



Division of Forensic Science 2023 Annual Report

May 20, 2024

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The Honorable John Carney
Governor

The Honorable Nathaniel McQueen, Jr.
Cabinet Secretary

May 20, 2024

To the Citizens of Delaware:

I am honored to recognize the outstanding work of the men and women of the Division of Forensic Science (DFS) detailed in this year's annual report. While their dedication and professionalism has resulted in numerous accomplishments, I will only highlight a few.

DFS continues to evolve to support development and growth that better serves the justice system throughout the State.

In 2023, the Division pursued state funding and federal grants to expand its data sharing and testing capabilities. It also strengthened its academic partnerships and internship programs to promote interest in forensic science among Delaware students. These efforts have established the Division as a key contributor to policies and initiatives to protect the health and safety of our citizens.

Also, with funding support from the Department of Health, through the Overdose to Action (OD2A) grant, the Toxicology Unit implemented a new testing method for Xylazine in postmortem cases. Previously, Forensic Science could examine drugs confiscated by law enforcement for the presence of Xylazine. With the new method, the Division can now analyze biological samples collected during autopsies to identify the presence of Xylazine.

This testing initiative aims to furnish our partners and stakeholders with a more comprehensive understanding of the prevalence of Xylazine in our state and the consequential impact it may have.

DFS maintains the highest scientific standards and ensures both organizational and individual integrity by continuing to meet accreditation standards and certifications. In 2023, the Toxicology, DNA, and Forensic Chemistry Units maintained accreditation in compliance with nationally recognized standards, while the Medical Examiner Unit maintained accreditation through the National Association of Medical Examiners.

Please join me in extending sincere thanks and congratulations to the women and men of DFS for a year filled with many accomplishments and successes.

Sincerely,


Secretary Nathaniel McQueen, Jr.



STATE OF DELAWARE
DEPARTMENT OF SAFETY AND HOMELAND SECURITY
DIVISION OF FORENSIC SCIENCE
200 South Adams Street, Wilmington, DE 19801
302-577-3420

The Honorable John Carney
Governor

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Cabinet Secretary

To My Fellow Delawareans:

On behalf of the men and women of the Division of Forensic Science (DFS), I am happy to present the 2023 Annual Report, which highlights the outstanding work and critical role that the DFS plays in the criminal justice process in Delaware.

The Mission of the DFS is to provide the most reliable scientific analysis of evidence for the administration of justice. Sound and timely pathology and forensic science services are provided for the justice system, driven by crimes committed and deaths occurring in the State of Delaware.

The organizational structure of the Division is a collaborative model where each discipline is equally invested in the overall success of the Division. A stratified model of accountability is used, where each team member has a specific role toward meeting the overall mission. I am proud to report that the DFS continued to meet the mission in 2023 despite any challenges presented throughout the year, which is a testament to the commitment and professionalism of the team at DFS.

By continuing to meet accreditation standards and certifications, the DFS maintains the highest scientific standards and ensures both organizational and individual integrity. The work ethic of the employees of the DFS is strong and we hold true to our core values of Integrity, Honesty, Thoroughness, Timeliness and Professionalism.

The DFS recognizes the significance of data sharing and works together with the Department of Health & Social Services, the Division of Public Health, the Department of Justice, the Delaware Information and Analysis Center, Law Enforcement and Federal partners to combat the on-going opioid epidemic and any other public health issues.

In 2023, the Division continued to pursue both state funding and federal grant opportunities, which allowed the DFS to expand its data sharing capacity by enhancing testing capabilities. The Division continues to expand its academic interface with the Delaware academic community by promoting forensic internship programs and participating in quality data collection and research. The Division firmly believes these efforts will promote interest in forensic science disciplines among Delaware students and lead to stronger information sharing projects. These outreach efforts, coupled with data sharing and collaboration lead to the Division being established as a key contributor across state agencies for the development of policies and initiatives to safeguard the health and safety of all Delawareans.



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I would like to thank the Criminal Justice Council for their continued support in providing grant funding in 2023, which provided much needed supplies, equipment, and training opportunities for the valued staff at DFS.

I am happy to report that funding through the Bureau of Justice Assistance FY '23 Byrne Discretionary Grant was approved to purchase sophisticated lab instruments used to quantitate THC and other cannabinoids in postmortem and DUI blood samples, as well as testing for ignitable liquid residue samples in the Fire Debris Section in partnership with the Office of the State Fire Marshal. A laboratory grade refrigerator and freezer to store postmortem samples was also purchased.

I would like to recognize the members of the Commission on Forensic Science for their dedication and commitment to providing oversight and guidance to foster professionalism within, and the development and growth of, the Division of Forensic Science. I am confident that with the continued work of the Commission and with the support of Governor John Carney and the General Assembly, the forward momentum of the Division of Forensic Science will continue in 2024.

I take great pride in the hard work and dedication of the men and women of the Division of Forensic Science and for their continued focus on providing the level of service that our customers and stakeholders deserve and expect. I remain confident that our staff will meet any challenge in order to fulfill our mission.

Sincerely,

A handwritten signature in black ink, appearing to read "John R. Evans".

John R. Evans, Director

The Division of Forensic Science

The Division of Forensic Science is comprised of four units including the Medical Examiner, Toxicology, DNA, and Forensic Chemistry. It is the mission of the Division of Forensic Science to provide the most reliable scientific analysis of evidence for the administration of justice. The Medical Examiner Unit serves the State of

Delaware with objective medicolegal death investigations in order to provide accurate death certification that complies with the standards set by the National Association of Medical Examiners (NAME) and the



Division of Forensic Science, Wilmington, DE

Delaware statutes. The Toxicology Unit performs analyses on biological specimens submitted by the medical examiner and Delaware law enforcement agencies for the presence (or absence) of volatiles and drugs. The Toxicology Unit is committed to providing state-of-the-art, timely forensic analyses that comply with the standards set by ISO/IEC 17025:2017 and the American Board of Forensic Toxicology (ABFT). The DNA Unit provides Delaware law enforcement agencies with a forensic DNA testing program that complies with the standards set by the DNA FBI Quality Assurance Standards and ISO/IEC 17025:2017. The Forensic Chemistry Unit tests physical evidence seized by Delaware law enforcement agencies, for the identification of controlled substances and fire debris analysis. Like the other Laboratory Units, the Forensic Chemistry Unit is committed to providing state-of-the-art, timely forensic analyses that comply with the standards set by ISO/IEC 17025:2017.

In 2014 the Commission on Forensic Science was created by state statute. The Commission is charged with providing oversight and guidance to ensure professionalism and integrity within the DFS and to support development and growth that better serves the justice system.

During 2023, the DFS continued to enhance operations and administration, embracing every challenge as an opportunity to improve. The DFS has maintained accreditation with the ANSI National Accreditation Board (ANAB). Additionally, the Medical Examiner Unit continues to be accredited through the National Association of Medical Examiners (NAME) and the Toxicology Unit meets the standards

established by the American Board of Forensic Toxicology (ABFT). The dedicated staff at the DFS continues to demonstrate a professional commitment to providing accurate, timely, and responsive forensic science service to all members of the criminal justice community in Delaware.



2023 DFS Organizational Chart. (Note that vacant positions are included in totals.)

Divisional Initiatives, Collaboration, and Information Sharing

Overview

The Division of Forensic Science believes that sharing of data and DFS information adds value to multiple governmental and academic initiatives. Working together across agencies, federal and state governments, and other stakeholder organizations supports the health and safety of the citizens and visitors of Delaware. Currently, DFS participates on two statewide commissions related to child death

and overdose death, two CDC funded projects, the Delaware Drug Monitoring Initiative, and several other forensic data driven projects with both our public health and law enforcement partners.

To forward the mission, the Division is continuously working on a comprehensive reporting system aimed at producing standardized information to key government and private sector stakeholders statewide. This work is identified as the Delaware Forensic Science Reporting Project (DFSRP).

National Violent Death Reporting System

Created by the Centers for Disease Control and Prevention (CDC) in 2002, the National Violent Death Reporting System captures extensive information about incidents, such as death certificates, mental health history, life stressors, job information, weapons used, victims and suspects, incident location, and other characteristics, to provide a clearer understanding of violent deaths. This surveillance system, implemented in all 50 states, the District of Columbia, and Puerto Rico, links the “who, when, where and how” to inform decision makers and develop prevention efforts to reduce violent deaths in our communities.

DFS remains a key partner in the National Violent Death Reporting System (NVDRS) and the Delaware Violent Death Reporting System (DVDRS) by providing autopsy and toxicology information on homicide and suicide deaths in Delaware. This work requires abstractors to collect key data from the DFS for the purposes of supporting effective prevention strategies to reduce violent deaths in Delaware.

Centers for Disease Control Biorepository Program

Funded by the National Institutes of Health (NIH) and the Centers for Disease Control and Prevention (CDC), The Sudden Death in the Young Case Registry (SDY) gathers information to learn about sudden death in children and find ways to prevent future fatalities. Delaware is one of 13 participating states in the project and collaborates with the staff of the Child Death Review Commission to identify causes of sudden death in our Delaware Children. A DNA sample is collected by the Medical Examiner Unit and the genetic information is used by researchers to identify causes of death in the hopes of preventing similar deaths in the future, as well as provide valuable information for the health and well-being of surviving siblings.

Delaware Drug Monitoring Initiative

In 2016 a team of individuals from the State of Delaware were selected to participate in a learning lab with the National Governors Association (NGA) in Washington DC. Delaware was one of only four states chosen to receive grant funding to examine methods for information sharing across state departments and divisions. The Division of Forensic Science collaborated with the Office of Emergency Medical Services (OEMS), the Delaware Information & Analysis Center (DIAC) and the Division of

Substance Abuse and Mental Health (DSAMH). The result of this collaborative effort produced a report that is now being distributed quarterly to stakeholders both statewide and federally.

The Delaware Drug Monitoring Initiative (DMI) utilizes data derived from the DFS, Delaware Emergency Medical Reporting System (DEMRS), Delaware Information and Analysis Center (DIAC), and the Delaware Division of Substance Abuse and Mental Health (DSAMH) to be used for situational awareness. The purpose of this initiative is to share consistent, actionable information to address the issues related to the drug epidemic affecting Delaware. The data provided in this report is aimed at assisting multiple agencies across Delaware in an effort to identify those in jeopardy of addiction and/or overdose. These efforts will help inform both law enforcement and public health officials as they work to identify additional treatment needs or programs. While all the data is housed under the respective agencies, the DMI report is created collaboratively within the DIAC for broader reach to key stakeholders. This work has opened the door for collaborative reporting statewide.

Disaster Preparation

The statewide Mass Fatality Plan is an ongoing effort in collaboration with the Division of Public Health to be prepared for a disaster. The Division of Forensic Science continues to participate in table-top disaster drills and on-scene disaster drills. The purpose of these exercises is to identify areas of strength and weakness, and to test the Mass Fatality Plan before the occurrence of a state disaster. As part of this work, DFS has developed internal Critical Incident Standard Operating Guidelines (SOG). These guidelines provide DFS staff with a framework for emergency operations that falls within the scope of other statewide disaster plans.

The second step of disaster preparation is the development of a statewide Family Assistance Center (FAC) plan. This plan is being modeled after the National Transportation & Safety Board efforts to promote a centralized location for multiple agencies to assist families during a disaster.

Overall Reporting & Collaboration

Data collected by the DFS is used in collaboration with other agencies such as Department of Health and Social Services, the Division of Public Health, the Division of Substance Abuse and Mental Health (DSAMH) the Department of Justice, DIAC, and other law enforcement organizations to promote the health and safety of the citizens of Delaware. In 2023, the DFS continued to expand its data sharing capacity by providing information regarding dangerous fentologues and additives such as xylazine and nitazine.

The Division has also increased our academic interface with the Delaware academic community by opening our doors to tours, promoting forensic internship programs, and participating in quality data

collection and research. The Division firmly believes these efforts will promote interest in forensic science disciplines among Delaware students and lead to stronger information sharing projects.

Overall, these external relationships have two goals: to educate stakeholders and collaborators on the principles and processes of the DFS, and to establish the Division as a key contributor across state agencies for the development of policies and initiatives to safeguard the health and safety of all Delawareans.

Community Engagement

One of the goals of the Division is to engage community partners by providing informational resources and encouraging scientific learning. Community outreach this year included lectures and tours given to both college and high school level students, including Odyssey Charter School and Salem Community College. Job shadow opportunities across all of the units at the DFS continue to be offered to college level students, resulting in 53 successful opportunities in 2023. The professional staff of the Division of Forensic Science is committed to promoting scientific knowledge and community collaborations.

Assessment, Accreditation, and Quality Assurance

Accreditation is a key component of the quality assurance program at the DFS. To be accredited means that the various units within the DFS are routinely inspected by outside organizations who ensure that the policies, procedures, and/or practices within the Division adhere to strict national or international standards. Standards followed by the DFS include those set forth by the International Organization for Standardization (ISO), the American National Standards Institute National Accreditation Board (ANAB), the American Board of Forensic Toxicology (ABFT), the National Association of Medical Examiners (NAME), and the Quality Assurance Standards (QAS) established by the Federal Bureau of Investigation (FBI).

ISO 17025:2017 Accreditation

The International Organization for Standardization is the world's largest developer and publisher of international standards. Laboratories use ISO 17025 to implement a quality system aimed at improving their ability to consistently produce valid results. Since the standard is about competence, accreditation is a formal recognition of the demonstration of that competence.

The DFS was originally ISO 17025 accredited in 2004 and has continually achieved the highest level of quality standard competency for testing with annual re-accreditation. The current ISO 17025 accreditation was provided by ANAB, which also publishes additional standards that must be adhered to for accreditation, and is scheduled to expire on November 30th, 2024.

American Board of Forensic Toxicology Accreditation

ABFT is dedicated to enhancing and maintaining standards of practice in the field of forensic toxicology.

The toxicology laboratory at the DFS is accredited to the ABFT standards, provided by ANAB and scheduled to expire on November 30th, 2024.

National Association of Medical Examiners Accreditation

The purpose of the NAME accreditation standards is to improve the quality of the medicolegal investigation of deaths in this country. NAME accreditation is an endorsement by NAME that the Division provides an adequate environment for medical examiners to practice their profession and offers reasonable assurances that the ME office serves its jurisdiction well.

The DFS has been NAME accredited since 1980 and continues to be in good standing with this organization.

FBI Quality Assurance Standards

The FBI's Quality Assurance Standards (FBI QAS) describe the requirements that laboratories performing forensic DNA testing or utilizing the Combined DNA Index System (CODIS) shall follow to ensure the quality and integrity of the data generated by the laboratory. The DFS has been compliant with the FBI QAS since 1997.

