerging, findings suggest that N_2O use disorder—based on the DSM-5 SUD criteria (Diagnostic and Statistical Manual of Mental Disorders, 5th Edition – Substance Use Disorder) —might exist in the heaviest N_2O users and concluded that the addictive potential of N_2O should not be underestimated.[34]Note that substance use disorder diagnoses consider a range of physiological and psychological symptoms, including tolerance, withdrawal, cravings, and functional impairment as a consequence of the substance use.

An individual can present with a wide array of symptoms and deficits which could be attributed to nitrous oxide use. For example, severe neurologic deficits or even psychosis can also be related to chronic nitrous oxide use. For providers suspecting chronic inhalant use, a comprehensive physical and neurological examination is recommended to assess for complications. Laboratory testing may help identify associated conditions such as electrolyte abnormalities, vitamin B12 deficiency, and potential liver or kidney impairment, as well as to detect other toxins in urine or serum. Imaging studies, such as MRI (magnetic resonance imaging), may be warranted when there is clinical suspicion of spinal cord degeneration resulting from chronic vitamin B12 deficiency.[35]

However, there are significant limitations in the routine testing for nitrous oxide exposure. Nitrous oxide is a volatile substance that is rapidly eliminated from the body and is not routinely detected in standard toxicology screens. As a result, objective confirmation of recent use is often not possible, making the diagnosis particularly reliant on clinical history. Some individuals may be aware of these testing limitations and may be more likely to engage in misuse under the assumption that it will not be detected, further complicating efforts to identify and intervene in cases of misuse.

DATA ON USE

Global

Misuse of nitrous oxide has been rising in Europe, Australia, and parts of Asia. According to the 2021 Global Drug Survey, which collected voluntary responses from over 32,000 individuals across 22 counties (primarily in Europe), 22.5% of survey respondents reported lifetime use of nitrous oxide, and nearly 10% had used it in the past year.[36]Longitudinal data show that among survey respondents 16 to 24 year olds, there was an increase from approximately 10% who used nitrous oxide in the past year in 2015 to over 20% in 2021, reflecting a growing trend in global use.[37]

National

Each year, the Substance Abuse and Mental Health Services Administration (SAMHSA), publishes the National Survey and Drug Use and Health (NSDUH) report. The most recent report, released in 2023, indicates that inhalant use remains a relatively small portion of overall substance use in the US. However, the data combines a wide range of substances under the umbrella of "inhalants." These include:

- Volatile solvents (e.g., paint thinners and removers, dry cleaning fluids, gasoline, glues, shoe polish, correction fluids)
- Aerosols (e.g., spray paints, deodorant and hair spray, fabric protector sprays, computer keyboard cleaner)
- Gases (e.g., ether, halothane, nitrous oxide, butane, propane)
- Nitrites (e.g., amyl nitrite, "poppers," locker room deodorizers "Rush")

When broken down by specific substances, nitrous oxide - often referred to as "whippets" - has shown fluctuating but notable levels of lifetime use. Among individuals 12 and older, reported lifetime use increased from 12.4 million in 2018 to nearly 14 million in 2022, then slightly decreased around 13 million in 2023. [38,39,40]

Further insights into adverse effects and emergency care utilization come from surveillance systems such as the National Electronic Injury Surveillance System (NEISS) which collects consumer-product related injuries treated in US emergency departments and the FDA Adverse Event Reporting System (FAERS) which collects reports of adverse events involving drugs and other biologic products. Between 2000 and 2019, these sources both noted a significant increase in nitrous oxide-related incidents:

- NEISS reported a six-fold increase in cases when comparing the periods 2000-2013 and 2014-2019. Over 90% of cases involved individuals ages 13 to 39, with 77% of cases occurring in males.
- Similarly, FAERS reported a 50-fold increase in adverse events over the same comparison period, with similar demographic patterns. [41]

State

In December 2024, the California Department of Public Health (CDPH) Regional Public Health Office surveyed local health jurisdictions to gather insights on the emerging concerns surrounding misuse of nitrous oxide across the state. While some counties shared no concern or "spikes" in case numbers, other counties did express concern either anecdotally, or with data from syndromic surveillance platforms (ESSENCE/BioSense), school district reports, traffic incidents, or observations of increased retail availability.

According to the Youth Risk Behavioral Health Surveillance System (YRBS), in 2019, 12.8% of California high school students reported ever using an inhalant. However, the survey does not distinguish between types of inhalants, so it is not possible to determine how many had used nitrous oxide specifically. [42]

CDPH's assessment identified growing anecdotal evidence of increased access to nitrous oxide, particularly through retail sources like smoke shops, and suggested rising usage among youth statewide. However, the absence of standardized surveillance definitions limits the ability to systematically monitor health impacts.

To track severe health outcomes, CDPH utilized the California Health Access and Information (HCAI) data on emergency department visits and hospitalizations.[43] HCAI datasets are composed from the mandatory reports of ED encounters and inpatient discharge records from California-licensed hospitals. Use of this dataset to understand the overall impact to the health care field is limited as chronic conditions that can result from acute or chronic use of nitrous oxide is not always treated in an inpatient or emergency department setting. For example, vitamin B12 deficiency ultimately leading to neurologic symptoms, including subacute combined degeneration (SCD) of the spinal cord are more likely to be diagnosed in the primary or specialty care settings - data sources not routinely captured in statewide hospitalization data.

Nationally standardized surveillance tools such as the National Syndromic Surveillance Program (NSSP) or the Council of State and Territorial Epidemiologists (CSTE) have yet to develop comprehensive case definitions or syndromic surveillance strategies specific to nitrous oxide use.

California Emergency Department and Hospitalization Data (2018-2023)

This section provides a summary of recent trends and health system data related to nitrous oxide use in California hospitals.

