



Division of Forensic Science 2017 Annual Report

*State of Delaware
Department of Safety and Homeland Security
200 South Adams Street
Wilmington, DE 19801*

John Evans, Director

Dr. Rebecca Walker, Chief Operating Officer

Dr. Gary Collins, Chief Medical Examiner

Jessica Smith, Chief Forensic Toxicologist

Amrita Lal-Paterson, DNA Technical Leader

Robyn Quinn, Forensic Chemistry Unit Leader

Johna Esposito, Quality Assurance Manager

Table of Contents

The Division of Forensic Science	3
Divisional Initiatives, Collaboration, and Information Sharing	4
Overview	4
National Violent Death Reporting System.....	6
Centers for Disease Control Biorepository Program	7
Delaware Drug Monitoring Initiative.....	7
Disaster Preparation	7
Overall Reporting & Collaboration.....	8
Assessment, Accreditation, and Quality Assurance.....	8
Medical Examiner Unit.....	10
Overview	10
Training and Outreach	11
Partners	12
Data	12
Toxicology	20
Overview.....	20
Staffing Update and Acknowledgements.....	20
Projects and Grants	21
Data	21
DNA.....	28
Overview.....	28
CODIS.....	28
Casework.....	29
Data	31
Forensic Chemistry	33
Overview.....	33
Casework and Accomplishments	33
Staffing and Limited Services.....	34
Data	34



State of Delaware
DEPARTMENT OF SAFETY AND HOMELAND SECURITY
OFFICE OF THE SECRETARY
P.O. BOX 818
DOVER, DELAWARE 19903-0818
302-744-2680

The Honorable John Carney
Governor

The Honorable Robert M Coupe
Cabinet Secretary

To the Citizens of Delaware:

I am honored to recognize the outstanding work of the women and men of the Division of Forensic Science (DFS) highlighted in this year's annual report. Their dedicated and professional service has resulted in numerous accomplishments as they carry forth the mission of the Division in serving our State.

The Division plays an integral role in the criminal justice and medical communities through its work with our law enforcement, the courts, emergency medical services, and treatment partners.

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

Sincerely,

A handwritten signature in blue ink, appearing to read "R M Coupe".

Robert M. Coupe
Secretary



**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**

**The Honorable Robert Coupe
Cabinet Secretary**

To My Fellow Delawareans:

On behalf of the men and women of the Division of Forensic Science (DFS), I am proud to present the 2017 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 Division of Forensic Science 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.

By meeting accreditation standards and certifications, the Division of Forensic Science continues to maintain the highest scientific standards and ensures both organizational and individual integrity. The work ethic of the employees of the Division of Forensic Science is strong and we hold true to our core values of Integrity, Honesty, Thoroughness, Timeliness and Professionalism.

During 2017, the Forensic Chemistry Unit became fully staffed with thirteen Analytical Chemists and I am particularly proud to share that the Division has met its' goal and is now independently capable of accommodating all of the State's controlled substances testing needs.

2017 was another busy year for DFS with an increase in the number of case submissions from 2016 to 2017 across each of the four disciplines; Toxicology, Forensic Chemistry, DNA and the Medical Examiner Unit. The dedicated staff continues to meet the increased demands, while keeping turnaround times on test results at an acceptable level and within Court established deadlines.

With the New Year in 2018 comes several exciting initiatives including a major morgue renovation project at the Wilmington Office, the addition of two new Forensic Pathologists to the M.E. Unit and grant opportunities allowing the DFS to increase our drug testing capabilities.

I would like to thank 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, Secretary of the Department of Safety and Homeland Security Robert Coupe, and the General Assembly, the forward momentum of the Division of Forensic Science will continue in 2018.

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 and I remain confident that they will meet any challenge in order to fulfill our mission.

Sincerely,

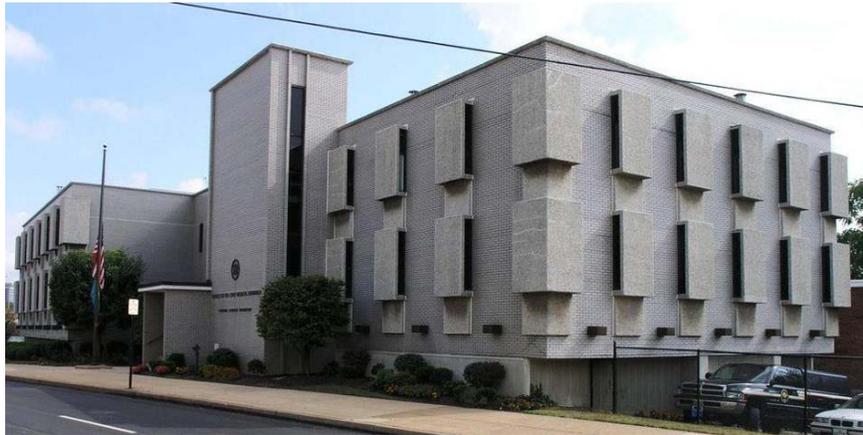
A handwritten signature in black ink, appearing to read "John R. Evans". The signature is fluid and cursive, with the first name "John" being the most prominent.