Medical Examiner Unit

Overview

The duties of death investigation for the State of Delaware fall to the Medical Examiner Unit (MEU), led by the Chief Medical Examiner (ME), Assistant MEs, Forensic Morgue Assistants, and Forensic Investigators. This Unit is responsible for investigating all suspicious and violent deaths in the State and performs postmortem examinations on cases that fall under its jurisdiction. The Unit operates out of three locations: the main office in Wilmington, the Tobin Building on the Stockley campus in Georgetown, and a satellite office in Dover (Kent County).

In 2023 the MEU investigated 3512 deaths, which is a 3.4% decrease in deaths investigated when compared with 2022. In 2023, the MEU accepted jurisdiction for and certified 1702 (or 48%) of the deaths investigated. The deaths certified by the MEU represents 15.6% of all deaths registered in the State of Delaware. In 2023, the deaths from drug and alcohol intoxication saw a decline from the previous year. The accidental deaths from drug intoxication decreased by 10 cases or approximately 2% from 537 deaths in 2022 to 527 deaths in 2023.

	2019	2020	2021	2022	2023
Autopsies	707	760	920	878	940
Inspections	289	331	374	412	327
Total Examinations	996	1091	1294	1290	1267
Inquiries*	450	504	485	470	435
Total Deaths Certified	1446	1595	1779	1760	1702
Non-Jurisdiction Investigations*	1239	1606	1661	1874	1808
Total Medical Death Investigations	2685	3201	3440	3634	3510
In Custody Deaths					27

*Note that inquiries are cases under the ME jurisdiction which did not require an examination and non-jurisdiction cases are investigated but determined not to be under ME jurisdiction.

The MEU reviews and approves all requests for cremations for decedents expiring in the State. The MEU reviewed 4453 cremation requests in 2023 for cases that were not investigated by the medical examiner.

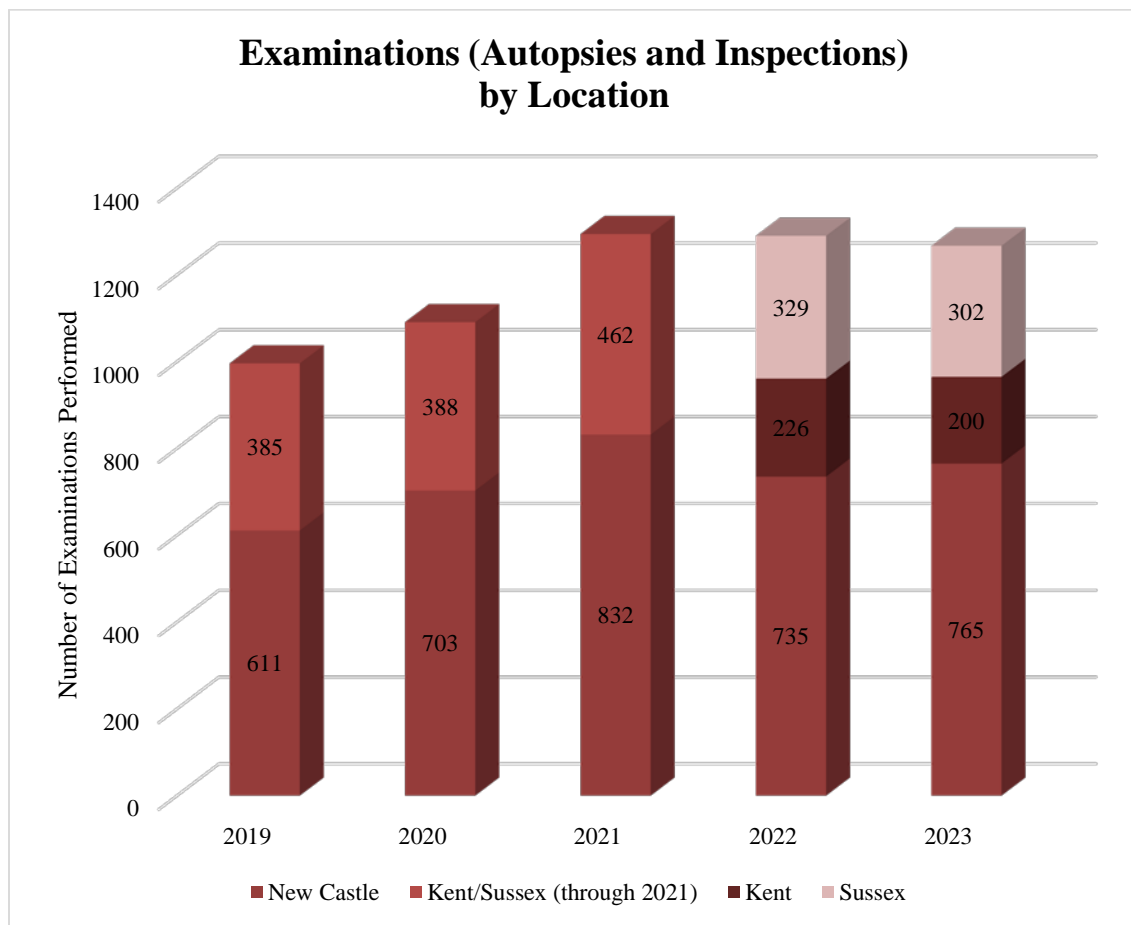
The Medical Examiner collaborates with the Gift of Life Organ Donor Program to approve organ and tissue donations in Delaware. In 2023 the DFS-MEU approved donations from 301 organs and tissue donors. Organs procured included heart, liver, kidneys, lungs, and pancreas. Tissues procured included cornea, skin, long bones, heart valves, and veins.

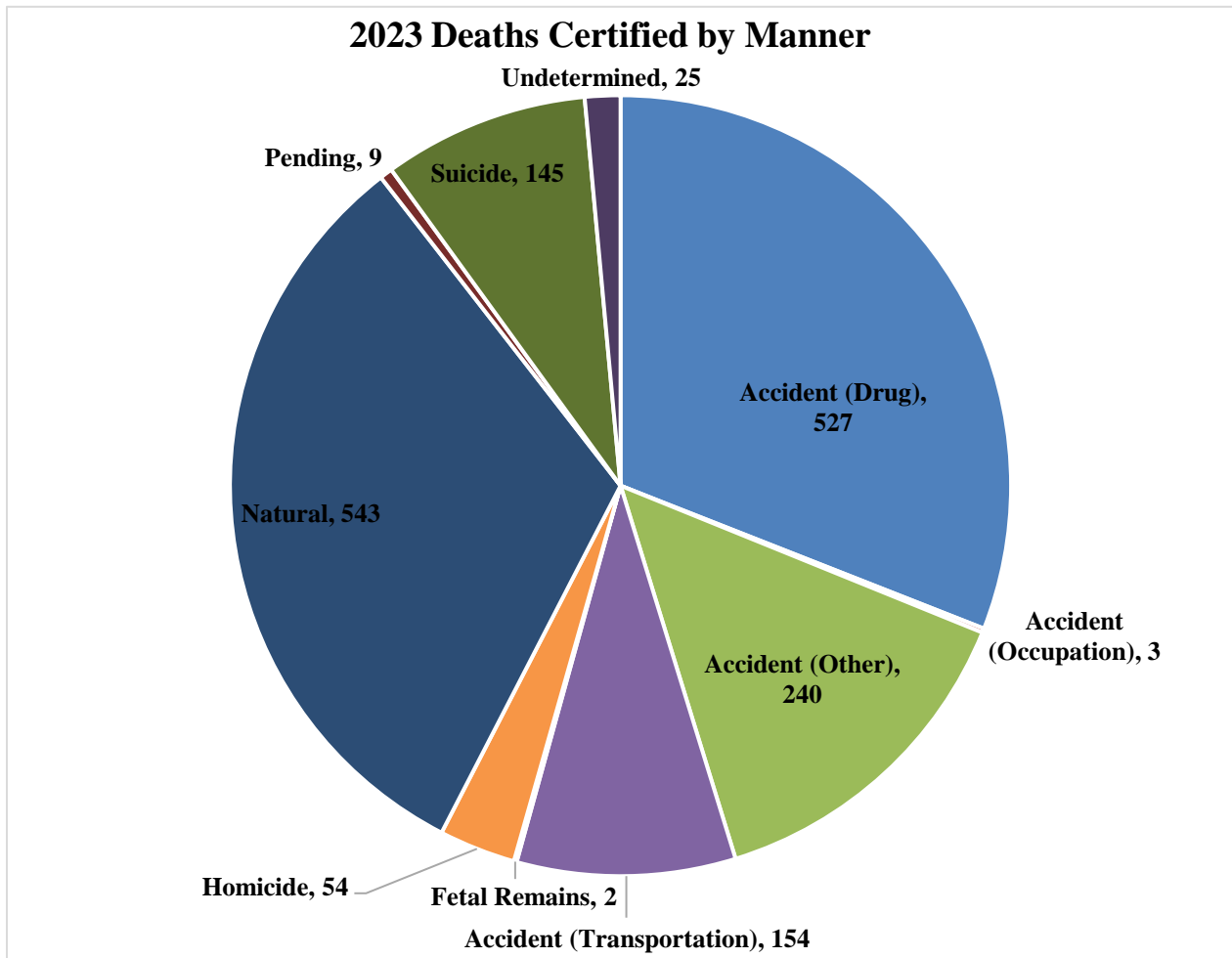
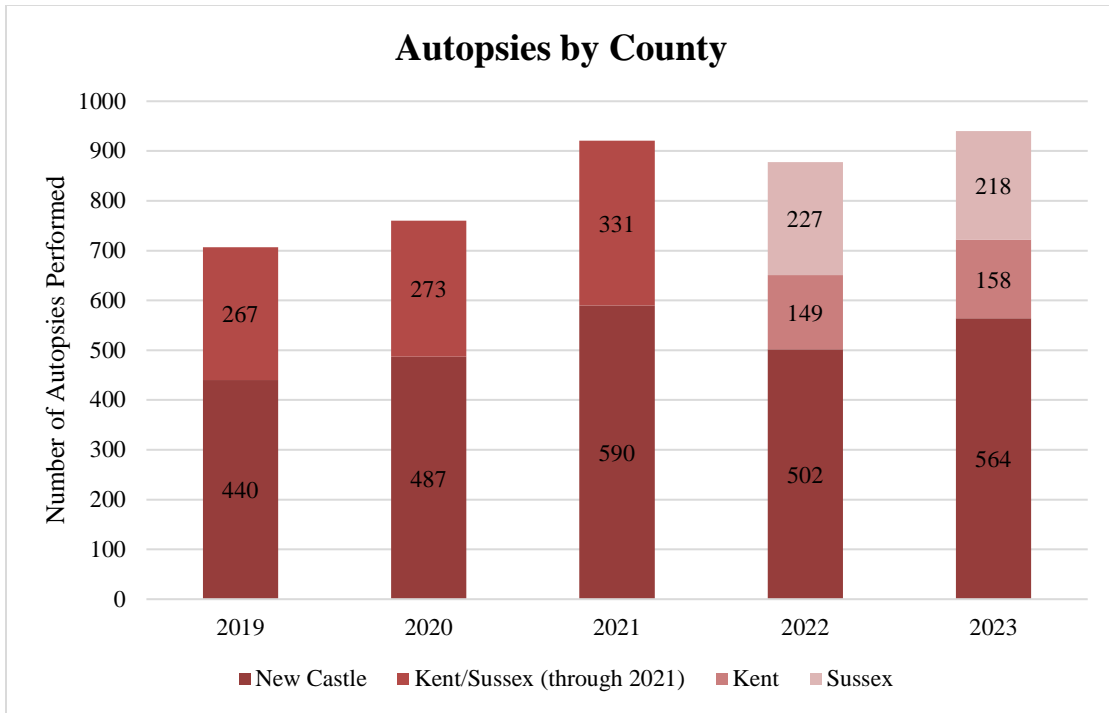
Partners

The MEU would not be able to accomplish our mission without the support of the Department of Safety and Homeland Security and the Delaware General Assembly. In addition, it is important to note the many agencies who assist in providing services to the MEU. These agencies include: Delaware law enforcement agencies, the Attorney General’s Office, Fleet Services, Office of the Child Advocate, the staff of all our Delaware hospitals, the Delaware Funeral Directors Association, the Gift of Life Donor Program, the Office of Vital Statistics, and all the funeral homes and health care practices that work with the Division. The MEU and Division values our relationships with all these agencies.