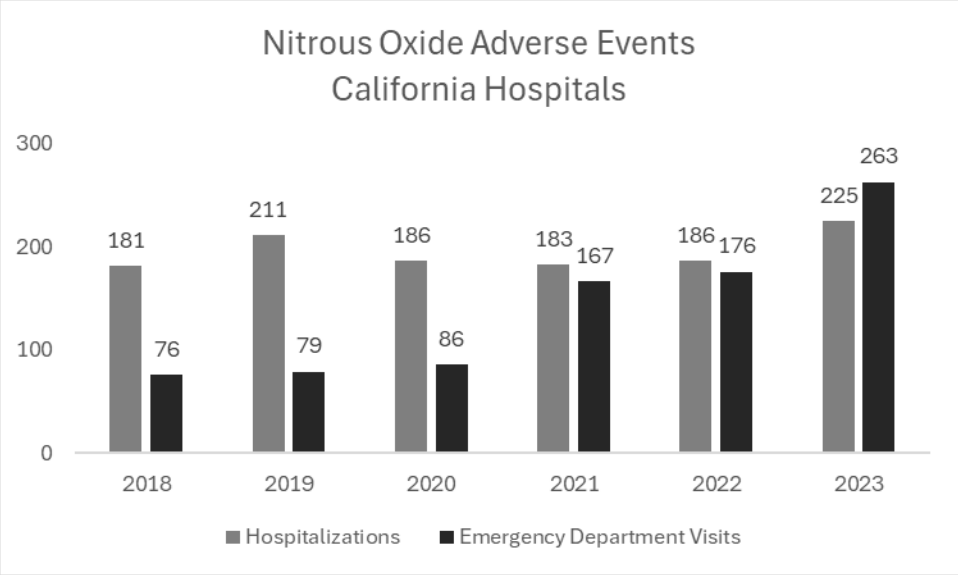
Using ICD-10-CM (International Classification of Diseases, 10th Revision, Clinical Modification) codes, CDPH defined nitrous oxide-related adverse events and B12 deficiency-related SCD as follows:

- Nitrous oxide adverse events: Acute poisoning or complications due to nitrogen oxides (T41.0x1A, T41.0x4A, T41.0x5A, T59.0XA). Note this definition includes the initial encounter for unintentional and undetermined intents for poisoning events but does not include intentional self-harm poisoning events or subsequent encounters.
- SCD due to vitamin B deficiency: G32.0 along with D51.8, D51.9, or E53.8.

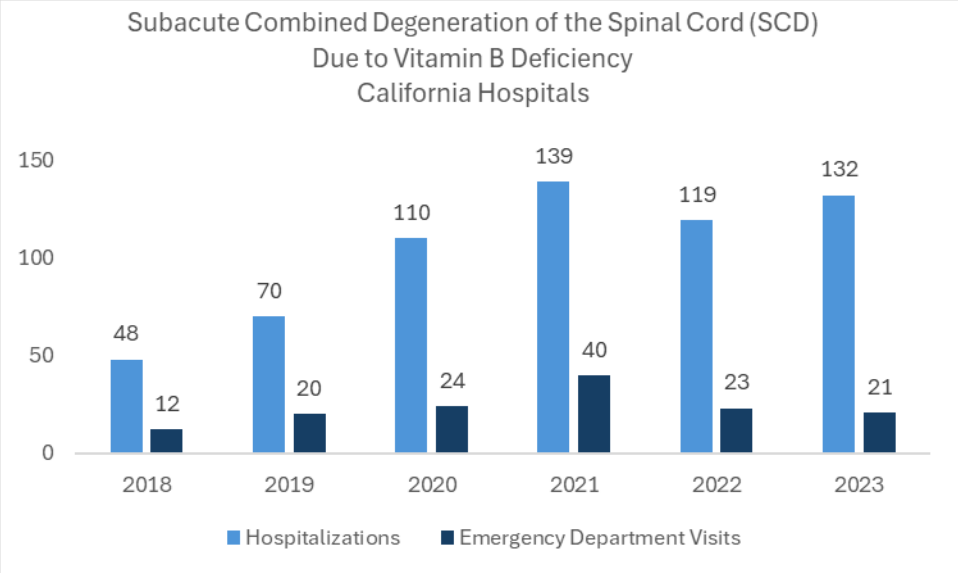
Key Findings from 2018 to 2023:

- Nitrous Oxide Adverse Events:
    - Emergency department visits related to nitrous oxide increased by 246%, from 76 visits in 2018 to 263 visits in 2023.
    - Hospitalizations also increased from 181 in 2018 to 225 in 2023. This 24% rise is modest compared to emergency department visits and does not show a consistent upward trajectory.
    - Hospitalizations outnumbered emergency department visits for the first time in 2023.
- Subacute Combined Degeneration (SCD) of the Spinal Cord:
    - Emergency department visits for this condition rose in 2021 but returned to previous levels in 2022 and 2023.
    - Hospitalizations for SCD due to vitamin B deficiency rose by 175%, from 48 to 132 cases during the same period.
    - Emergency department visits for this condition rose in 2021 but returned to previous levels in 2022 and 2023.

It's important to note that the true burden of SCD is likely underestimated, as these conditions are more frequently identified outside of hospital settings.



Source: HCAI, 2018-2023



Source: HCAI, 2018-2023

Mortality Data

The Substance and Addiction Prevention Branch (SAPB) at CDPH does not conduct routine surveillance of fatalities due to nitrous oxide alone. However, SAPB does conduct surveillance on fatal drug-related overdoses including when nitrous oxide is used in combination with other drugs within their scope (e.g., opioids, methamphetamines, etc.). In 2023, there were less than 11 unintentional (accidental) or undetermined drug-related overdose deaths that included nitrous oxide as one of the substances listed in the cause of death statement on the death certificate. This is likely an undercount of all fatalities involving nitrous oxide, given surveillance is conducted for other drug-related overdose deaths where nitrous oxide was listed as an involved substance.