John R. Evans, Director

The Division of Forensic Science

The Delaware Division of Forensic Science (DFS) was established on June 24, 2014 with the signing of Senate Bill 241 by Governor Jack Markell. Senator Robert I. Marshall was the primary sponsor of the legislation with broad bi-partisan support in both the Senate and House. The bill reassigned forensic and pathology examinations,

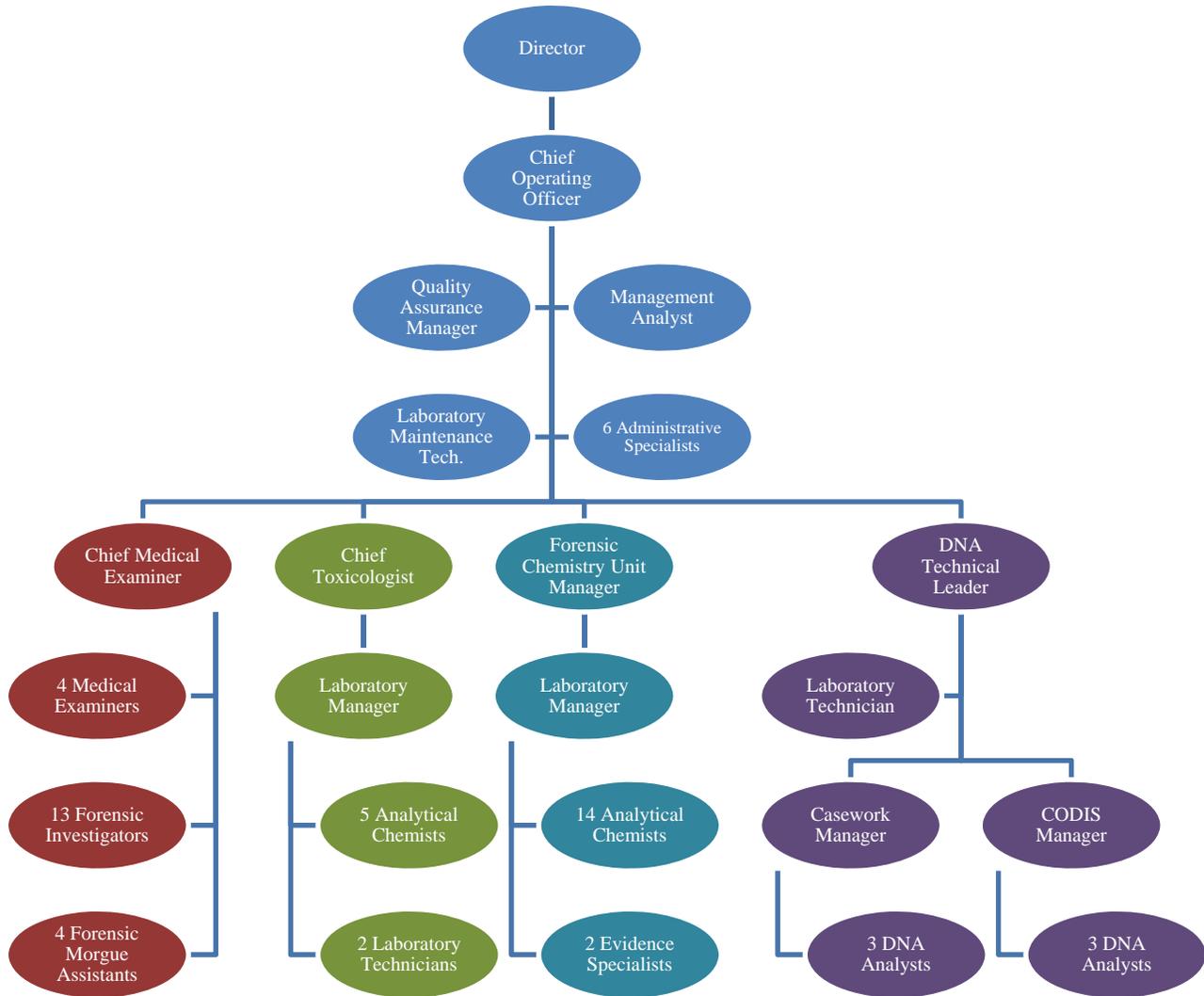
formerly performed by the Office of the Chief Medical Examiner (OCME) within the Department of Health and Social Services (DHSS), to the Department of Safety and Homeland Security (DSHS). In addition, a Commission on Forensic Science was created



Division of Forensic Science, Wilmington, DE

by the legislation. 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 2017, the DFS continued to enhance operations and administration, embracing every challenge as an opportunity to improve. The Forensic Chemistry Unit became fully staffed with thirteen Analytical Chemists, who are able to accommodate all of the State's forensic drug testing needs. The DFS maintained accreditation with the American Society of Crime Laboratory Directors Laboratory Accreditation Board (ASCLD/LAB), which has since merged to become part of ANSI/ASQ 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 through the American Board of Forensic Toxicology (ABFT). The DFS staff includes a board certified Chief Forensic Toxicologist, Forensic Pathologists, as well as certified Forensic Investigators, which all go toward our commitment to providing accurate, timely, and responsive forensic science service to all members of the criminal justice community in Delaware.



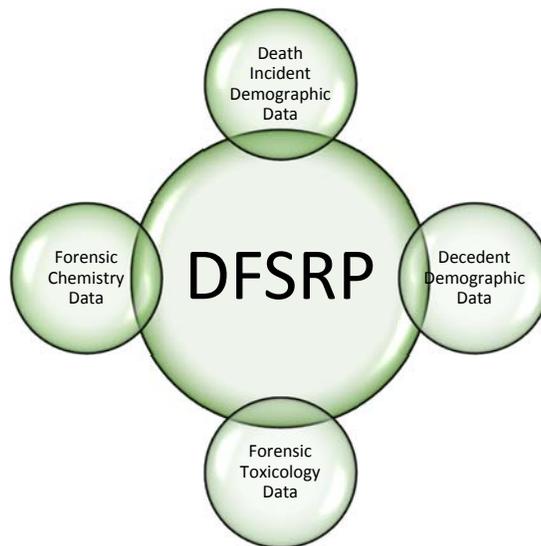
2017 DFS Organizational Chart. (Note that vacant positions are included in totals.)