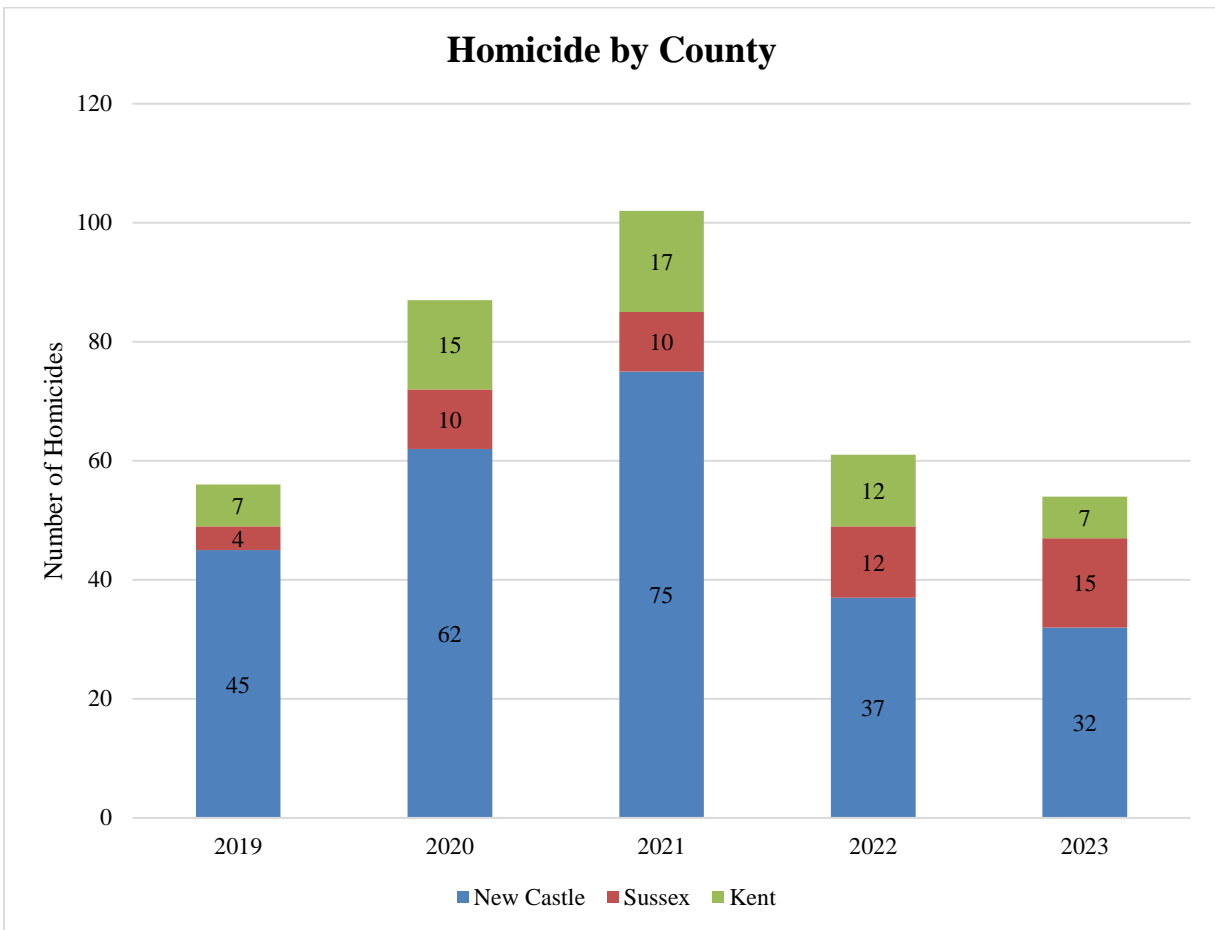
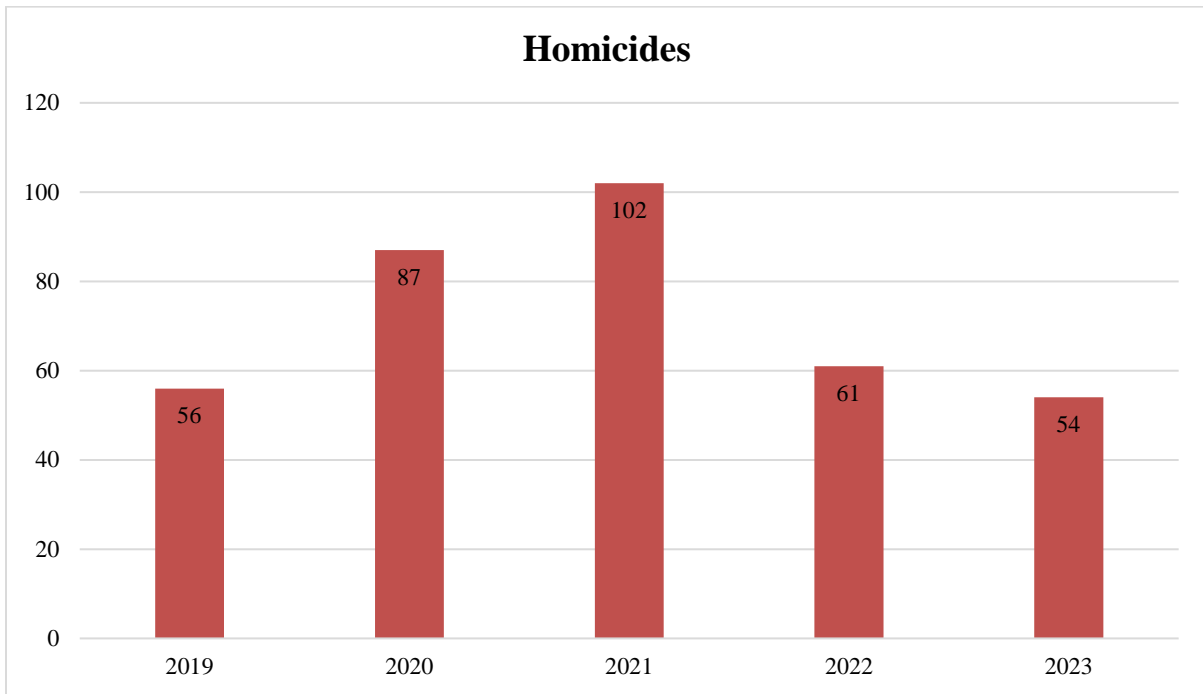
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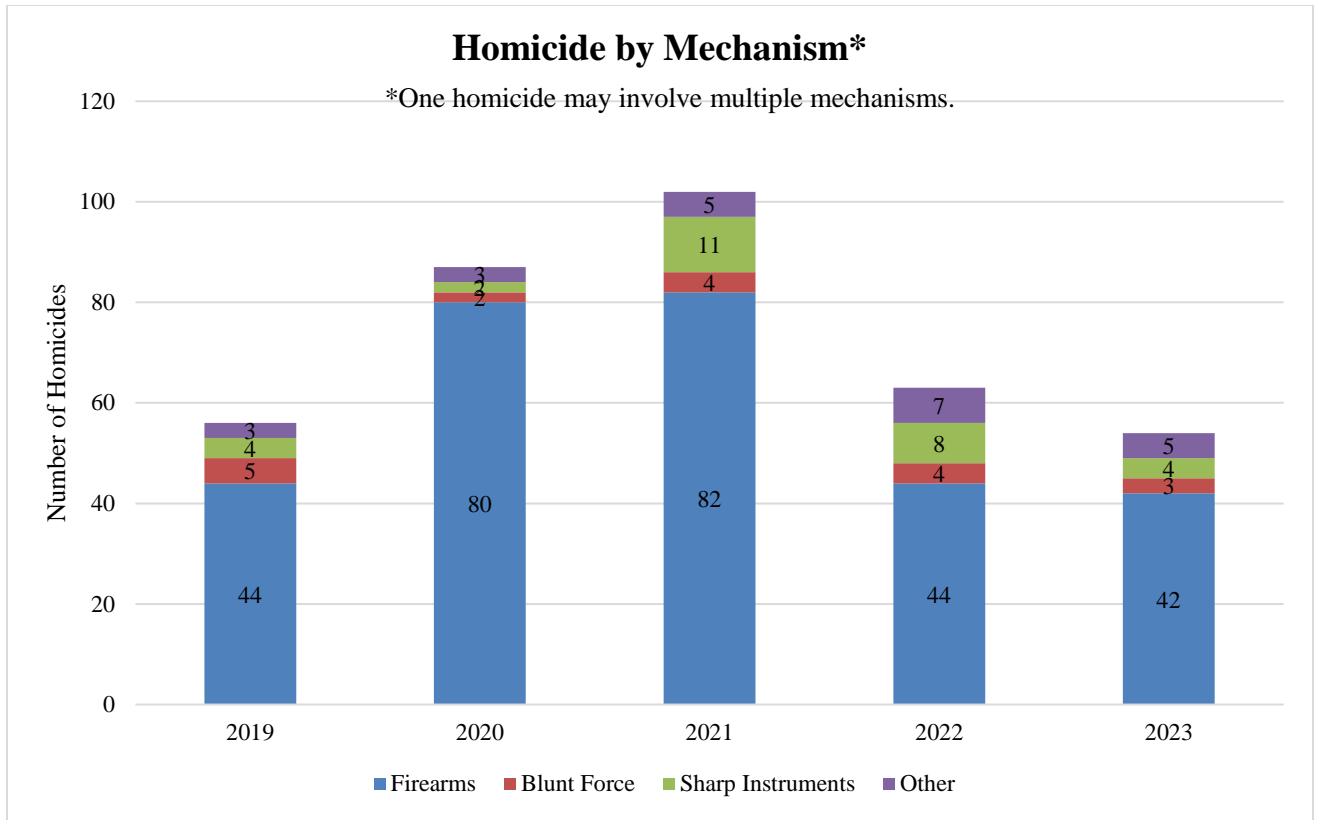
Cases Reviewed



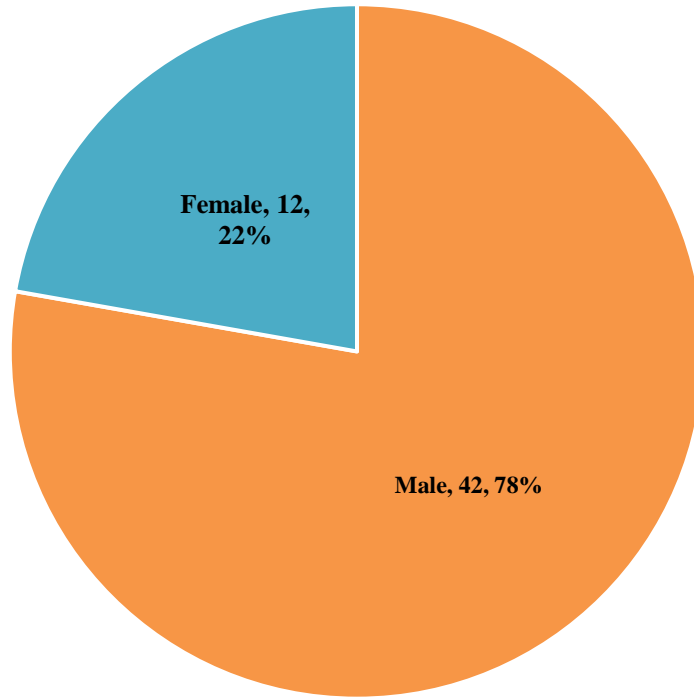


Homicides

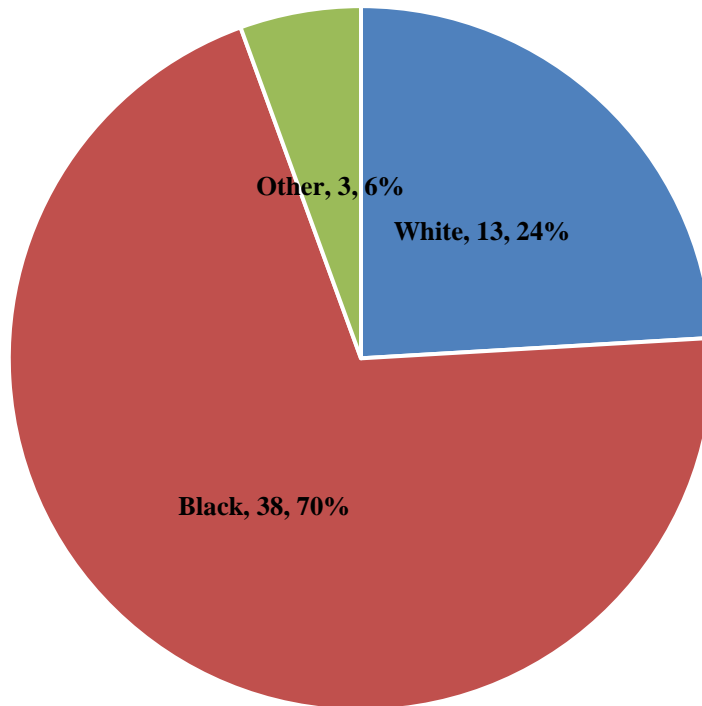




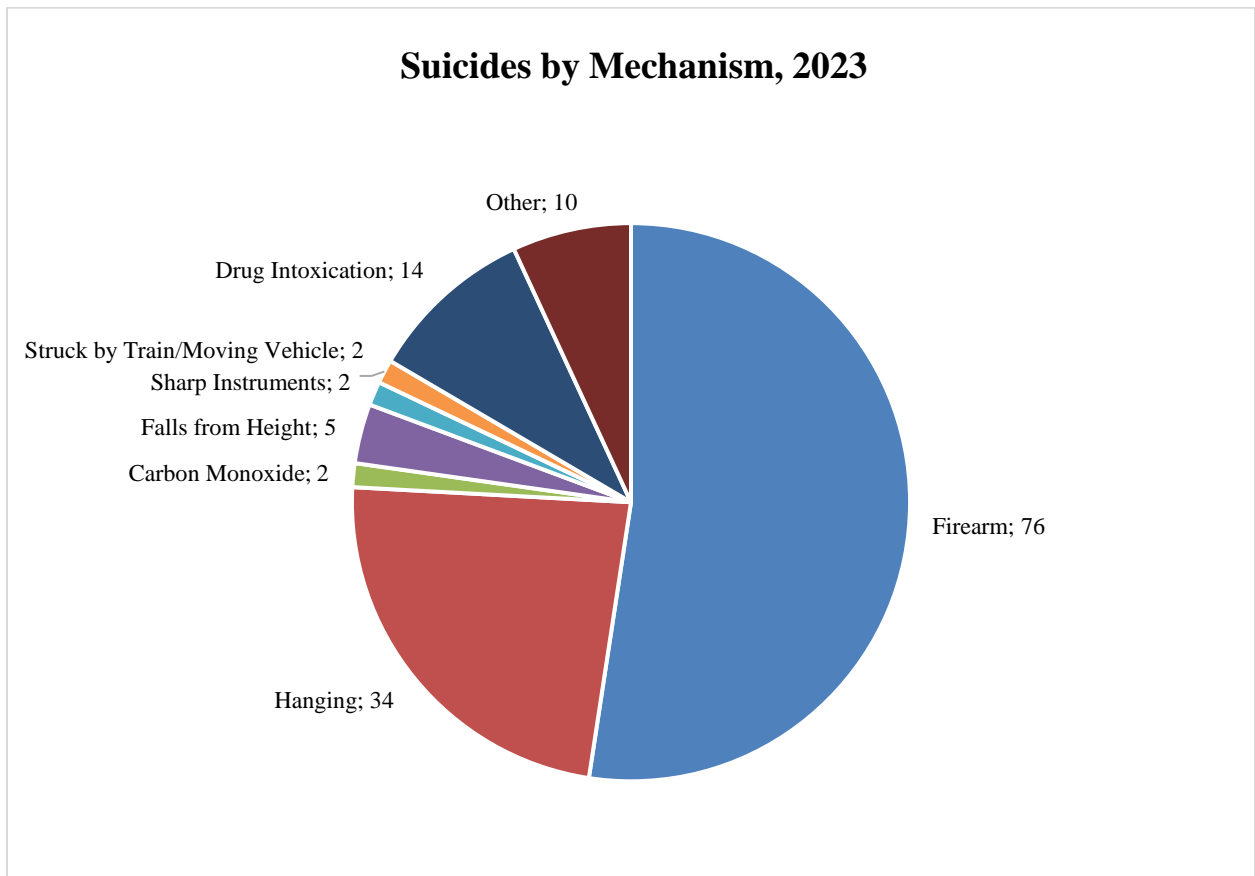
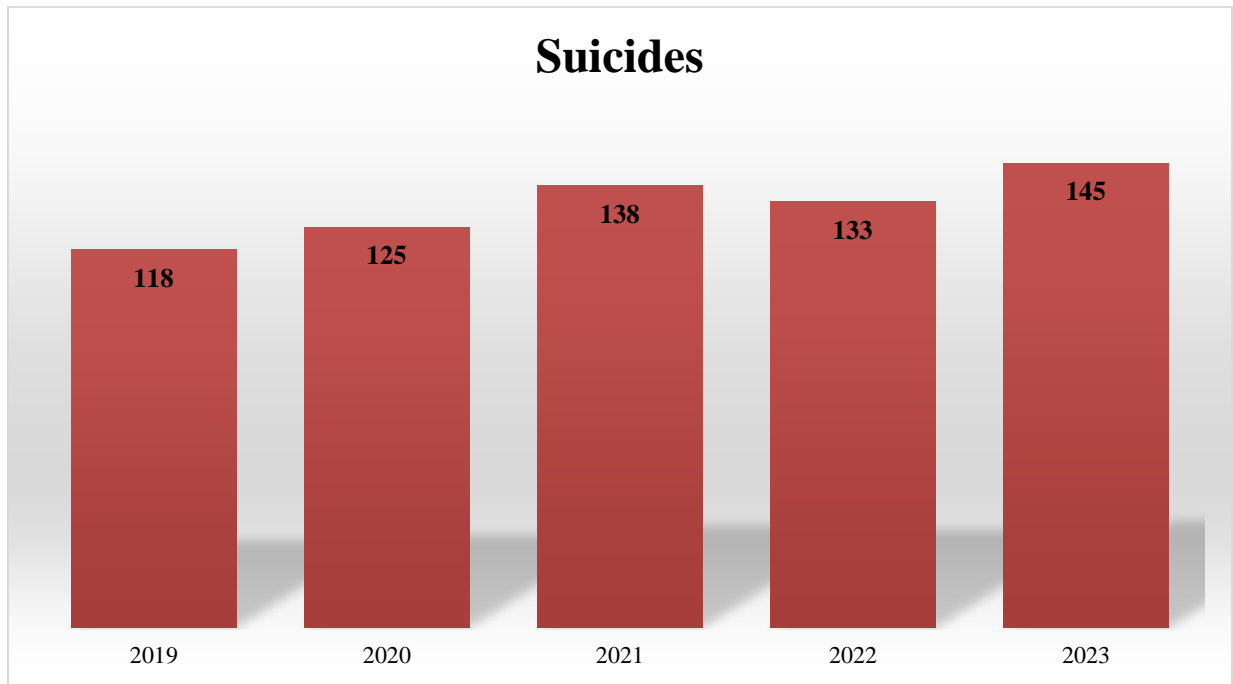
2023 Homicide Victims by Gender