Orange County Data

Orange County Emergency Department and Hospitalization Data (2018-2023)

Like the patterns seen statewide, Orange County hospitals also saw an increase in emergency department visits related to nitrous oxide poisonings and complications. The pattern was less obvious with respect to hospitalizations for subacute combined degeneration of the spinal cord due to a deficiency in vitamin B12 due to the small number of cases (fewer than 11 for each year from 2018 to 2023). In fact, even with the trend for nitrous oxide adverse events, the number of events in any year were fewer than 20, and thus assessments regarding patterns should be made with caution.

In addition to surveilling for nitrous oxide poisonings and degeneration of the spinal cord, the section below also includes counts for hospitalizations and emergency department visits in Orange County hospitals due to non-specific inhalant-related mental and behavioral disorders. While this classification covers more substances than just nitrous oxide, this diagnostic category is meaningful in assessing the extent of inhalant use/misuse.

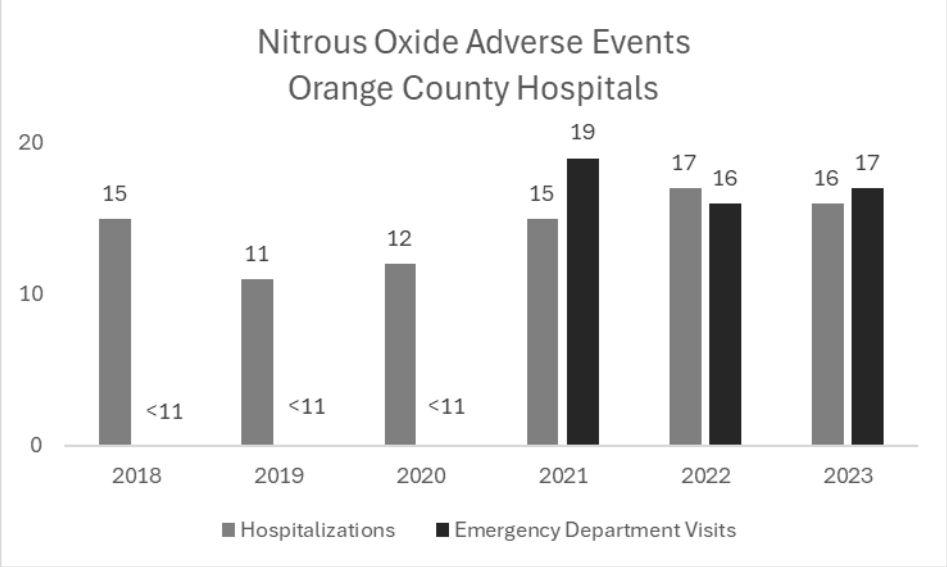
To track severe health outcomes, HCA, also utilized the California Health Access and Information (HCAI) data on emergency department visits and hospitalizations.[43] The HCAI dataset HCA used is composed from the mandatory reports of ED encounters and inpatient discharge records all the California-licensed hospitals located in Orange County.

Using ICD-10-CM codes, Orange County HCA followed CDPH definitions for nitrous oxide-related adverse events and B12 deficiency-related SCD as described in the previous section. Additionally, HCA defined inhalant-related disorders as:

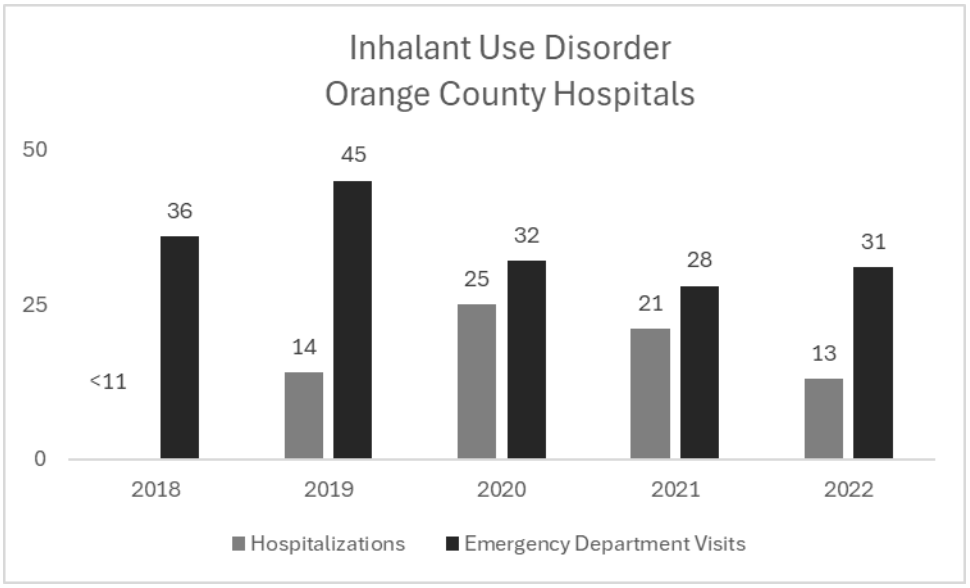
- Behavioral disorders resulting from volatile substances (includes nitrous oxide): Includes inhalant intoxication, dependence, and inhalant-related psychotic disorders (F18).

Key findings from 2018-2023:

- Nitrous Oxide Adverse Events:
    - Emergency department visits increased to 19 events in 2021, where the previous three years combined had totaled no more than 16 cases from 2018 to 2020. Cases did not continue to climb after 2021, but remained at similar, slightly lower levels.
    - Hospitalizations for nitrous oxide events remained mostly stable.
- Subacute Combined Degeneration (SCD) of the spinal cord:
    - Emergency department visits for this condition were fewer than 11 in any given year from 2018 to 2023. The cumulative total for all years from 2018 to 2023 was fewer than 11 visits.
    - Hospitalizations for SCD were also very few in Orange County hospitals, numbering fewer than 11 in any given year from 2018 to 2023, and totaling no more than 26 cases in that period. However, by 2023, there were 13 cases, more than any other year for the previous 5 years.
- Inhalant Use Disorder:
    - Hospitalizations and emergency department visits did not show a consistent increase pattern. Instead, emergency department visits peaked in 2019 at 45 cases, and hospitalizations peaked at 25 cases in 2020, before returning to similar levels to prior years by 2022 (2023 data not yet available).