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 all who we serve. Currently, DFS participates on two statewide commissions related to child death and overdose death; two CDC funded projects; the Delaware Drug Monitoring Initiative; the Delaware Substance Abuse Strategic Planning team; 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 (DFSRRP). DFSRRP is facilitated by research and data abstraction conducted within the Division of Forensic Science under the Department of Safety and Homeland Security, and is aimed at providing consistent data related to toxicology, forensic chemistry, and death-related data to assist in law and health related initiatives statewide. The goal of this work will support the vision of the Division and promote a common platform for all operational and clinical data within the Division of Forensic Science. The DFSRRP Model is represented below, and is inclusive of the following elements:



Death Incident Demographic Dataset is data retrieved from the Pathology Unit. It includes data points such as: date, Medical Examiner (ME) number, notification time, incident arrival times, responding agencies, incident address, and location type (home, business, accident scene, hospital, etc.). This information will be able to link to both OEMS and DELJIS data.

Decedent Demographic Dataset is data retrieved from the Pathology Unit. It includes data points such as: race, ethnicity, age, gender, medical history, and manner of death. A unique identifier may be assigned to each decedent in an effort to protect an individual's health information.

Forensic Toxicology Dataset is data retrieved from the Forensic Toxicology Unit. It includes data related to toxicology results of decedents. This data set takes an estimated 30-45 days for the casework to be completed. To meet the needs of our stakeholders, DFS is routinely reviewing our testing capabilities and expanding our scientific methods.

Centers for Disease Control Biorepository Program

In 2017 DFS has continued to partner with the Child Death Review Commission for the collection of biological samples as part of the funded sudden death in the youth (SDY) CDC reporting project. DFS works with the SDY Registry to submit certain cases for DNA sampling as part of the grant requirement. DNA samples are then shipped to the University of Michigan SDY Biorepository. Forensic Investigators work with family members to obtain consent so that the DNA sample will be available for sudden child death research. The data and samples are used to create a resource that will be used by National Institute of Health funded researchers to investigate SDY. This vital work is being conducted to identify causes of sudden death in Delaware Children and is a result of the hard work of our DFS team.

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 and 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 Delaware Forensic Science Reporting System (DFSRS), Delaware Emergency Medical Reporting System (DEMRS), DIAC, and the Delaware 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. To date, this is the only situational awareness report produced as part of a collaborative effort across state agencies. This report undergoes constant scrutiny to identify ways to improve the data provided. 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.

Disaster Preparation

The Division of Forensic Science worked with partners at the Division of Public Health Emergency Medical Services and Preparedness Section to finalize a statewide Mass Fatality Plan. As part of this ongoing effort to be prepared, the Division of Forensic Science has participated in disaster drills at both

the local and statewide levels. The purpose of these exercises was to identify areas of strength and weakness, and to test the Mass Fatality Plan before the occurrence of a state disaster.

In 2017 DFS actively participated in the second step of disaster preparation, the development of a statewide Family Assistance Center (FAC) plan. This plan is modeled after the National Transportation and Safety Board efforts to promote a centralized location for multiple agencies to assist families during a disaster. This plan is in the final stages and should be ready for testing in 2018.

Overall Reporting & Collaboration

One of the efforts that the Division of Forensic Science encourages is the sharing of information with stakeholders and government agencies in Delaware. This is accomplished by successful collaboration, participation on commissions and other data analysis efforts across State departments and agencies. To accomplish this mission the Division of Forensic Science works closely with the Department of Health and Social Services, the Division of Public Health, the Department of Justice, the Delaware Information Analysis Center, the University of Delaware, and other health and law enforcement organizations statewide.

The Division has also increased its academic interface with the Delaware academic community by opening its doors to tours, promoting forensic internship programs, and participating in quality data collection and research. The Division firmly believes these efforts will promote forensic science disciplines among Delaware students and lead to stronger information sharing projects.

Overall, these external relationships have two goals: to promote confidence in the Division of Forensic Science by demonstrating transparency in forensic principles and processes, 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.

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 Society of Crime Laboratory Directors Laboratory Accreditation Board (ASCLD/LAB), the American Board of Forensic Toxicology (ABFT), the National Association of Medical Examiners (NAME), and Quality Assurance Standards (QAS) established by the Federal Bureau of Investigation (FBI).

ISO 17025:2005

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 ASCLD/LAB (which has since merged with ANAB, or ANSI-ASQ National Accreditation Board), which also publishes additional standards that must be adhered to for accreditation, and is scheduled to expire on June 30, 2020.

American Board of Forensic Toxicology

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

The toxicology laboratory at the DFS received a Certificate of Laboratory Accreditation in Forensic Toxicology by the ABFT on July 1, 2016, which will expire on July 1, 2018.

National Association of Medical Examiners

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. The current NAME accreditation expires January 16, 2019.

FBI Quality Assurance Standards

The FBI's Quality Assurance Standards 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 for the State and performs post mortem examinations on cases that fall under its jurisdiction. The Unit operates out of the main office in Wilmington, the Tobin Building on the Stockley Center in Georgetown, and a recently established satellite office in the Capitol Building in Dover (Kent County).

The number of deaths investigated by the MEU increased in 2017. This increase was largely due to the upsurge in deaths related to drug use. Statewide, deaths from drug and alcohol intoxication increased by 12% from 308 in 2016 to 348 in 2017. In 2017, the MEU investigated 2178 reports of death and accepted jurisdiction of approximately 60% of the cases. For 2017 the MEU certified 1303 deaths, which represents 14% of deaths registered by the State of Delaware.

	2015	2016	2017
Autopsies	580	649	610
Inspections	331	329	307
Total Examinations	911	978	917
Inquiries*	245	305	386
Total Deaths Certified	1156	1283	1303
Non-Jurisdiction Investigations*	902	816	875
Total Medical Death Investigations	2058	2099	2178
*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.			