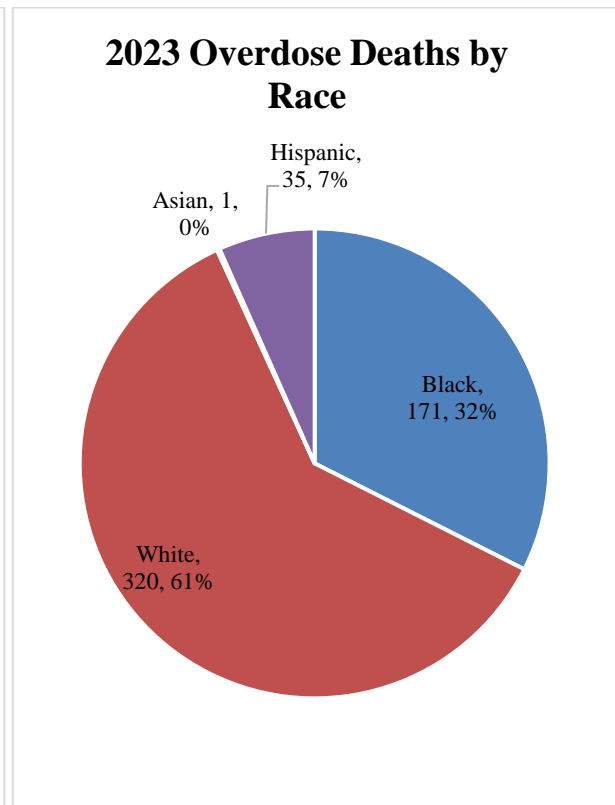
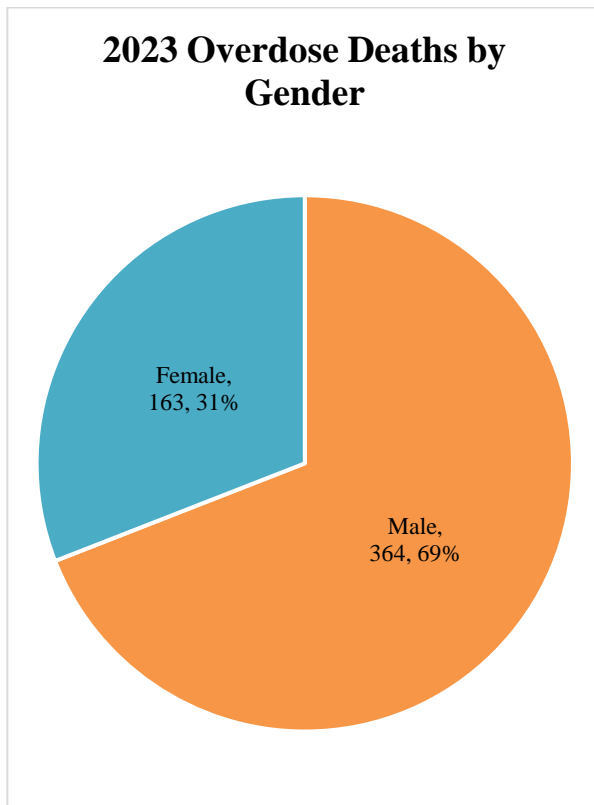
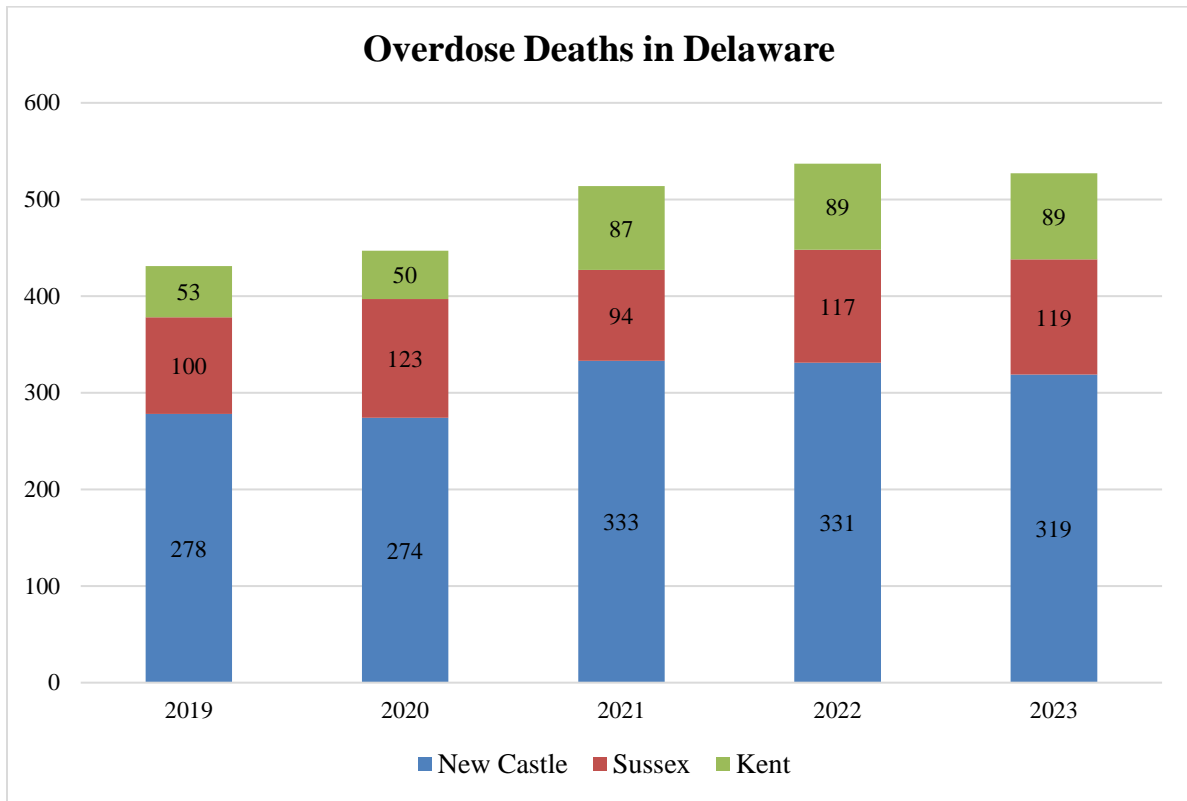
2023 Homicide Victims by Race

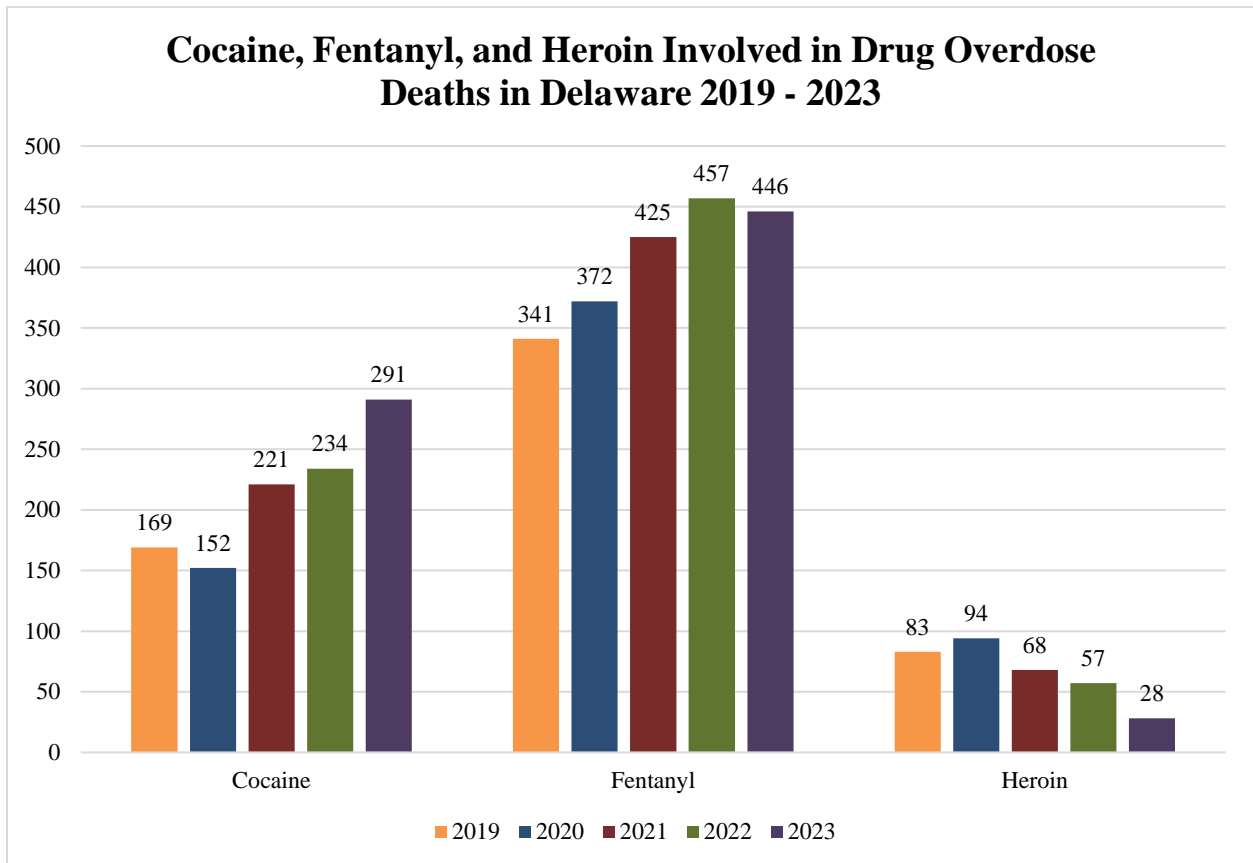
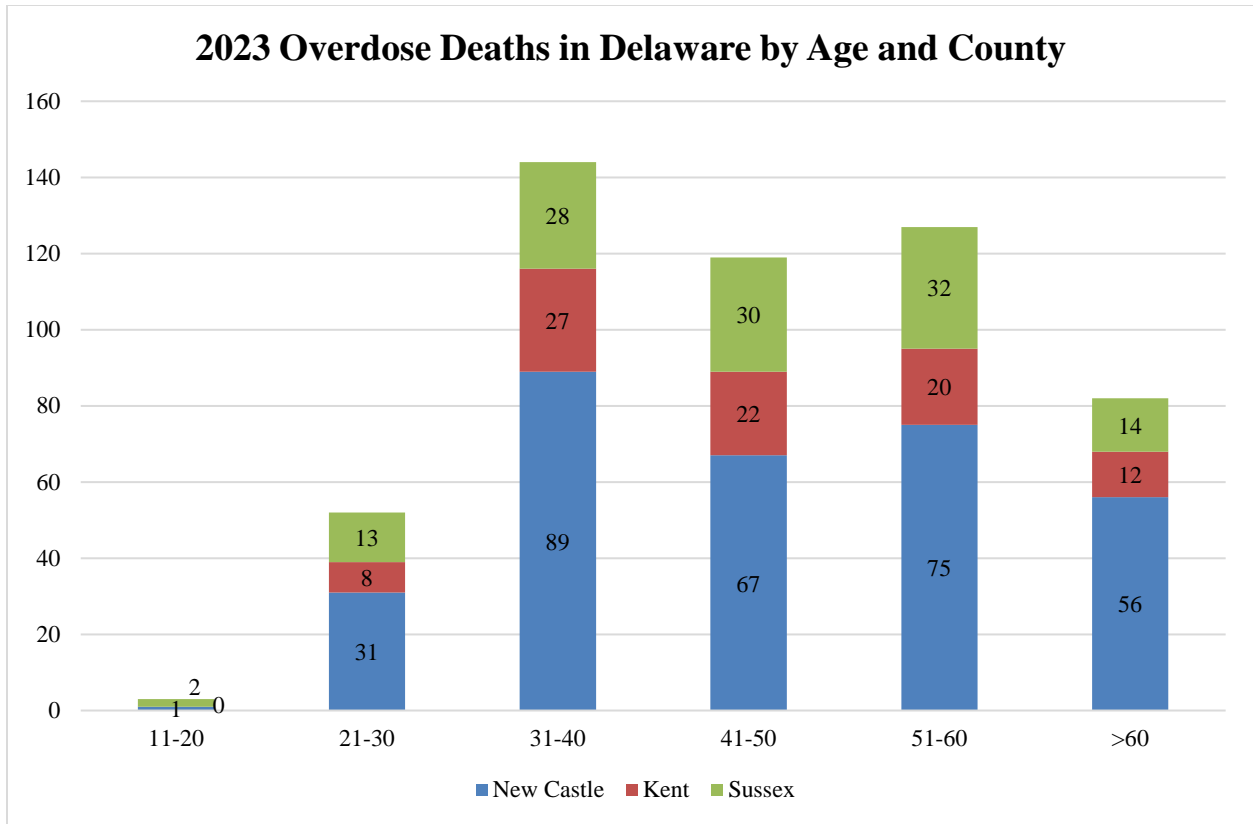


Suicides



Drug Overdose Deaths





Toxicology

Overview

The Toxicology (Tox) Unit of the State of Delaware Division of Forensic Science handles both postmortem and Driving Under the Influence (DUI)/Other cases. The unit is comprised of a staff of 11: the Chief Forensic Toxicologist, the Casework Laboratory Manager I, the Research Laboratory Manager I, seven Analytical Chemists (three for casework and four for research), and one Laboratory Technician.