Source: HCAI, 2018-2023

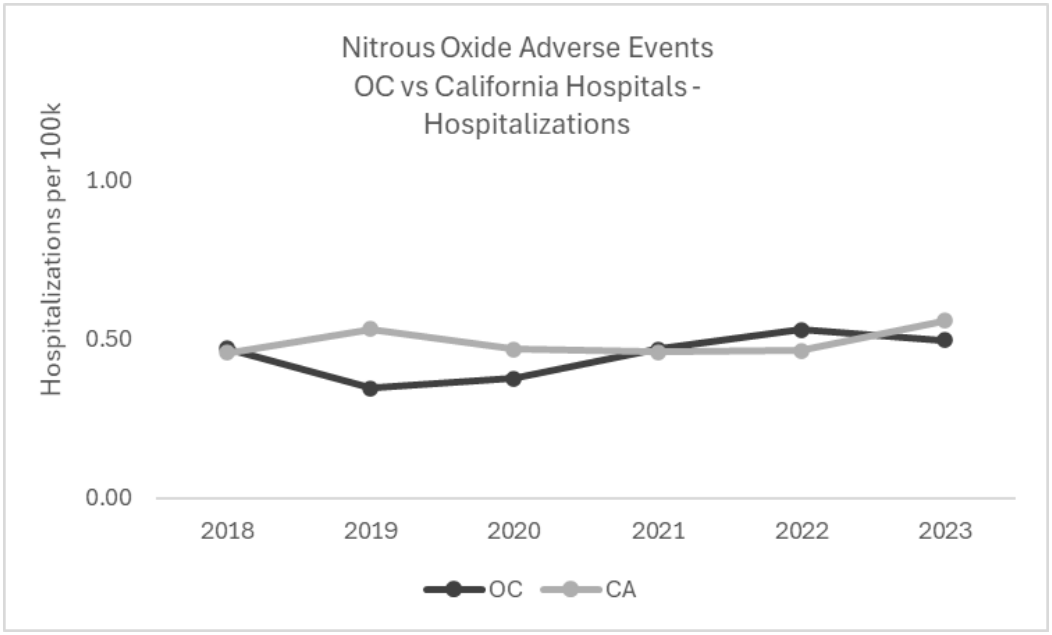


Source: HCAI, 2018-2022

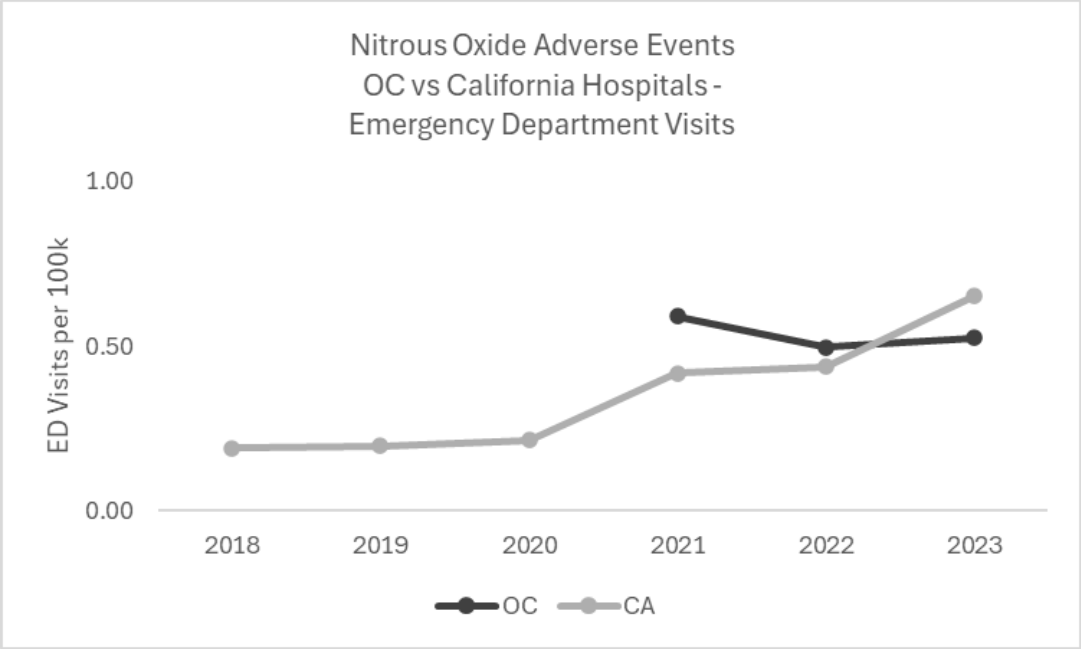
Comparing Orange County to California Trends in Nitrous Oxide Use

In order to compare nitrous oxide use in Orange County to California and account for population, the rate of hospitalization and emergency department visits per 100,000 population were calculated.

Generally, Orange County and California had similar rates for nitrous oxide adverse events. Note that Orange County's rates need to be interpreted with caution as they are based on 20 or fewer events, and thus less statistically stable. As a result, small differences in rates year-to-year or compared to California are not as meaningful.



Source: HCAI, 2018-2023; CA DOF P3, 2022 Vintage[44]



Source: HCAI, 2018-2023; CA DOF P3, 2022 Vintage

Orange County Mortality Data

Between 2020 and 2024, just under 11 deaths among Orange County residents were attributed to nitrous oxide poisoning or involved nitrous oxide as a contributing factor or underlying condition at the time of death. Notably, approximately two-thirds of these deaths were classified as suicides, while the remaining third were categorized as accidental or natural deaths in which nitrous oxide contributed to the individual's overall health condition or disease progression.

Orange County - Insights from the Community

Both the Orange County Department of Education (OCDE) and the OC Health Care Agency (HCA) administered anonymous surveys regarding nitrous oxide use in Orange County. These surveys assessed the extent of nitrous oxide misuse in the communities or schools where survey participants served and evaluated the associated level of concerns among the first responder community (for the HCA survey) and school district personnel (for the OCDE survey).