An additional responsibility of the Medical Examiner is to approve organ and tissue donations. In 2017, the MEU approved 40 of the 70 individuals that were accepted for organ donation. Organs procured included heart, liver, kidney, and lungs while tissues procured include cornea, skin, long bones, and heart valves.

Some of the improvements within the Medical Examiner Unit included the opening of a satellite office in Kent County to accommodate improved response times to deaths occurring in Kent County; an update to the computer software used by the MEU; and planning for major improvements to the morgue facilities at the Wilmington office.

In 2017 the unit experienced changes in personnel which included the retirement of Dr. Adrienne Sekula-Perlman. Dr. Perlman served the State for 23 years and ended her tenure with the MEU as Deputy Chief

Medical Examiner. Additional changes included the hiring of a Chief Forensic Investigator and two additional full-time board certified forensic pathologists and a part time forensic pathologist, as well as two forensic investigators. 2018 will see the MEU fully staffed with the Chief ME, three full time and one casual-seasonal Assistant ME, Chief Forensic Investigator, seven full time and 5 casual-seasonal Forensic Investigators, and three full time and one casual-seasonal Forensic Morgue Assistants. Despite the staffing challenges of the second half of 2017, the unit was able to achieve the goals and objectives of the Division of Forensic Science.

Training and Outreach

The Division continues to promote education and training among the staff in the MEU. As part of our community involvement, several of our Forensic Investigators are actively involved in outreach educational activities with local police departments and police academies, fire and paramedic training programs, as well as hospital based training programs. Our Forensic Investigators participate in regular in-house training provided by the pathologists, and many of them have attended local and national conferences such as: The Annual Delaware State Police Homicide Conference, the Annual New England Seminar in Forensic Sciences, and the American Academy of Forensic Sciences Annual Conference. The pathologists stay current by participating in educational activities geared toward maintenance of board certification, attending conferences sponsored by the American Society of Clinical Pathology, National Association of Medical Examiners, International Homicide Investigators Association, and National Association of Attorney Generals.

The MEU is active in our academic community by participating in presentations and providing internship and training opportunities to pathology residents from the University of Pennsylvania, as well as undergraduate students at University of Delaware and residents of Delaware enrolled in other tertiary institutions.

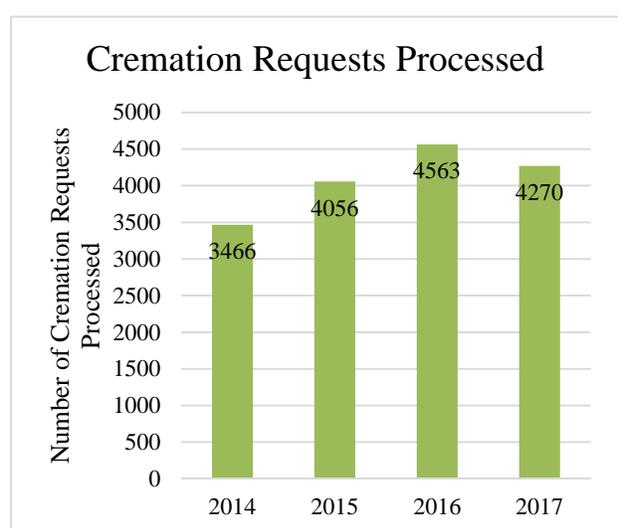
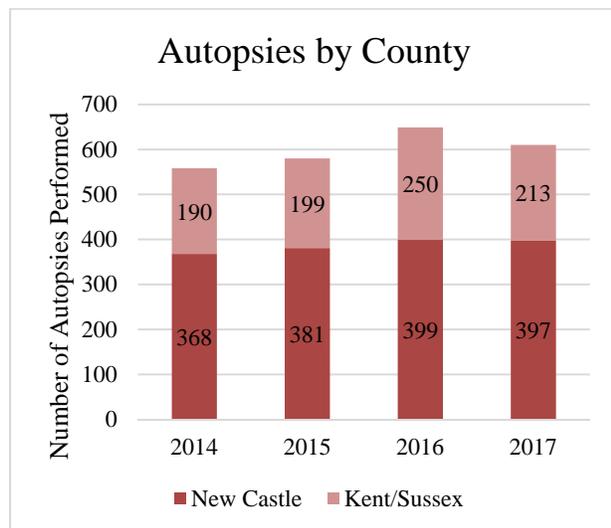
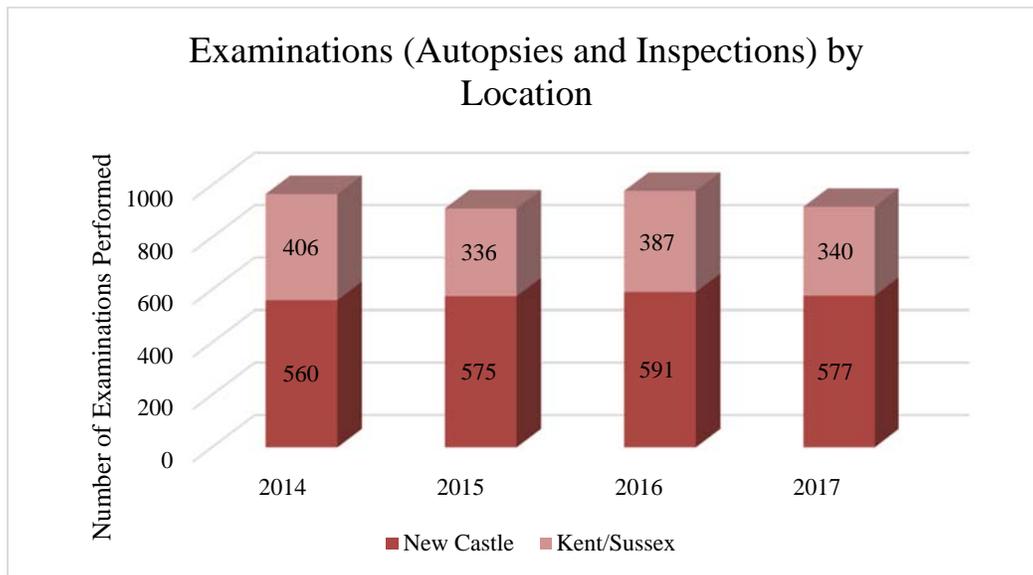
The unit actively participates in multiple mortality review committees and research projects. These projects utilize data collected from death investigations to aid in disease and injury prevention, disease surveillance programs, health improvement programs, and addiction prevention and treatment programs. Some of the agencies and program collaborators include the Division of Public Health, the CDC funded Sudden Death in Youth (SDY) project, National Violent Death Report System, and the State of Delaware Child Death Review Panel and Maternal Mortality Review. Other Federal agencies that have partnered with DFS include the Consumer Product Safety Commission (CPSC) and the Occupational Safety and Health Administration (OSHA).