Most cases (including all DUIs) begin with a preliminary ELISA (Enzyme-linked Immunosorbent Assay) Drug Screen, which tests qualitatively for the following 18 drugs/drug classes: Amphetamine, Methamphetamine, Opiates, Phencyclidine, Buprenorphine, Methadone, Benzodiazepines, Cocaine, Barbiturates, Cannabinoids, Oxycodone, Fentanyl, Carisoprodol, Diphenhydramine, Ketamine, Meperidine, Tramadol, and Zolpidem. Positives from this screen are entered for additional confirmatory testing. A Special Testing ELISA panel is also available, which includes Acetaminophen and Salicylates.

The Toxicology Unit has five confirmatory procedures for the following drugs/drug classes (and their metabolites), which provide quantitation (concentrations or amounts of drugs): Amphetamine-type Stimulant and Bupropion (AMP); Antidepressant, Antihistamine, and Cyclobenzaprine (ADP); Benzodiazepine, Z-drug, and Quetiapine (BENZ); Cannabinoid (THC); and Multidrug Panel 1 (1MP)¹. All confirmatory procedures utilize Liquid Chromatography-tandem Mass Spectrometry (LC-MS/MS) except the THC method, which uses Gas Chromatography-Mass Spectrometry (GC-MS).

In addition to the ELISA Drug Screen, the Toxicology Unit has two confirmatory (but qualitative) drug screens. The Alkaline Drug Screen (ALKDS) procedure covers approximately 200 different compounds, and the Acidic/Neutral Drug Screen (ANDS) covers another approximately 20 compounds.

Alcohol/Volatiles Analysis (VOL) using Headspace Gas Chromatography with Flame Ionization Detection (GC-FID) is another routine procedure used by the unit. In addition to ethanol, this procedure provides quantitation of acetone, isopropanol, and methanol and qualitative identification of acetaldehyde and 1,1-difluoroethane.

Staffing and Accreditation

The Toxicology Unit had two resignations in 2023 (the Laboratory Technician in January and one Analytical Chemist II in June). These vacancies were filled in March and August, respectively. An

¹ Note that this method was implemented with all cases received as of 09/01/23, as will be detailed later.

internal promotion meant that another vacancy was created in August, which was filled in December. These staffing transitions have meant that the team has spent a significant amount of time training.

The Tox Unit is an accredited laboratory—both to the standards set by ISO/IEC 17025:2017 and to those by the American Board of Forensic Toxicology (ABFT). The unit had a surveillance assessment in Spring 2023 and maintained its laboratory accreditation requirements.

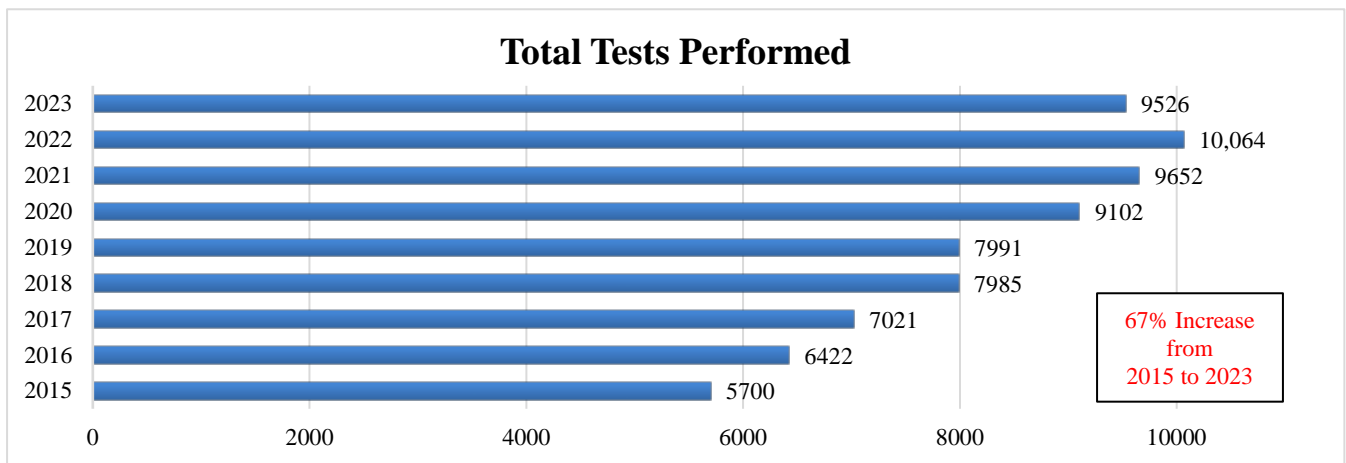
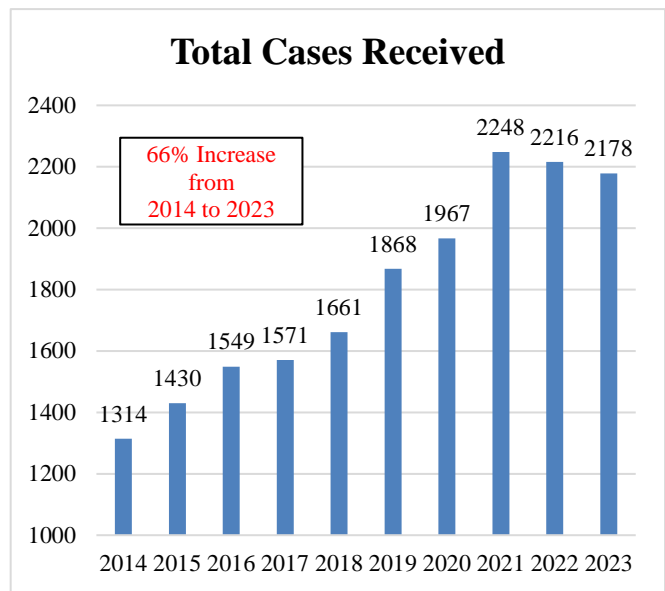
Data

The below statistics have been hand-gathered and hand-tallied.

Total Cases Received and Total Tests Performed

In 2023, the Toxicology Unit received **978 DUI/Other cases** and **1200 postmortem cases²** for testing. This equated to **2178 total cases received** and **9526 total tests run in 2023**. This bar graph shows how the number of cases has increased **66% over the past ten years, although the past two years have seen declines compared to 2021**.

Because each case may have multiple samples and/or require more than one test, and because the unit also runs 38 proficiency test samples each year (as well as verifications and sometimes repeat samples), the number of tests performed far exceeds the number of cases received each year. In 2023, there were 9526 tests performed in the Tox Unit—a



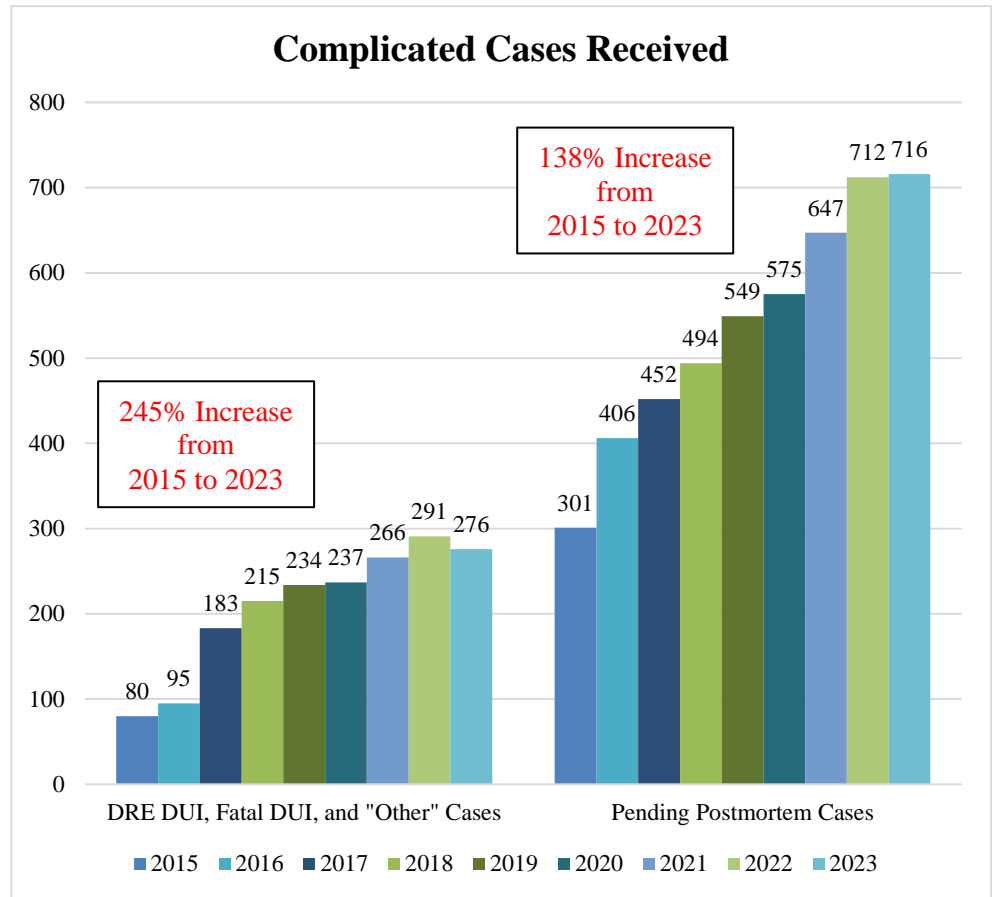
² Note that this total does not include an additional 102 cases that were received by the Tox Unit as “Save Only” cases and for which no testing was completed.

67% increase since 2015 (when 5700 tests were performed). Despite more complex testing and many newly hired positions, the Tox Unit managed to keep turnaround times at acceptable levels.

Increase in Complicated Cases

DRE DUI, Fatal DUI, and “Other” Cases

To really get a handle on the amount of work being done in the unit, one needs to examine the number and type of tests that are being completed. DUI cases received from Drug Recognition Experts (DREs), for example, generally require significantly more testing than non-DRE cases. The same is true for fatal and “Other” cases such as inquiries into child death or endangerment (including



children who have died while caregivers were drug-impaired and children consuming drugs themselves). As the chart shows, the number of DRE, Fatal, and “Other” cases are rising precipitously, **up 245% since 2015, although again, there was a slight decrease compared to 2022.**

Pending Postmortem Cases

Similarly, different types of postmortem cases require varying amounts of time to complete. Pending cases, so named because the cause and/or manner of death is/are pending further investigation (and which include suspected drug deaths), comprised **60% of the postmortem cases received in 2023**; this is the highest this percentage has ever been. These pending cases often require multiple tests, including time-consuming ALKDS procedures and/or advanced quantitative confirmations. The Tox Unit often receives hospital samples from drug overdose deaths for complete testing. The number of postmortem pending cases is **up 138% since 2015.**

ELISA Drug Screening Data

The below tables display the ELISA Drug Screen results to show the number of positives for each drug/drug class for all cases as percentages of the total cases received. It is important to note that this is screening data, so these are strictly preliminary/presumptive results.

Of the DUI/Other cases received in 2023, 53.5% screened positive for cannabinoids (marijuana), and 38.3% screened positive for fentanyl. The top percentage for cannabinoids has stayed consistently above 50% for the past five years, as shown in the below table. It is encouraging to see that the percentage of cases screening positive for fentanyl is the lowest it has been in the past four years. This is perhaps again a sign that we are finally getting a handle on the fentanyl/opioid epidemic. Cocaine and benzodiazepines are the next top two categories, just like in 2022 and 2021.

DUI/Other Cases:

Drug/Drug Class (Cross-Reactives) on ELISA	Percentage of DUI/Other Cases that Screened Positive				
	2023	2022	2021	2020	2019
Cannabinoids	53.5%	55.4%	52.6%	55.3%	57.1%
Fentanyl	38.3%	42.0%	44.2%	41.5%	37.7%
Cocaine	30.2%	27.8%	24.1%	20.8%	20.8%
Benzodiazepine	19.9%	21.2%	20.9%	26.3%	24.7%
Methamphetamine	13.3%	14.1%	14.4%	11.8%	9.7%
Methadone	12.4%	11.9%	13.5%	13.2%	11.9%
Amphetamine	11.5%	10.0%	12.8%	12.2%	8.4%
None Detected	10.4%	8.5%	9.1%	6.4%	5.6%
Opiate	8.9%	16.4%	17.2%	24.5%	24.1%
Diphenhydramine	5.6%	6.2%	5.4%	6.3%	7.2%
Buprenorphine	4.8%	3.5%	5.4%	5.4%	4.4%
Oxycodone	3.9%	3.5%	5.2%	6.6%	8.8%
Phencyclidine	2.0%	3.5%	6.2%	7.7%	4.9%
Ketamine	1.2%	1.3%	0.6%	1.4%	0.6%
Zolpidem	0.9%	1.1%	0.8%	1.1%	1.5%
Barbiturate	0.7%	0.6%	0.4%	0.2%	0.8%
Tramadol	0.3%	0.7%	0.4%	0.8%	0.7%
Carisoprodol	0.1%	0.1%	0.6%	0.5%	0.8%
Meperidine	0.0%	0.0%	0.0%	0.0%	0.0%

Fentanyl remains the drug on ELISA with the greatest percentage of postmortem cases screening positive (39.3%), as can be seen in the below table. It is again promising to see though that this percentage did drop 1.1% since 2022. The next highest percentages, which were all greater than 20%, were as follows:

cannabinoids, cocaine, and None Detected. Interestingly, the percentage of cases screening positive for opiates has steadily declined over recent years, from 25.0% in 2019 down to 8.8% in 2023. This is likely because fentanyl has largely replaced heroin.