Orange County K-12 School Insights

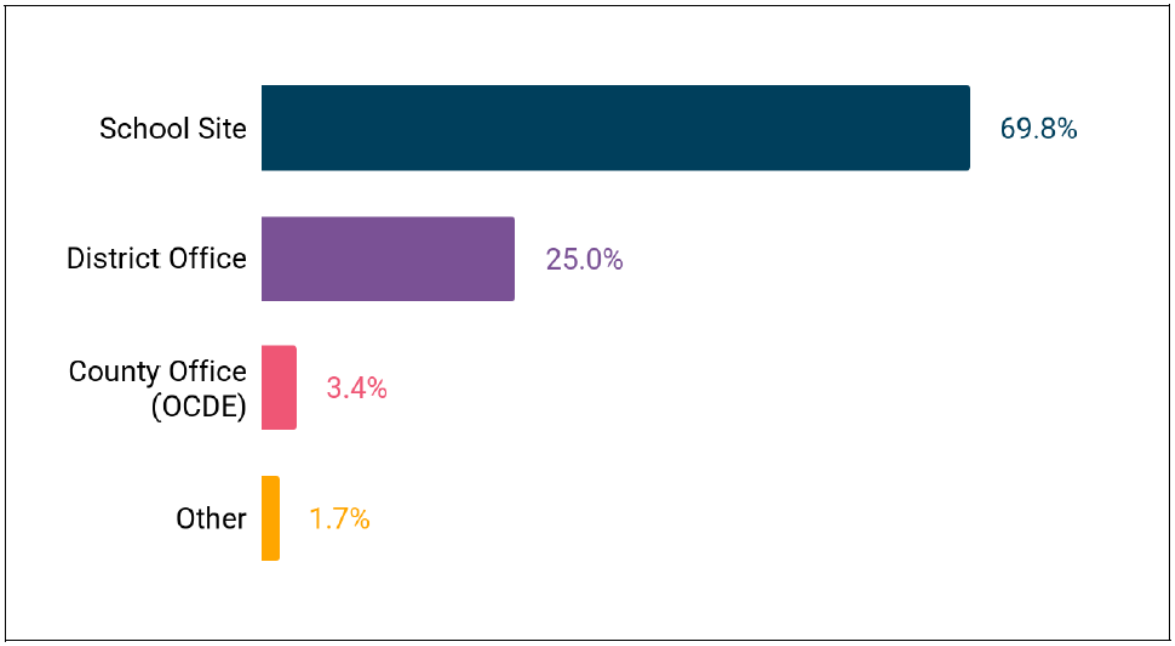
Earlier this year, the OCDE distributed an anonymous survey [45] to school and district personnel across Orange County to gain a better understanding of nitrous oxide misuse. Survey questions included respondent worksite location, work setting, role, witnessed or suspected incidents of nitrous oxide use in the past year, staff or student concerns around nitrous oxide use, level of concern by respondent, as well as an open space for additional comments or observations. A total of 114 staff personnel completed the survey with a larger proportion completed from Central County, followed by North County, West County and South County.

1. Respondent Worksite Location (n=114)

Region	Count	%
North County (Anaheim, Brea, Buena Park, Cypress, Fullerton, La Habra, La Palma, Placentia, or Yorba Linda)	31	27.2%
Central County (Garden Grove, Irvine, Orange, Santa Ana, Stanton, Tustin, Villa Park, or Westminster)	43	37.7%
West County (Costa Mesa, Fountain Valley, Huntington Beach, Los Alamitos, Newport Beach, or Seal Beach)	28	24.6%
South County (Aliso Viejo, Dana Point, Laguna Beach, Laguna Hills, Laguna Niguel, Laguna Woods, Lake Forest, Mission Viejo, Rancho Santa Margarita, San Clemente, or San Juan Capistrano)	12	10.5%

Source: OCDE, 2025

Most respondents were from school sites, with the majority serving as classroom teachers, school nurses or district administrators.