Partners

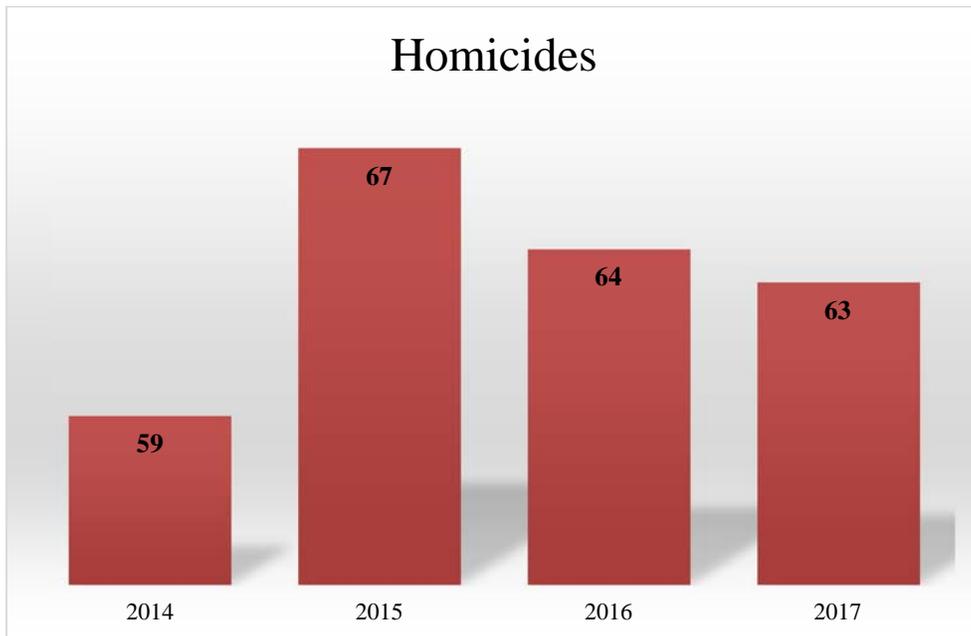
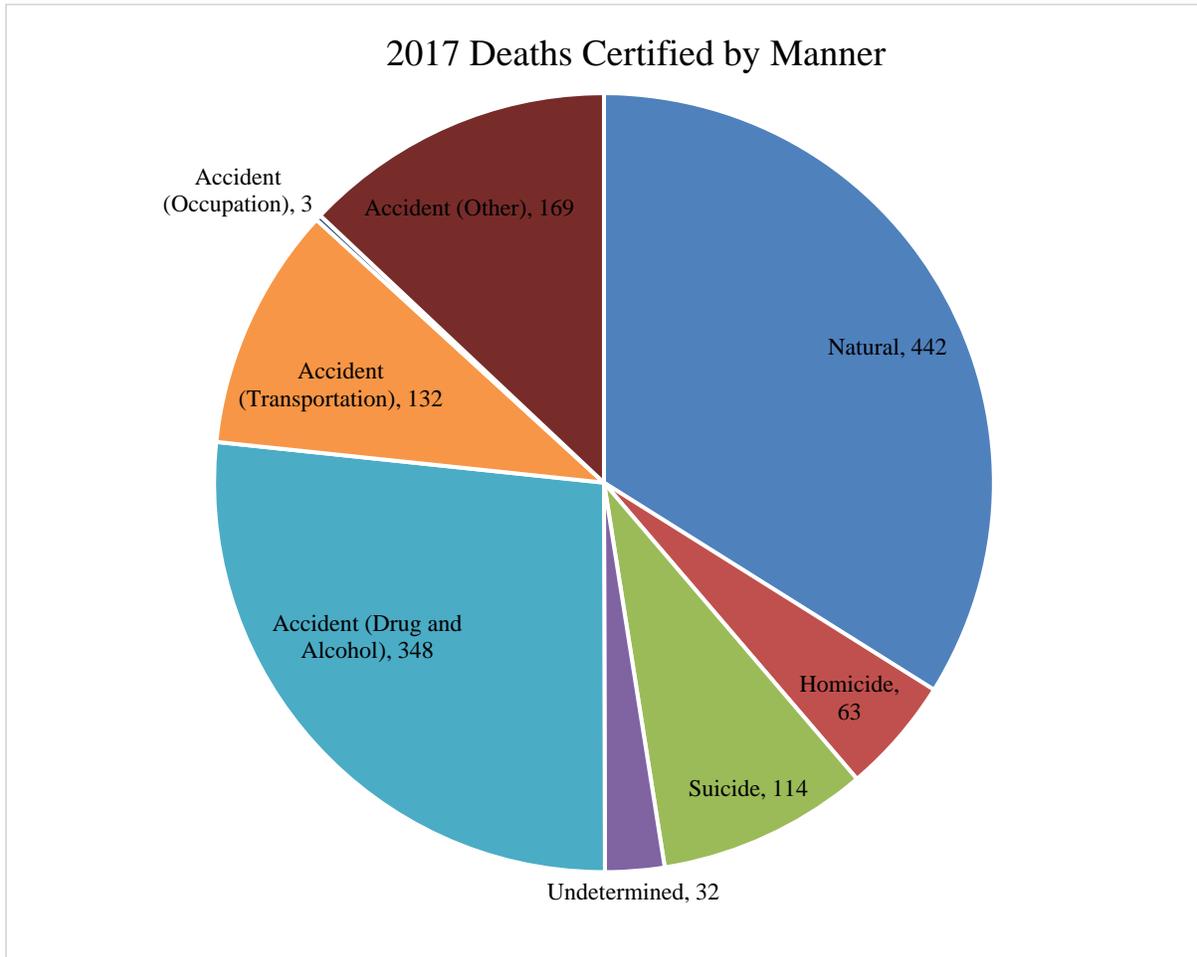
The Medical Examiner Unit could not accomplish this important work without the support of the Department of Safety and Homeland Security and the Delaware General Assembly. In addition, it is important to note the many agencies who assist in providing services to Delaware. These agencies include: Delaware law enforcement agencies, the Attorney General’s Office, 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 medical practices who do business with the Division. The Division values the partnership contributions of the many agencies.