Postmortem Cases:

Drug/Drug Class (Cross-Reactives) on ELISA	Percentage of Postmortem Cases that Screened Positive				
Result	2023	2022	2021	2020	2019
Fentanyl	39.3%	40.4%	36.5%	39.1%	37.8%
Cannabinoids	33.4%	33.4%	31.0%	32.6%	26.0%
Cocaine	28.9%	25.2%	21.8%	18.2%	21.0%
None Detected	21.8%	22.4%	27.1%	24.2%	25.6%
Diphenhydramine	14.8%	16.6%	17.2%	17.8%	16.5%
Amphetamine	13.6%	15.6%	14.4%	12.7%	11.6%
Opiate	8.8%	13.7%	15.5%	21.3%	25.0%
Benzodiazepine	8.2%	11.8%	10.9%	11.9%	13.1%
Methamphetamine	7.4%	9.1%	8.4%	7.8%	5.1%
Oxycodone	6.6%	5.8%	6.5%	7.4%	9.0%
Methadone	5.8%	4.5%	5.2%	6.2%	4.0%
Buprenorphine	4.4%	4.1%	2.7%	3.7%	4.4%
Ketamine	1.4%	1.0%	0.7%	1.1%	0.8%
Tramadol	1.3%	1.0%	1.1%	1.7%	2.7%
Barbiturate	0.7%	0.7%	0.6%	0.8%	0.6%
Phencyclidine	0.6%	1.0%	0.9%	1.0%	0.8%
Zolpidem	0.6%	1.7%	1.3%	1.2%	1.5%
Carisoprodol	0.2%	0.3%	0.6%	0.3%	0.4%
Meperidine	0.0%	0.0%	0.0%	0.1%	0.0%

Fentanyl and Xylazine Data

Because of the switch in September to the new 1MP panel, it is difficult to capture the top ten reported compounds from confirmatory procedures for 2023 since these compounds were split across two different methods throughout the year. We have still captured the fentanyl data, however, as can be seen below.

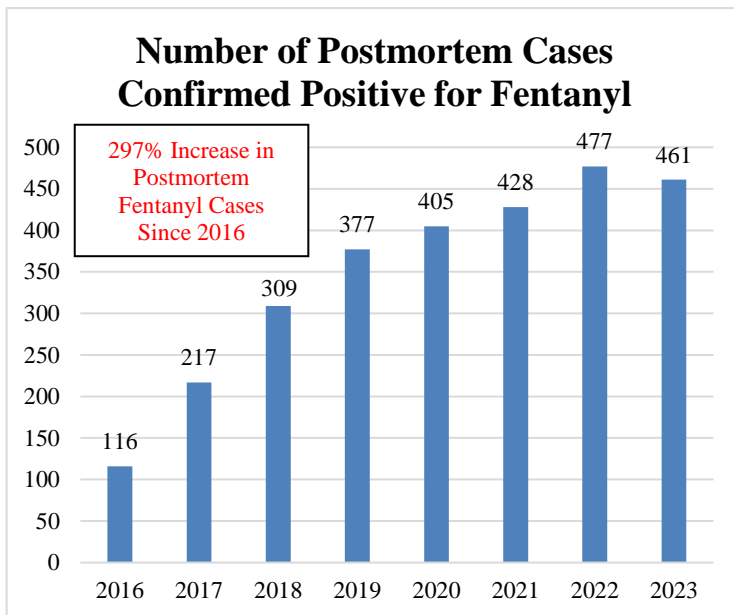
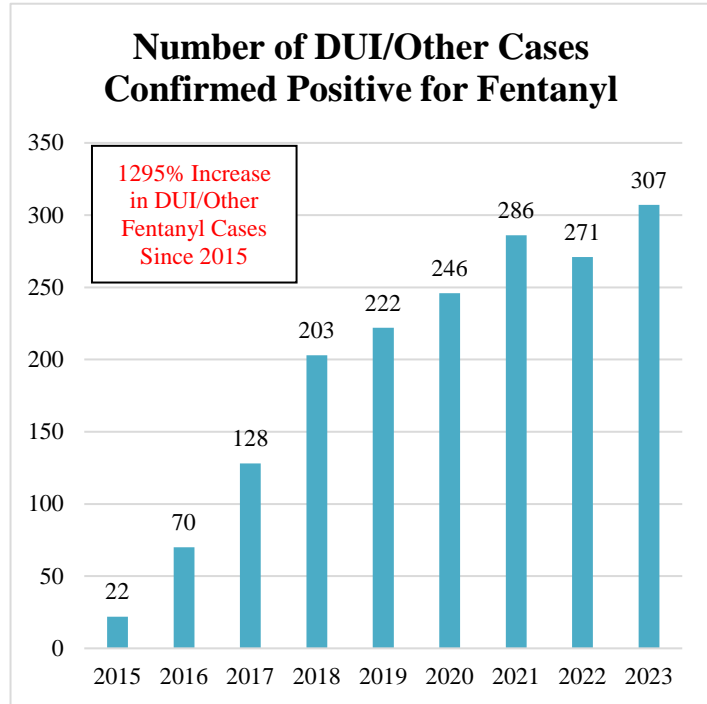
Fentanyl confirmations in the Tox Unit have increased even further since 2022 for DUI/Other cases; they have **increased 1295% for DUI/Other cases since 2015**, as the chart illustrates.

Fentanyl confirmations have **increased 297% for postmortem cases since 2016**, as shown below; however, it is again encouraging to see that the total number was lower in 2023 compared to 2022.

Xylazine is a veterinary sedative that has been found in illicit fentanyl in recent years; the use of naloxone has no effect on xylazine.

Xylazine is now included on the 1MP panel at

a reporting limit of 10 ng/mL. It is important to note that 1MP does not just contain fentanyl compounds, however; it is a confirmatory procedure for many different drugs/drug classes, as will be discussed in the



next section. Despite this, our statistics show that xylazine was positive/reported in **34.4% of the 151 DUI/Other cases** run on 1MP and in **40.8% of the 184 postmortem cases** run on 1MP in the last four months of 2023. It is interesting to note that for every case but one when xylazine was positive, fentanyl was also positive. For the one case (which was a postmortem one) that did not contain fentanyl along with xylazine, fluorofentanyl (a fentanyl analog) was positive.

Projects and Grants

The Toxicology Unit completed two projects in 2023. The first project was the revalidation of *Alcohol/Volatiles Analysis by Headspace GC-FID* (VOL) in February, now using Agilent DB-BAC1 UI and DB-BAC2 UI columns. This resulted in several improvements, including improved chromatography and uncertainty of measurement for all four quantitative analytes.

The second project was the validation of *Multidrug Panel 1 Confirmation and Quantitation by LC-MS/MS* (1MP), which was implemented for all casework received as of 09/01/23. This method contains 69 analytes and 54 internal standards for 123 total compounds—our largest panel to date! This method includes xylazine, which is of great interest due to it being a newer drug trend. This method essentially combined six of our previous extractions all into one, thereby requiring much less sample volume per case. Another huge benefit of the new 1MP panel is much lower reporting limits (and higher upper limits) for many analytes. 1MP includes the following drugs/drug classes (and their metabolites):

- Cocaine
- Dissociative Anesthetics (Dextromethorphan, Ketamine, and Phencyclidine)
- Hydroxyzine
- Levamisole
- Lidocaine
- Naloxone
- Narcotic Analgesics (Buprenorphine, Fentanyl, Fentanyl Analogs, Synthetic Opioids, Levorphanol/Dextrorphan, Meperidine, Methadone, Opioids/Opiates (Codeine, Morphine, 6-Monoacetylmorphine, Hydrocodone, Hydromorphone, Oxycodone, and Oxymorphone), Propoxyphene, and Tramadol)
- Nitazenes
- Xylazine

The Tox Unit received federal grant funds in 2023 through the Centers for Disease Control and Prevention's (CDC's) Overdose Data to Action (OD2A) cooperative agreement to support their efforts in response to the opioid/fentanyl epidemic. The 1MP project was made possible because of the OD2A grant funds. In 2023, the Tox Unit also received Congressionally Directed Spending (CDS) grant funds, which were used to purchase supplies (such as pipette tips and analytical standards) for our next project, which will take place in 2024.

DNA

Overview

The DNA laboratory consists of two sections, the Databasing or CODIS (COmbined DNA Index System) section and the Casework section. The Databasing section processes all the convicted offender samples submitted to the laboratory from the Delaware State Police/State Bureau of Identification (DSP/SBI), Probation and Parole, and the Department of Corrections (DOC), then uploads the generated DNA profiles into the CODIS database. The Databasing section is also required to confirm all potential hits. The Casework section examines evidence, conducts preliminary testing for body fluids, performs DNA testing, and interprets data derived from the tests to draw and support conclusions. The laboratory accepts all types of cases ranging from theft and property crimes to homicides and sexual assaults. The DNA profiles generated from processing casework may also be entered into CODIS at either the State or National index (level).

CODIS

At the beginning of 2023, 65 offender samples had not been uploaded to CODIS. All but seven of these samples were received by the laboratory in December of 2022. All these samples were uploaded into CODIS in 2023. In 2023, the CODIS section received 1265 offender samples. This number includes 184 samples that could not be tested due to incomplete submission information. The laboratory received approximately 13.5% more samples in 2023 than in 2022.

The average turnaround time (TAT) for uploading offender samples into the National database increased slightly in 2023 from an average of 18 total days (13 working days) in 2022 to an average of 21 total days (15 working days) in 2023. We sometimes receive offender samples with incomplete submission information. For samples with missing information and samples that do not produce a usable DNA profile, we continue to work with DOC.

In 2023, 1144 offender samples and 176 casework samples were uploaded into the State and National indexes. It should be noted that some offender samples only gave a partial DNA result. These samples were re-processed and uploaded again, once additional DNA information was obtained from them. Offender samples were processed monthly, and by the end of the year all samples, except those received in December 2023 had been uploaded into CODIS. Those final samples were upload in the first quarter of 2024.

In 2023, the DNA laboratory had 62 CODIS hits or “matches” from either the State or National index. The national hits include DNA profiles from several states that either hit to DE convicted offender or

where DNA profiles uploaded by DFS hit to cases, offenders, or arrestees from other states. The CODIS hits included scanning device, theft, motor vehicle theft, carjacking, home invasion, person prohibited, burglary, robbery, sexual assault, and homicide cases. In past years, there were instances in which a convicted offender's sample was collected and uploaded on good faith into CODIS. When the offender's DNA profile hit on an evidence sample, during the confirmation process, it was realized that the offender profile had to be removed from CODIS because the offender did not have a qualifying offense under Title 11. We have been in contact with DOC about proper collection. Additionally, we have proposed a legislative initiative to collect samples from all felonies. We are currently waiting on direction from the U.S. Department of Justice on whether the individual's names can be released.

The table below reflects the types of cases that have hit in CODIS for 2023.

CODIS Hits	Type of Case	CODIS Hits	Type of Case
18	Burglary	9	Robbery
8	Homicides	1	Unidentified Remains
9	Sexual Assaults	1	Home Invasion
1	Assault	3	Theft/trespassing/criminal mischief
9	Carjacking/stolen/theft of motor vehicle	1	Resisting Arrest
1	Scanning Device	1	Person Prohibited

Casework

In the beginning of 2023, there were 110 cases that were either assigned but not completed or unassigned from 2022. Sixty-nine (69) of those cases were unassigned at the end of 2022; this included cases with suspects and unknown suspects. In 2023, the DNA unit received 711 new case submissions and 40 subsequent

Types of Cases Received in 2023	New Submissions	Supplemental Submissions
Homicide / Att. Homicide	48	7
Sexual Assault	206	11
Assault	37	3
Burglary	117	8
Robbery	23	4
Missing Person/Death Investigation	12	0
Miscellaneous	79	4
Possession of Firearms	172	3
Proficiency Tests	17	0

submissions for a total of 751 submissions. Subsequent submissions are defined as those cases requiring additional testing after a report has been issued or those cases where a report was held until additional evidence had been submitted and tested. There was an approximate 3% increase in the total number of

submissions from the previous year. By the end of 2023, there were 179 cases that were either assigned but not completed (81) or unassigned (98). This is an increase from the previous year. All those cases are on track to be completed in the beginning of 2024. The table provides a breakdown of the types of cases received during 2023.

Our average turnaround time (TAT) increased approximately 8% from 45 total days in 2022 to 49 total days in 2023. In 2023, not only did we have an increase in the number of cases that were submitted when compared to 2022, but we also had an increase in the number of specimens we examined.

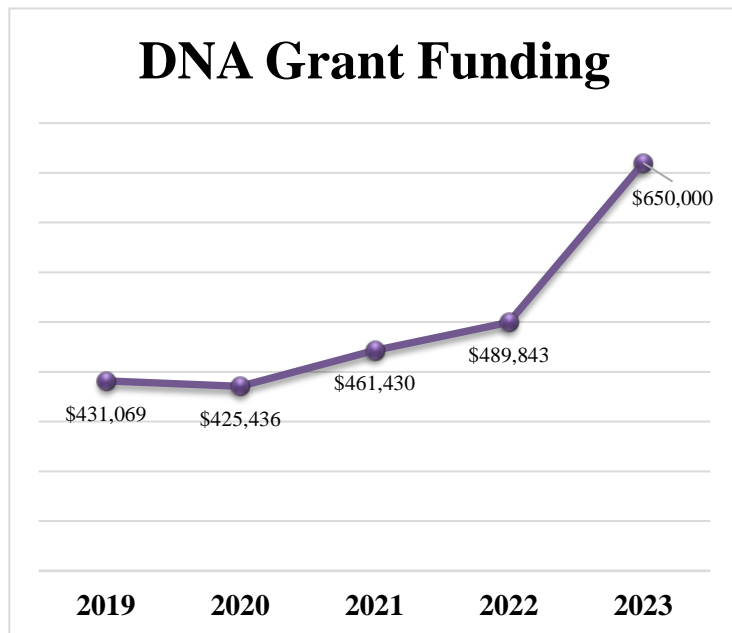
In April of 2022, the Sexual Assault Kit Initiative (SAKI) Testing Policy was implemented by the State of Delaware. It should be noted that some of these cases could have additional evidence that may need to be tested by DFS. Of the 206 sexual assault cases submitted for testing, 76 were from years prior to 2023. The average completion TAT for sexual assault cases (includes kits and other evidence) is 52 days. This is well within the 90 days noted in the SAKI policy.

Due to the inability of DFS to hire and retain Forensic Evidence Specialists (FES), in 2023, the Laboratory Managers in DNA have been tasked with the FES duties as it relates to DNA evidence intake, returns, and scheduling all appointments. The Casework Manager continues to handle the DNA Backlog Reduction Grants. On September 30, 2023, the DNA Backlog Reduction Grant for FY2021 ended. The closeout documentation by the laboratory was due to the Bureau of Justice Assistance (BJA) by January 30, 2024. The laboratory is currently managing 2 DNA Capacity Enhancement Backlog Reduction (CEBR) Grants. The FY2022 CEBR grant for \$489,843 closes on September 30, 2024. The FY2023 CEBR is for \$650,000 closes on September 30, 2025.