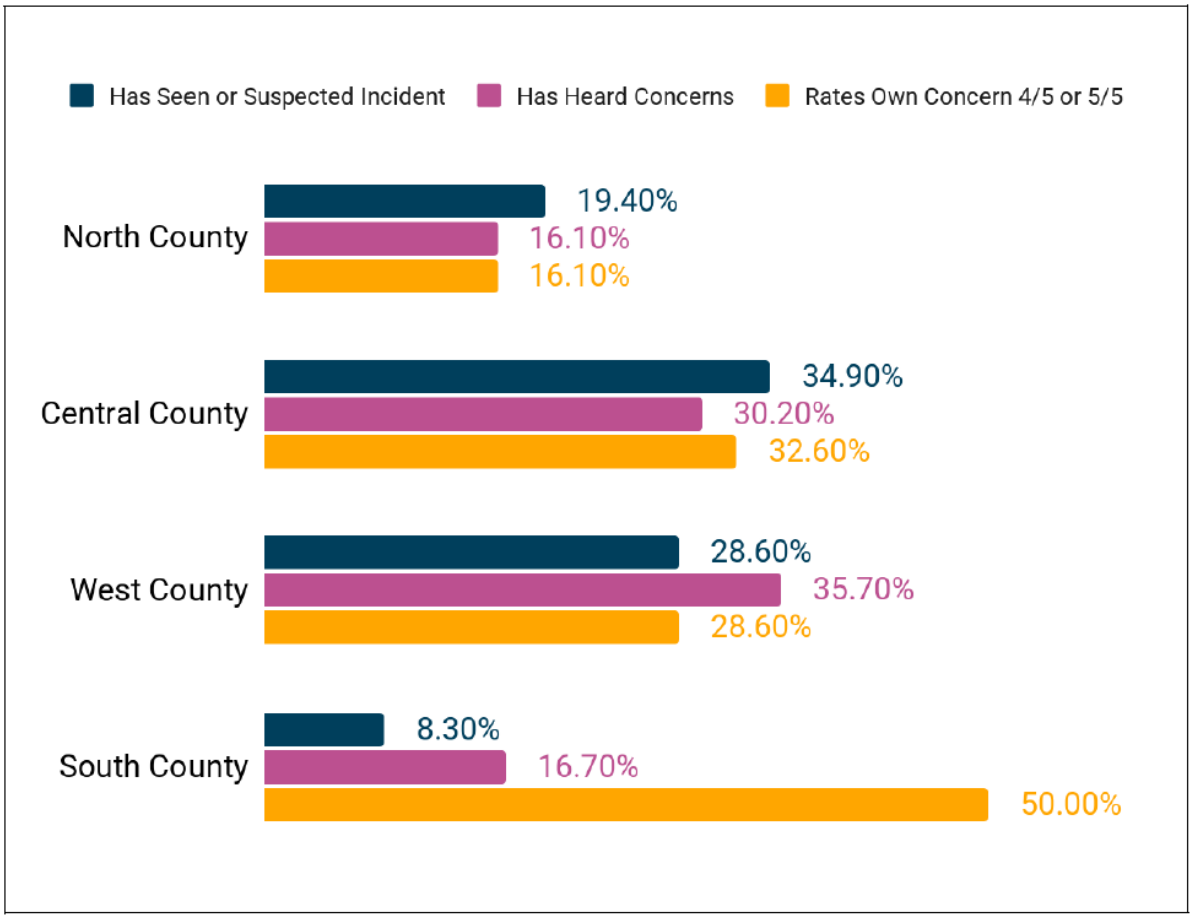
Source: OCDE, 2025

Reviewing responses by region, a higher percentage of respondents from West and Central County indicated seen or suspected nitrous oxide incidents and hearing of concerns about nitrous oxide from students or staff as well as personal concerns compared to other regions. While respondents from South County noted less seen or suspected incidents (8.3%) compared to other regions. The same respondents indicated higher rates of personal concern for nitrous oxide use.

Regional Differences

Region	Has seen or suspected an incident	Has heard concerns from students or staff members	Rates their own concern 4/5 or 5/5 (Very Concerned)
North County (n=31)	19.4%	16.1%	16.1%
Central County (n=43)	34.9%	30.2%	32.6%
West County (n=28)	28.6%	35.7%	28.6%
South County (n=12)	8.3%	16.7%	50.0%

Source: OCDE, 2025



Source: OCDE, 2025

Open ended responses indicated concerns for resurging misuse among high school students and at house parties, easy access through retail outlets, smoke shops, and party stores as well as identified paraphernalia found on or near school campuses. Responses also indicated a need for increased understanding of signs of use, understanding of risks, and the need for educational materials for staff, parents, and students.

Orange County - First Responder and Local Clinician Insights

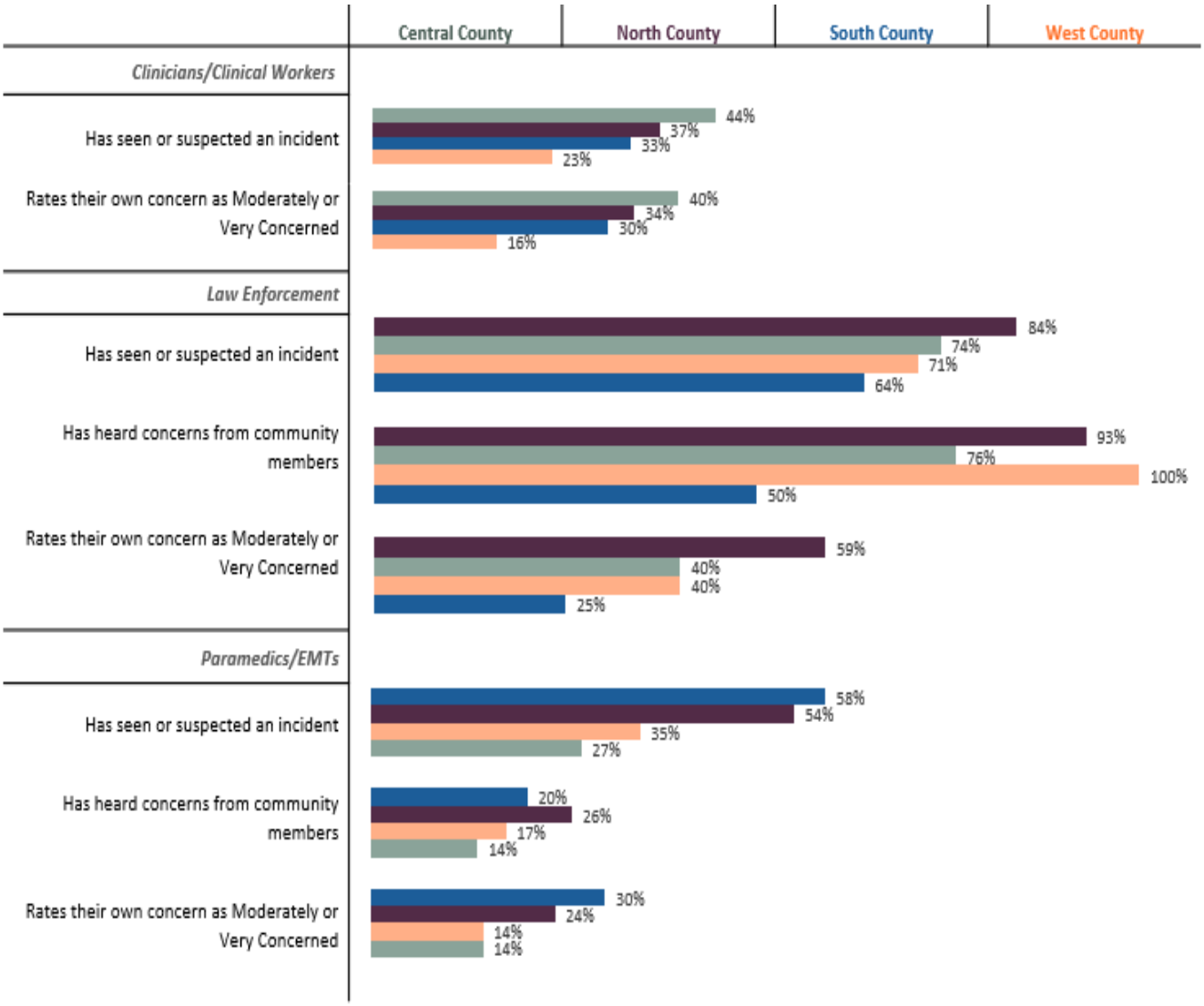
This survey[3] was conducted by HCA from March through May of 2025 and garnered 753 anonymous responses; 57% were from clinicians (n=431), 30% from members of law enforcement (n=225), and 14% from emergency medical technicians (EMTs)/paramedics (n=104). Overall, respondents had numerous concerns regarding their perception of the increasing trend of nitrous oxide misuse, the use of the substances among young persons, and the increased availability in retail settings and online.