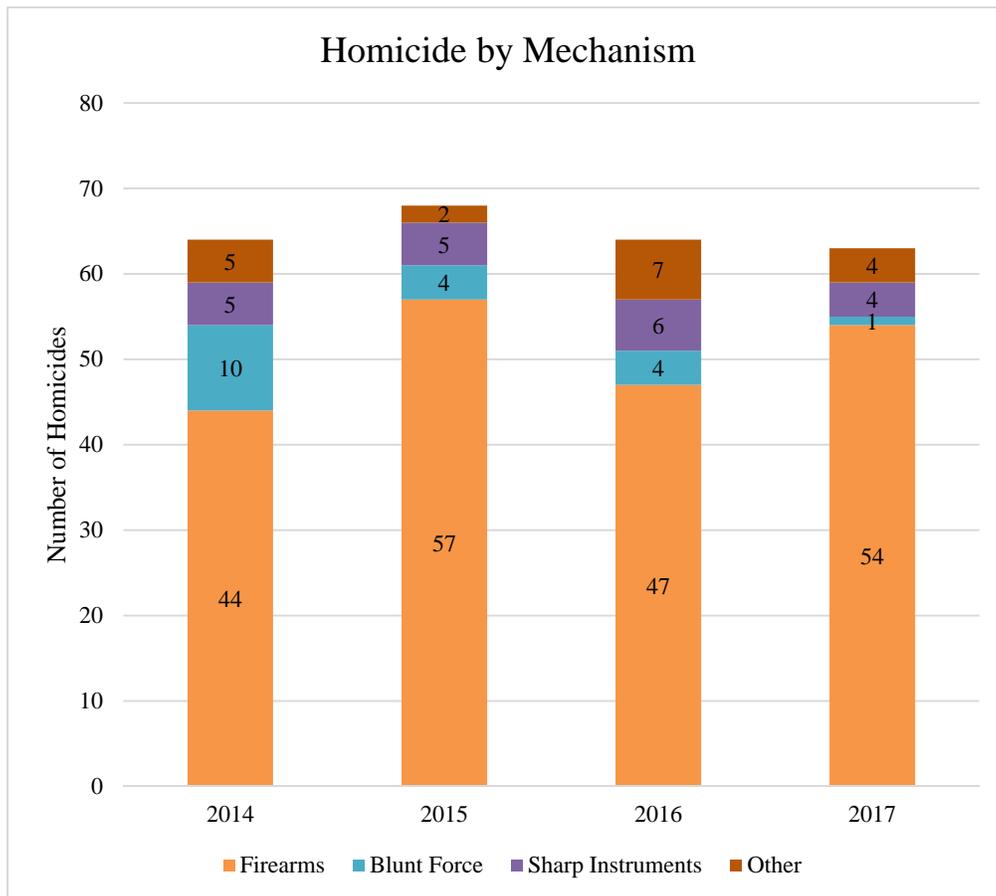
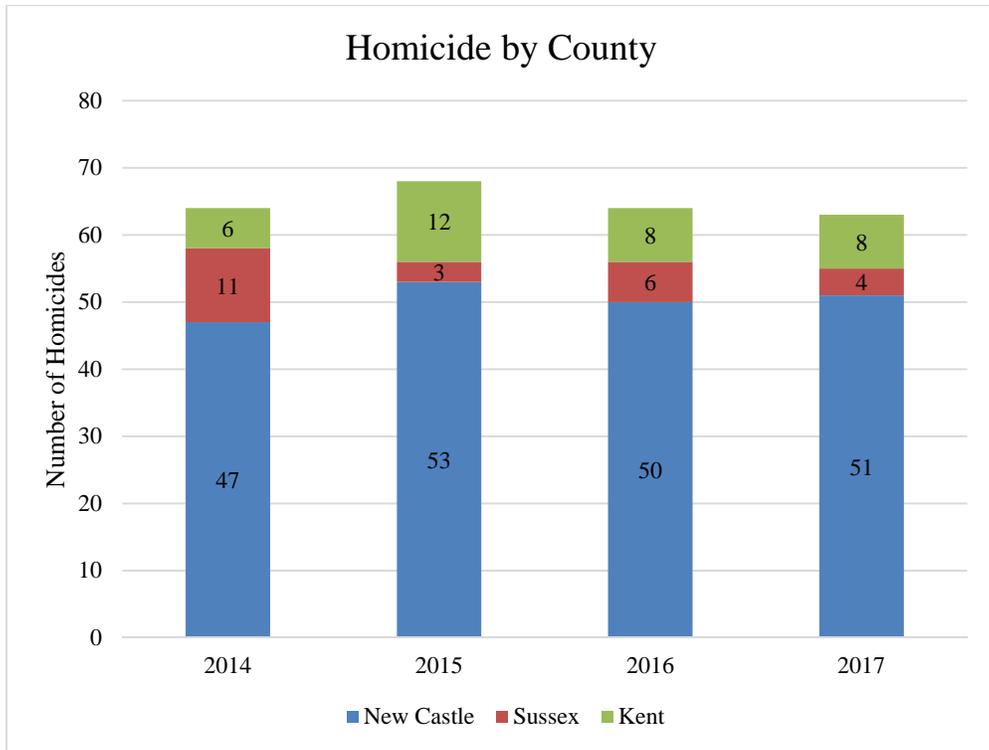
Data