The amount of grant funds has fluctuated over the years. Grant funds have allowed the DNA unit to function. In 2023, about 94% of the DNA Unit's operational costs are funded by grants.

The DNA Unit uses all the grant funds allotted, which contributes to increased grant funding.

With the DNA FY 2021, and 2022 grant funds, the laboratory continued to purchase reagents, consumables, and other supplies for



processing casework and convicted offender samples, provide required continuing education training for each DNA Analyst, pay for external laboratory audits, purchase proficiency tests for each analyst, and purchase new laboratory software. Aside from the daily operational supply purchased with grant funds, the DNA unit purchased a new instrument for quantitation, QuantStudio. The validation was going to be outsourced to a vendor, but the FY2023 grant is currently frozen and cannot be used.

Validation or performance checks are a critical part of forensic DNA work. Validations are done on new testing procedures while performance checks are done to determine if there are any effects from upgrades or modifications to previously validated procedures. As noted in previous DFS annual reports, the DNA Laboratory does not have an individual primarily dedicated to performing validation/performance checks studies. Validation/performance checks can be done by Analysts and/or Managers in the DNA Unit, but as funding becomes available, the goal is to outsource validation studies to qualified vendors.

We continue to use a chemistry kit that examines 27 DNA markers, seven more than the FBI requirement.

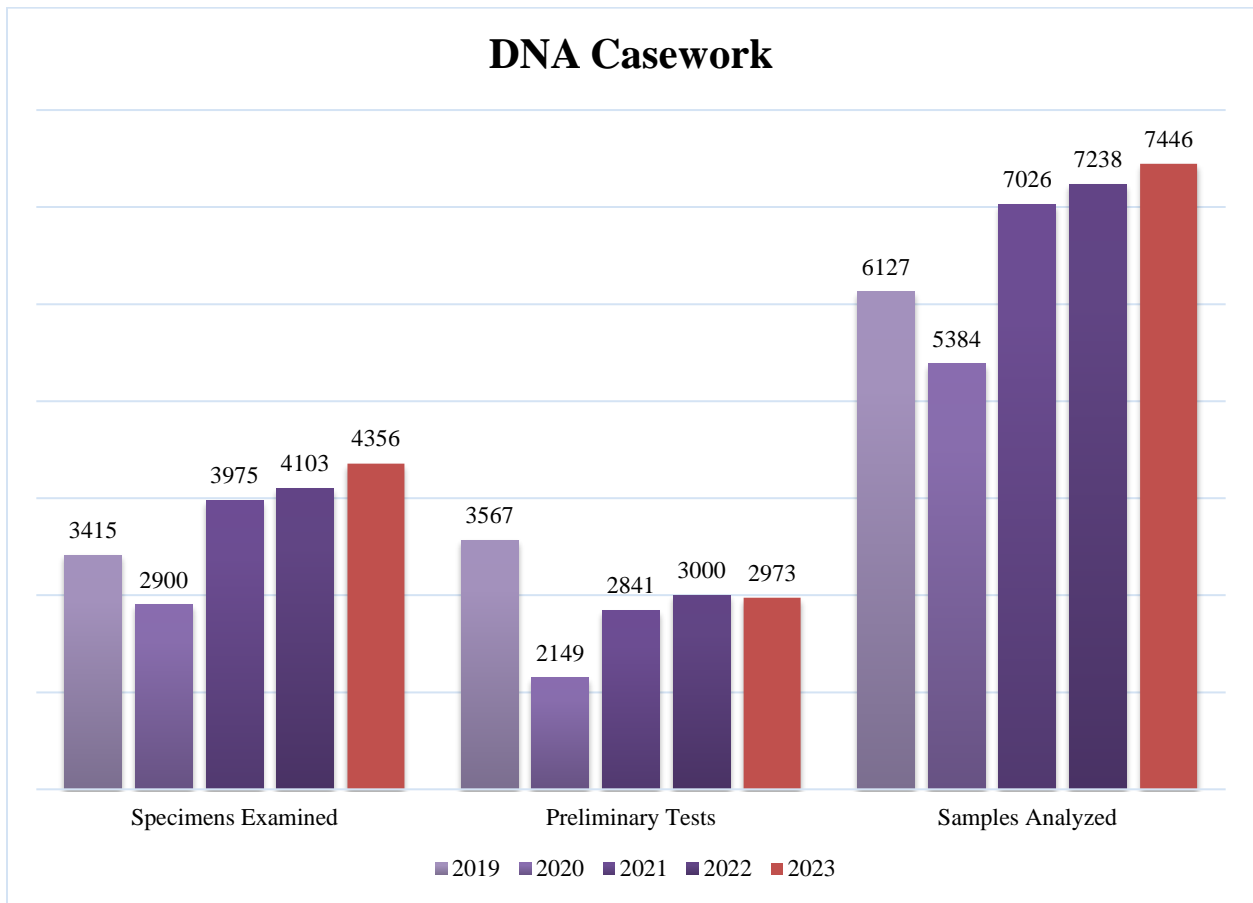
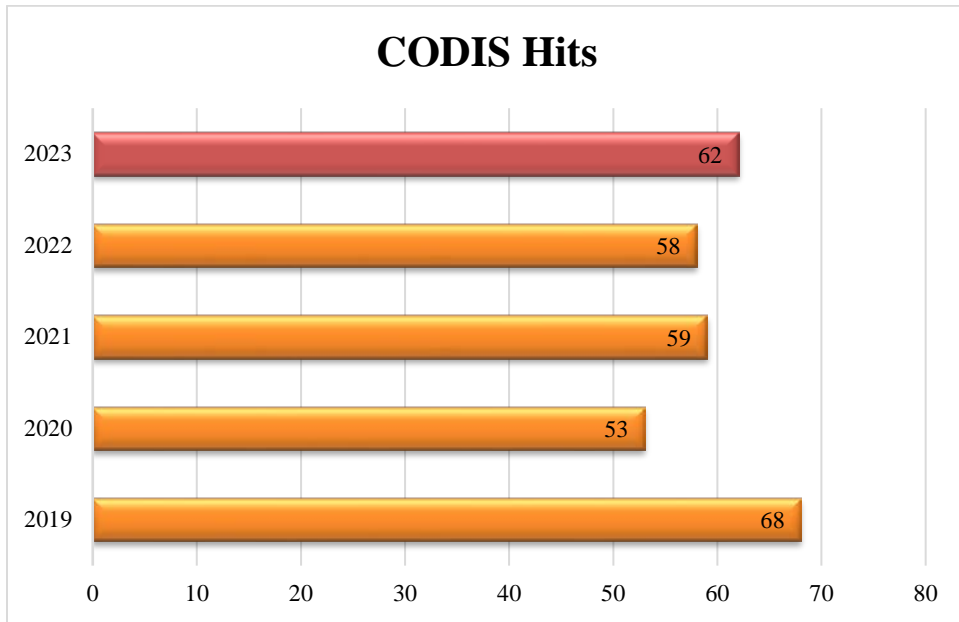
The DNA laboratory underwent on-site external audits for casework and databasing based on the FBI's Quality Assurance Standards in March 2023. These Quality Assurance Standards were effective as of July 1, 2020. The DNA laboratory had zero non-conformities, meaning we met or exceeded each standard. In June 2023, the FBI, after reviewing the results of the audit, sent us a letter of compliance.

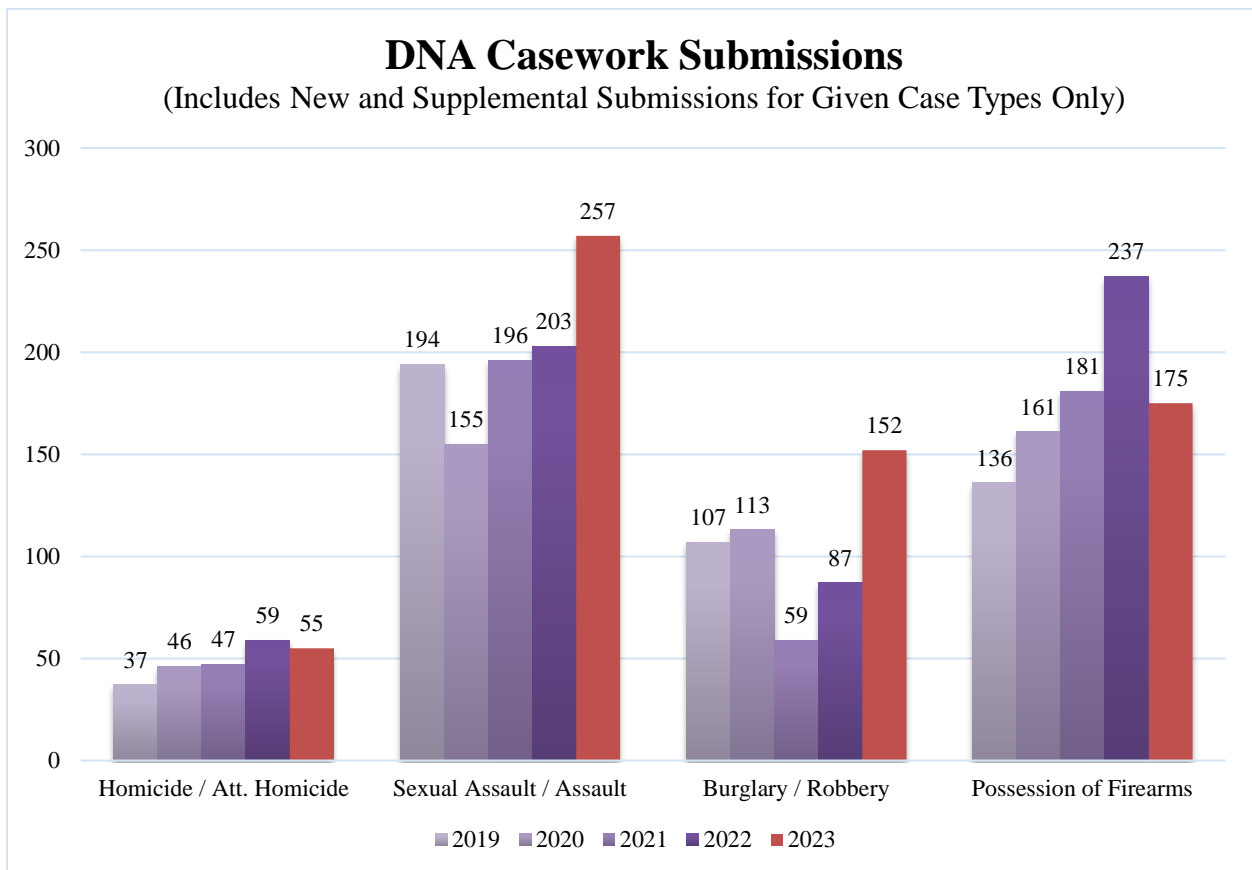
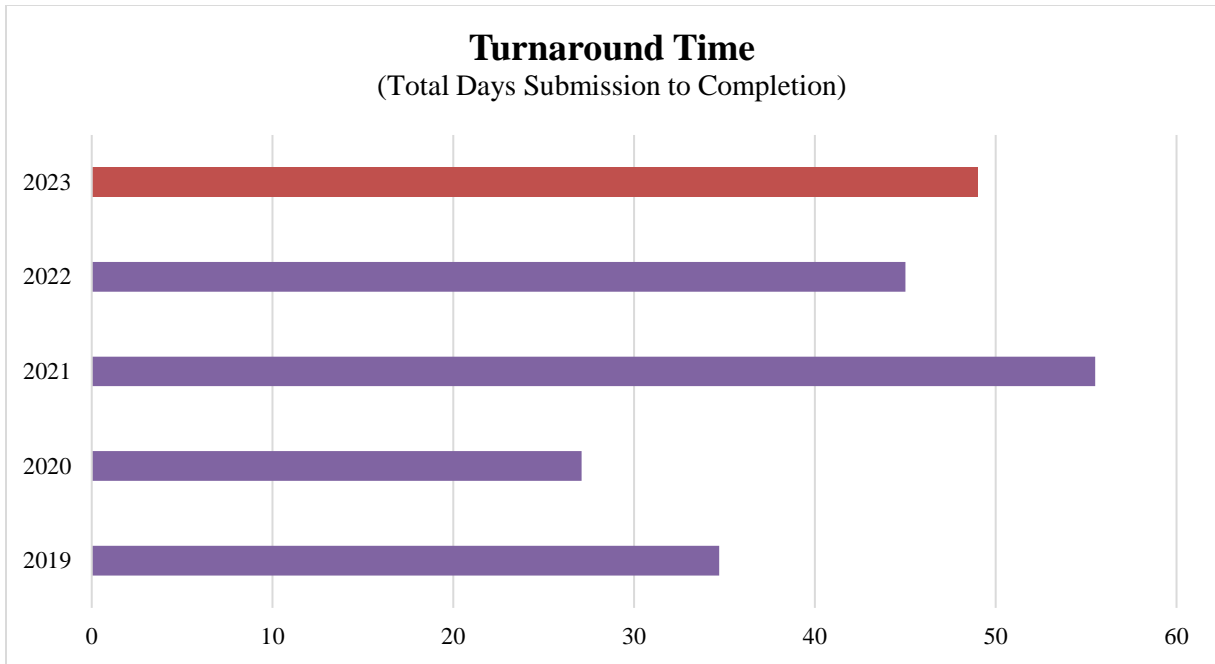
The following chart provides a comparative analysis of casework for 2019, 2020, 2021, 2022, and 2023 (the percentages in parenthesis show year-over-year changes):

	2019	2020	2021	2022	2023
Total Case Completions	621(-4%)	548 (-12%)	627(+14%)	665(+6%)	682 (+3%)
Turnaround Time (Total days submission to completion)	34.7 (-39%)	27.1 (-22%)	55.5 (+104%)	45(-18%)	49 (+8%)
Case Submissions	592 (-5%)	561(-5%)	612 (+9%)	726(+19%)	751 (+3%)
Staffing (Full-time casework)	5.6 (-3%)	4.8 (-14%)	5 (+4%)	5.5(+15%)	5 (-9%)

In summary, during 2023, the DNA laboratory received 3% more cases and examined more evidence than in 2022. The number of cases completed by the DNA laboratory in 2023 outnumbered the total case completed in the previous years. We continue to work towards keeping our backlog to a manageable number in the next year.