Among all respondents, the most common level of concern was "somewhat" (24.7%), followed by "slightly" (21.8%). However, the level of concern varied widely by whether the respondent was a clinician, paramedics/EMT, or law enforcement, with members of law enforcement having the largest percent of respondents expressing high levels of concern ("very" at 26.1%), and paramedics/EMTs having the smallest percent of the three respondent types in this category (10.6%).

As seen in the following figure ("Select Responses from First Responder…"), clinicians and law enforcement working at sites in Central and North County had higher rates of seeing or suspecting an incident of nitrous oxide misuse and rating their own concern as moderately or very concerned. However, among paramedics and EMTs, the highest rates of seeing or suspecting an incident and rating their own concern as moderately or very concerned were highest among respondents working in South County. Furthermore:

- Law enforcement respondents showed the highest rate of concern and the highest number of incidents seen compared to clinicians/clinical workers and paramedics/EMTs.
- Respondents from North County from all three categories of first responders and clinicians/clinical workers consistently represented the geographical area most likely (or second-to the area most likely):
    - To have seen or suspected a nitrous oxide-related incident.
    - To have heard concerns about nitrous oxide from a community member.
    - To rate their concern regarding nitrous oxide as moderate to very concerned.

Select Responses in Nitrous Oxide Assessment by Job Role and Location of Work Site (%)



Source: Orange County HCA, 2025

Among all respondents, the most common response was to note the popularity, increased use, or upward trend of nitrous oxide use. Respondents also frequently noted the use and popularity among youths and minors. Many noted concerns about the availability and related ease of obtaining this substance at retail establishments.

It is interesting to note that several also responded that they did not see nitrous oxide use, or did not feel it was a concern, or not a concern in light of other substances used in the community (for example fentanyl). Several others noted use of nitrous oxide in motor vehicles and/or concerns while operating motor vehicles.

Orange County Fire Authority Insights

The Orange County Fire Authority (OCFA) which serves 23 cities and unincorporated areas across Orange County, reviewed nitrous oxide-related incidents based on calls for service between January 1, 2023 through March 17, 2025.[46] Data was limited, with many gaps and challenges in analyzing the data as many cases were categorized under general substance use or overdose and were not specifically identified as nitrous oxide-related incidents. Additionally, there was wide variability in documentation and dependence on clear physical evidence or patient self-report to link the incident to nitrous oxide use, making it more difficult to analyze data specific to nitrous oxide use. During the 26-month period, a total of 44 known nitrous oxide-related cases (0.00016%) out of 268,274 emergency medical service (EMS) calls for service were identified, with 72% of those 44 cases occurring amongst those ages 13 to 34.

While most of the nitrous oxide-related cases were due to misuse, four cases were related to adverse reactions from administration of nitrous oxide during medical or dental procedures - underscoring the importance of proper administration, monitoring, and post procedure evaluation when using nitrous oxide in medical settings.

Commonly reported symptoms included dizziness, confusion, and weakness. Many patients in settings suggestive of misuse included the presence of paraphernalia such as nitrous oxide canisters (68% of incidents) or ballons. Incidents occurred in urban settings, in residential areas, vehicles, and public spaces such as parking lots and parks. Cities with more than 5 nitrous oxide-related incidents included Garden Grove, Irvine, and Santa Ana.

REGULATORY EFFORTS – LAWS AND ORDINANCES

This section outlines how nitrous oxide is currently regulated across national, state, and Orange County, highlighting key gaps, enforcement challenges, and recent legislative actions aimed at curbing misuse of nitrous oxide.

National Public Health and Regulatory Efforts

While there is no overarching federal law specifically regulating misuse of nitrous oxide in the US, several states—including California, New York, and Texas—have implemented state-level legislation to curb use by restricting sales, setting age limits, and penalizing inhalation for intoxication. Federal oversight primarily focuses on the substance's legitimate applications in medicine, dentistry, and industry, with misuse addressed indirectly through use and distribution laws.

Existing Law in California

Nitrous oxide is listed under California Proposition 65 by the Office of Environmental Health Hazard Assessment (OEHHA) as a chemical known to cause developmental and reproductive toxicity.

Under California Penal Code 381b, it is a misdemeanor offense to sell, furnish, or distribute nitrous oxide if the seller knows, or reasonably should know, that the substance will be used for intoxication

Despite these regulations, due to legal provisions permitting sales to individuals 18 years of age and older, nitrous oxide canisters remain accessible in retail settings such as kitchen and restaurant supply stores, supermarkets and large retail department stores, specialty kitchen stores, automotive stores, smoke/vape shops, sex shops, gas stations as well as online retail platforms including Amazon, eBay, and Walmart. Earlier this year, Humboldt County, California published their findings *Recreational Nitrous Oxide Retail Landscape Analysis*[47] observing nitrous oxide products and paraphernalia located in plain sight at 24% of the retail outlets visited between October 2024 to April 2025, with the majority found at smoke shops.[i]

In practice, enforcement is challenging. Purchasers may withhold their intended use when questioned, and unless law enforcement directly witnesses inhalation, it is difficult to establish this use. In 2019, California Senate Bill 193 sought to restrict sales of nitrous oxide at smoke shops and tobacco retailers, but the measure failed to pass.