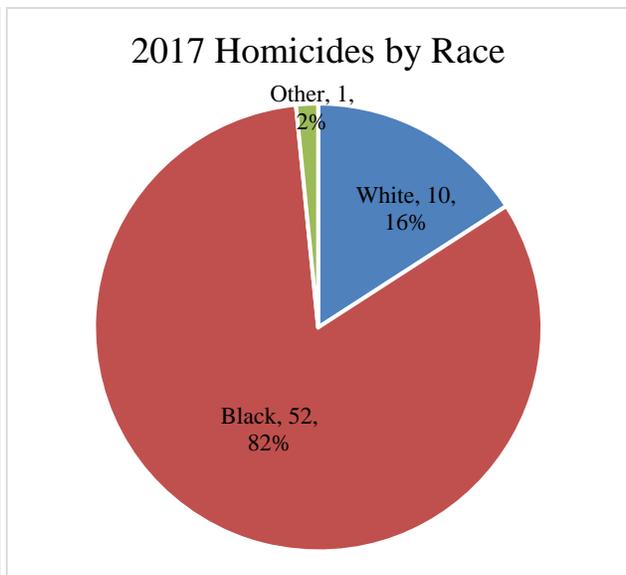
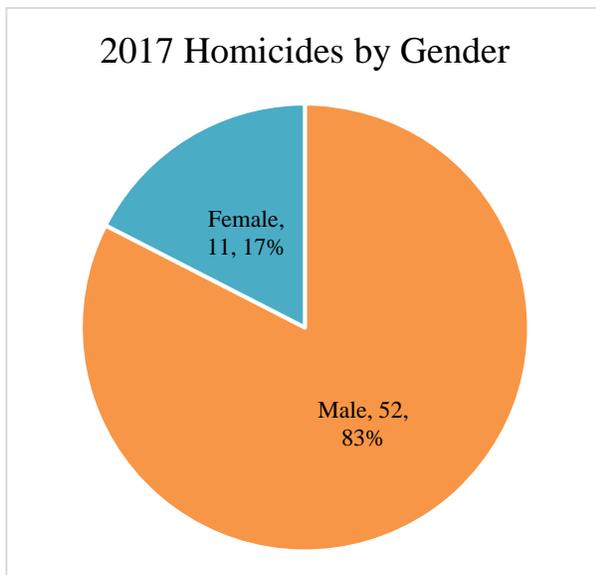
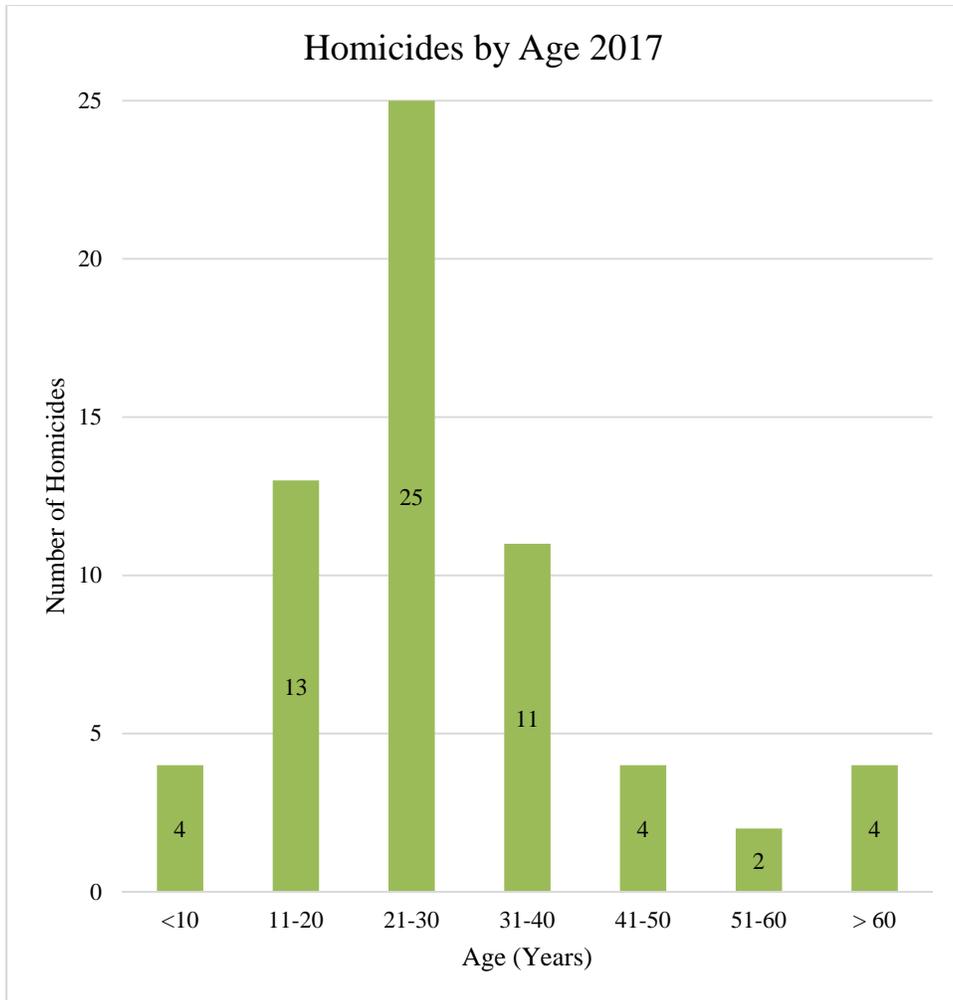
Cases Reviewed