Data





Forensic Chemistry

Overview

The Forensic Chemistry Unit (FCU) is comprised of two distinct sections. The Controlled Substances Section analyzes evidence submitted by Delaware law enforcement agencies for the presence of controlled substances. These controlled substances may be present in substances such as powders, liquids, food products, oil, waxes, plant material, paper, mushrooms, commercially produced pharmaceuticals and clandestine tablets or capsules. This section follows the Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) recommendations regarding analytical schemes for the identification of controlled substances, as well as an internationally accepted statistical sampling plan that allows the chemist to make an inference about populations by testing a set portion of exhibits with a 95% level of confidence; this sampling plan reduces the amount of time processing cases while providing scientifically valid results. The Fire Debris Section works directly with the Delaware State Fire Marshal's Office and other local offices to analyze evidence associated with arson investigations. Fire Debris case types include all fire-related deaths, incendiary fires, and arson-related offenses. Evidentiary samples are prepared and analyzed according to ASTM International Standard Practice and Test Methods to determine the classification of any ignitable liquids present in the submitted evidence.

Staffing

The full complement of the Forensic Chemistry Unit starting in 2023 included a Laboratory Manager II, a vacant Laboratory Manager I, 10 full-time analytical chemists (1 vacant), 1 vacant part time analytical chemist, and two vacant Forensic Evidence Specialists positions.

The FCU underwent significant staffing changes in 2023. This included filling the Laboratory Manager I and vacant chemist positions and hiring an analytical chemist to fill a later vacancy. The Forensic Evidence Specialist positions were filled by April, however, were both vacant by October. One position was filled in late November.

Despite the changes in staffing and the training required, the members of the FCU were able to continue to process cases from all law enforcement agencies and decrease the turnaround time from 2022.

Casework and Accomplishments

Controlled Substances

Chemists in the FCU completed 1626 cases in 2023, which was greater than the 1524 cases submitted. In the cases analyzed in 2023, there were 191,597 exhibits submitted, and of those, 22,864 were tested.

The turn-around-time for the cases was 38 days from submission to completion, however with a turnaround time of 20 days from submission to assignment, the actual bench turn-around-time starting from assignment to completion was 18 days across the unit.

Fire Debris

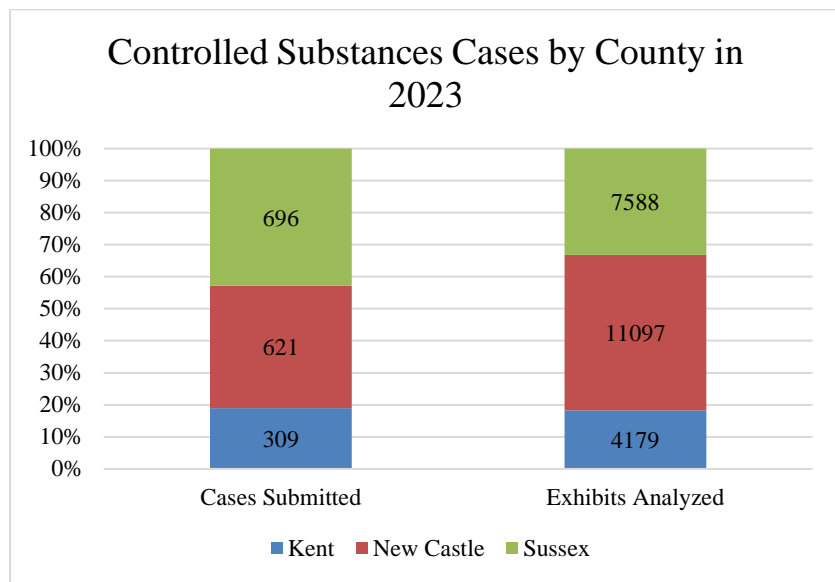
In the 36 cases submitted in 2023, there were 104 cans to be analyzed. Due to the complexity of the fire debris evidence, analysis of this evidence takes a considerable amount of time as compared to controlled substance evidence. The average fire debris case takes 25 days to analyze the data.

In addition to timely and efficient case processing, the FCU remained committed to community outreach, and participated in presentations to local high schools, law clerks, career fairs, and a chemist alumni college.

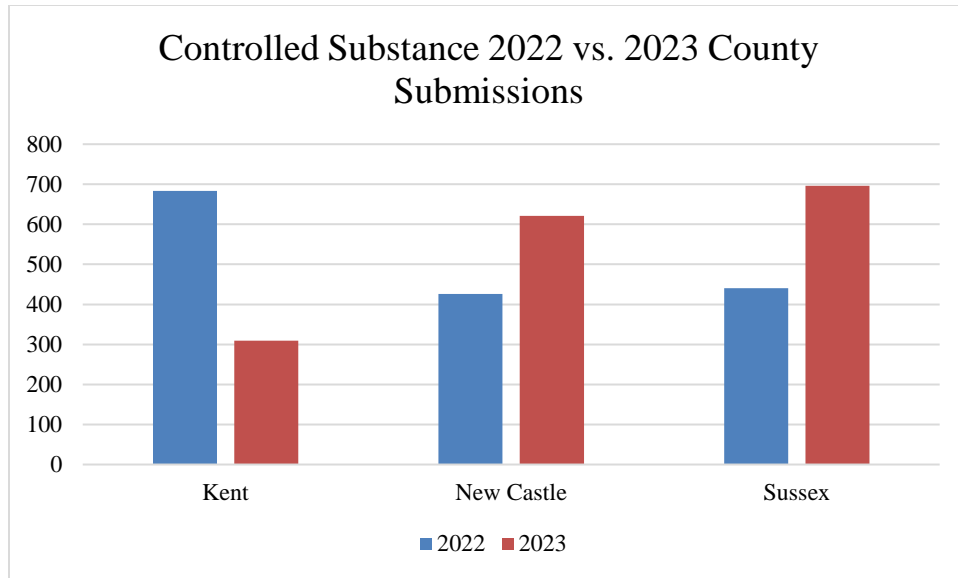
Data

Controlled Substances

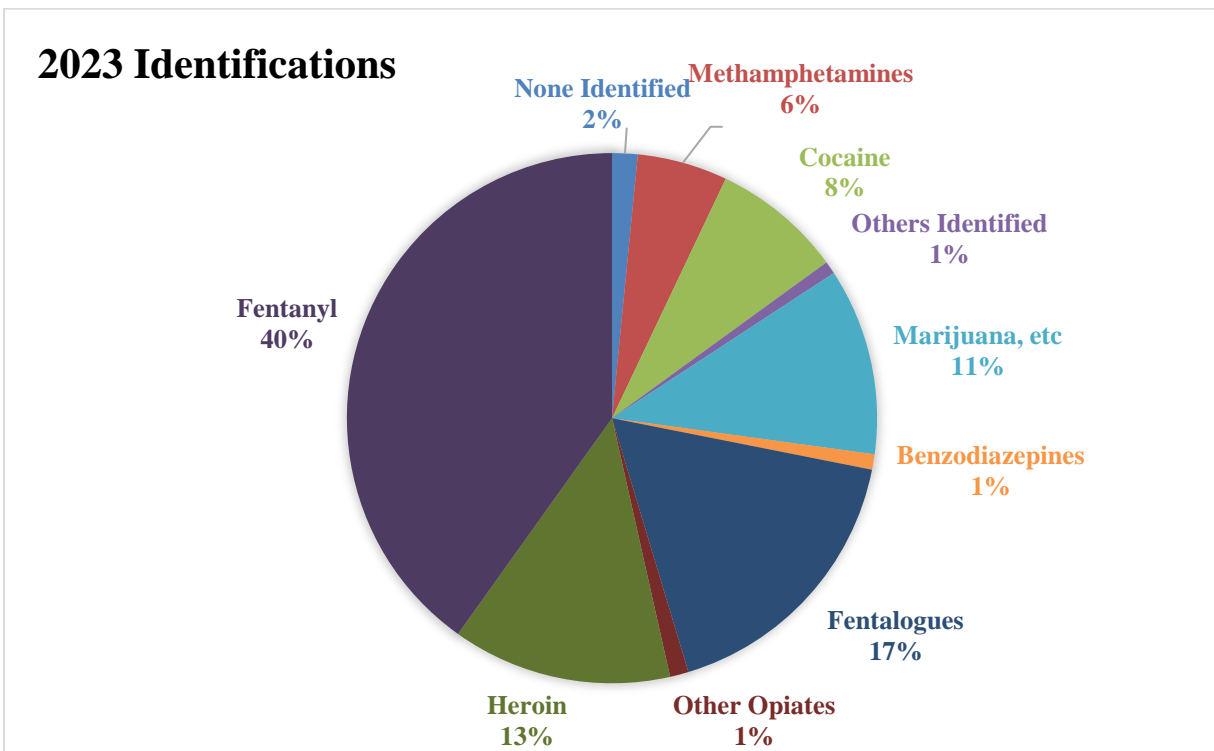
The chart below illustrates the breakdown, by county, of the cases submitted to the DFS Controlled Substances Section and the Exhibits Analyzed. In 2023, Sussex County submitted the most cases, accounting for 60% of the evidence submitted to the section, but only 33% of the evidence analyzed. This can be attributed to submitted cases with many of the same item present.



A notable difference from 2022 to 2023 were the case submissions by county. While both New Castle and Sussex had an approximately 50% increase in case submissions, Kent County had a 54% decrease as seen below.

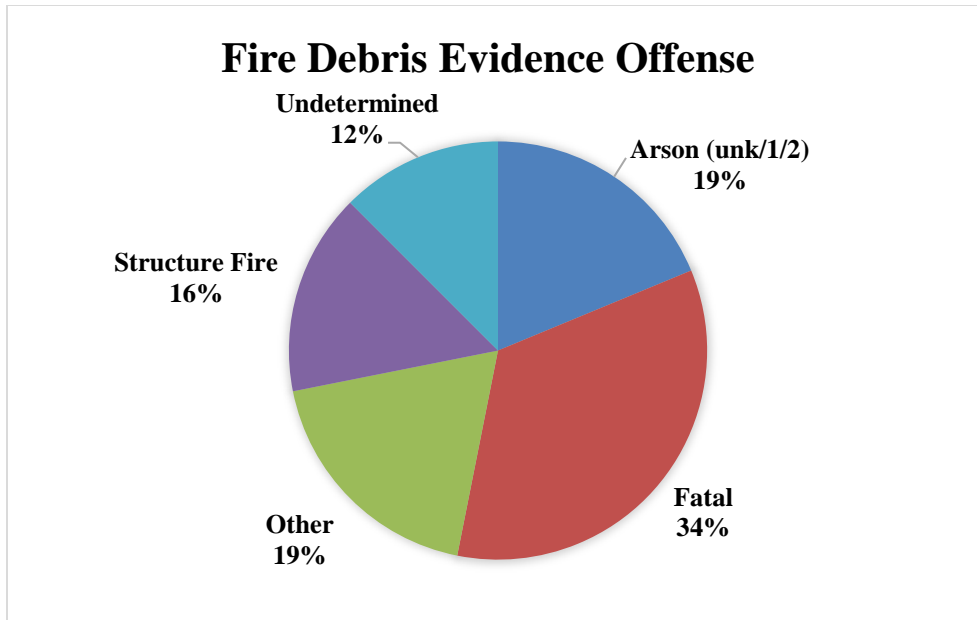


The following chart displays the substances identified by drug category. Percentages were calculated by the total number of exhibits analyzed and because the unit reports multiple controlled substances present, each exhibit may contain more than one.

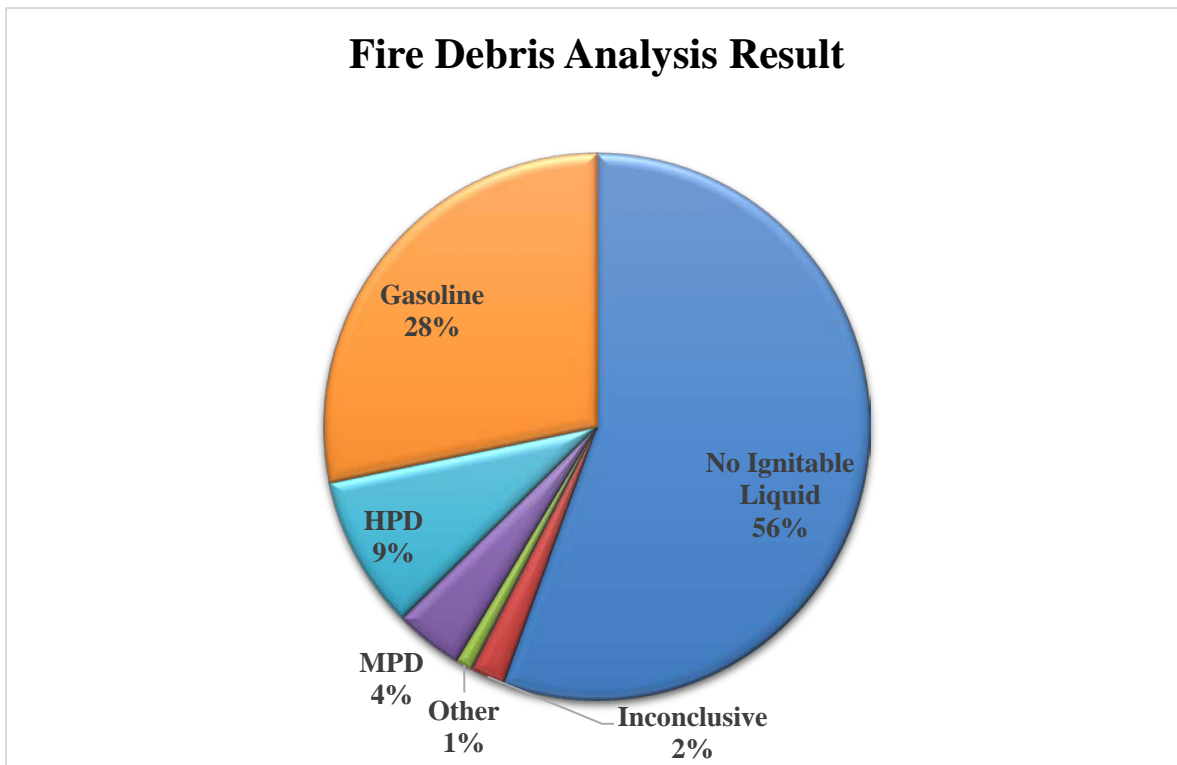


Fire Debris

Evidentiary analysis is prioritized based on the offense associated with the evidence. The below chart displays the offenses of the evidence analyzed in 2023.



Testing for fire debris analysis results in a classification based on ASTM standard test methods. The following chart breaks down the classification results from analysis in 2023.



Conclusion

For answers to further questions, please see the DFS Website at <https://forensics.delaware.gov/>.