California Local Government Ordinances and other Local Actions

Across California, local governments, including county and city governments, have passed ordinances to address the emerging issue of the misuse of nitrous oxide.

Some locations have limited retailers ability to sell nitrous oxide or related devices (e.g., City of Stanton, City of Ukiah in Mendocino County, and the City of Rialto in San Bernardino County, and the City of Los Angeles, which banned the sale of nitrous oxide to minors).[48,49,50,51]Other locations have considered resolutions limiting nitrous oxide sale and distribution including the City of Santa Ana.[52] Shasta County issued a health alert warning against the misuse of nitrous oxide.[53]

[i] Humboldt County supports its work to prevent nitrous oxide misuse through education and prevention activities using the Department of Health Care Services (DHCS) Substance Use Block Grant (SUBG) Primary Prevention Services Grant.

Orange County Local Ordinance

On February 25, 2025, the Orange County Board of Supervisors approved an ordinance prohibiting the sale or distribution of nitrous oxide or related dispensing devices—except for:

- Food products where it is used as a culinary propellant
- Vehicle performance enhancement
- Medical or dental care

The ordinance went into effect on March 27, 2025, applying specifically to unincorporated areas of Orange County.[54]

PUBLIC HEALTH CONSIDERATIONS AND RECOMMENDATIONS

This section highlights key public health strategies to address nitrous oxide misuse, including calls to improve professional awareness, implement prevention efforts that include limiting access, and improve data collection.

RECOMMENDATIONS

- Improve Community and Professional Awareness
- Limit Access for Misuse
- Improve Data Collection and Surveillance

Improve Awareness

With the widespread availability and access to nitrous oxide and the growing prevalence of reported misuse, it is important to increase community and professional awareness of nitrous oxide misuse and the negative impacts this use can have on an individual's health and the welfare of their family and community.

Increased medical professional and first responder awareness is also needed so that appropriate care can be delivered.

With the increasing popularity and easy access of nitrous oxide for illicit use, sharing information with youth, parents and teachers could assist in prevention campaigns. Information on proper and safe disposal of canisters and tanks, when found, would also benefit the community.[ii]

To effectively increase awareness, lessons learned from the Tobacco Use Prevention Program, as well as the Fentanyl is Forever campaign, are worthwhile implementing to curb the misuse of inhalants - including nitrous oxide.

Limiting Access for Illicit Misuse

While selling nitrous oxide for the purpose of recreational intoxication is already illegal under California law, it is still widely available and easily accessed by the public at retail sites under a thin veneer of legitimate use. Culinary-grade nitrous oxide canisters are more easily accessed at smoke shops, adult sex shops, and through online retailers. Other retail sites where nitrous oxide can be purchased include also include grocery stores, retailers such as Walmart and Target, and automotive shops.[iii]

Local government can consider implementing ordinances for businesses in order to curb access to nitrous oxide for misuse. These can include additional signage and display restrictions, restriction of sales within certain distance to schools, parks, or other public locations. Additionally, cities and counties can consider adjusting business licensing requirements or adjust zoning and land use approvals to limit sales at businesses more commonly associated with misuse such as smoke/vape shops, sex shops, or gas stations.

With limited utility of flavored culinary grade nitrous oxide for culinary applications, flavored product sales can be limited to specialized culinary stores, and/or restricted to licensed restaurants/chefs for professional use. When sold for legitimate purposes (culinary use and automotive use), additional measures to minimize risk of misuse include restricting access to a locked area in the store to encourage store employees to follow appropriate measures, including checking identification for age prior to sales.

[ii] Here are some tips of what to do with nitrous oxide canisters, when discovered: Do not puncture, incinerate or store N_2O canisters near flammable materials; Do not dispose N_2O canisters in the regular trash; Contact OC Waste & Recycling for further instructions on where you can turn these items in for safe disposal. https://www.oclandfills.com/

[iii] **A Note about Environmental Impact and Appropriate Disposal of Nitrous Cylinders:**
One concern raised by community members in the first responder survey, as well as other forums, is the problem with proper disposal of nitrous oxide gas cylinders. Because they are pressurized containers, they must be handled separately from other waste, and not all facilities accept this type of waste.

Having more awareness regarding safe and proper disposal of gas cylinders and having more facilities accept this type of waste will increase community safety and reduce the negative environmental impacts of nitrous oxide.

Improve Data Collection and Surveillance

As noted in the process of creating this report, data remains inconsistent and limited regarding the specific misuse and negative effects of nitrous oxide. To assist HCA in this report, a survey was conducted to get more input from the community. Many limitations exist with the findings from the surveys. Due to limitations in awareness and self-reporting, the data and anecdotal accounts shared in this report likely underestimate the extent of intentional misuse.

Improved data and surveillance collection is needed. If the state is starting to see a statewide increase, there might be benefit in simplifying first responder reporting and increasing awareness and education to the medical community for appropriate documentation.

Examples of areas to improve data and surveillance collection could include training and/or standardizing documentation when responding to certain incidents to verify if nitrous oxide was at the scene or if symptoms were related to nitrous oxide. Increasing awareness about the presentation of an individual with nitrous oxide-related symptoms and training on appropriate documentation may also improve data collection among the medical professional community.

CONCLUSION

Nitrous oxide misuse is an emerging public health concern that requires increased community and professional awareness as well as improved data collection to further understand the negative impacts and efficacy of local policy changes. Until broader federal and state efforts are put in place to curb misuse, addressing this at the local level is important to reduce negative impacts to communities and families. Cities and communities can implement simple strategies to address, reduce access, and increase awareness.

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