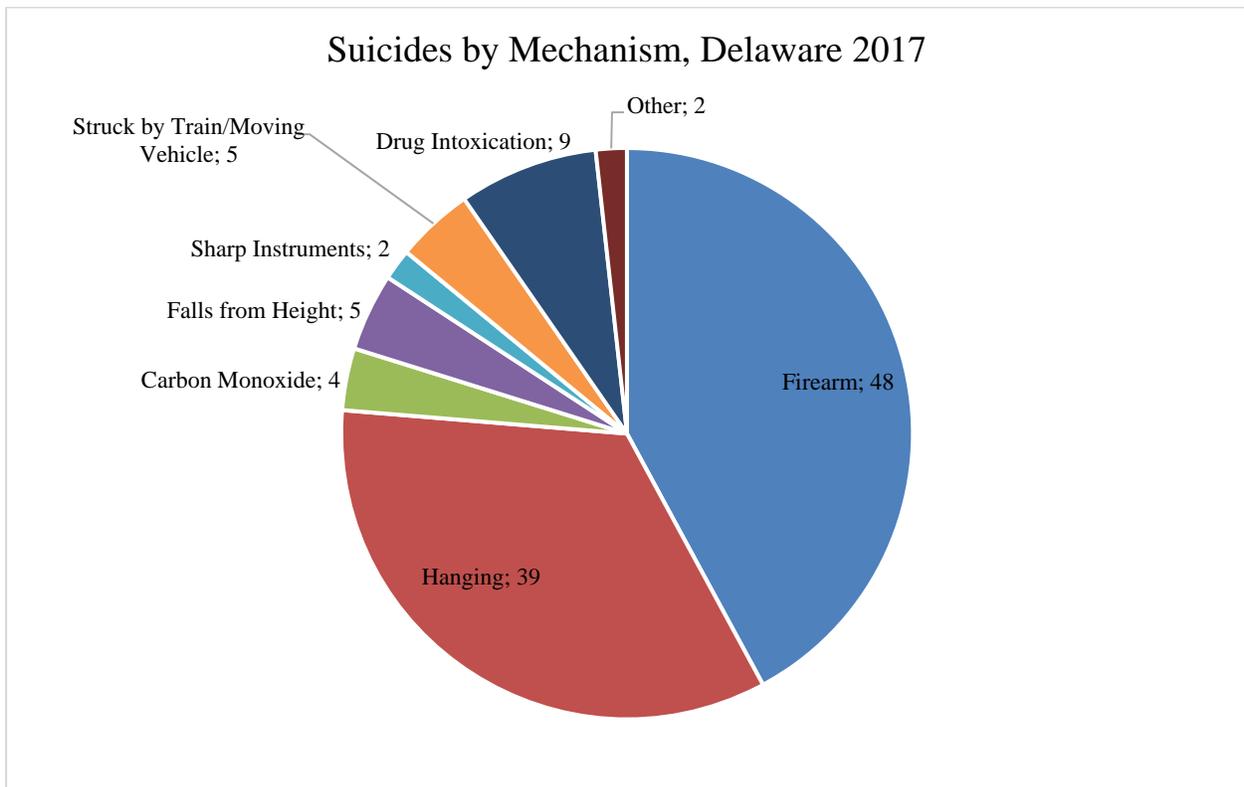
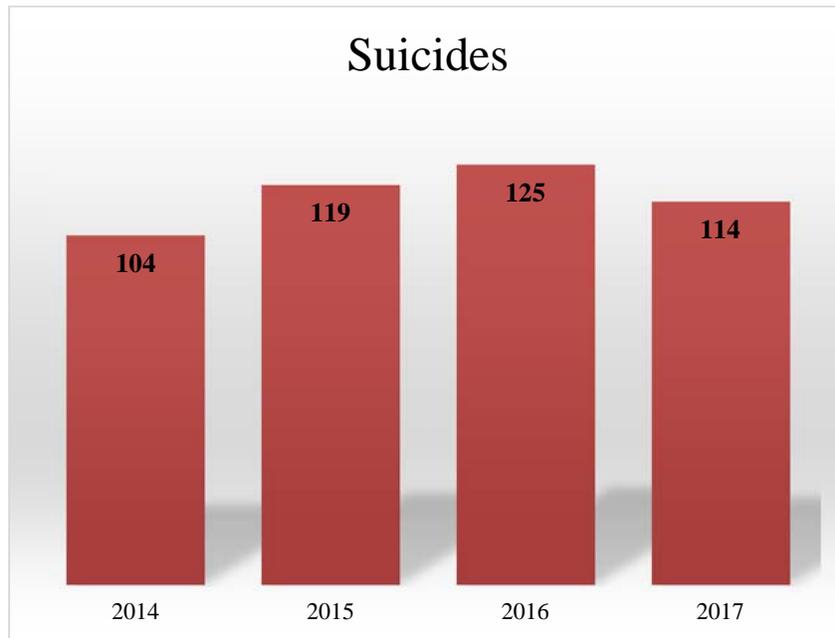
Homicides



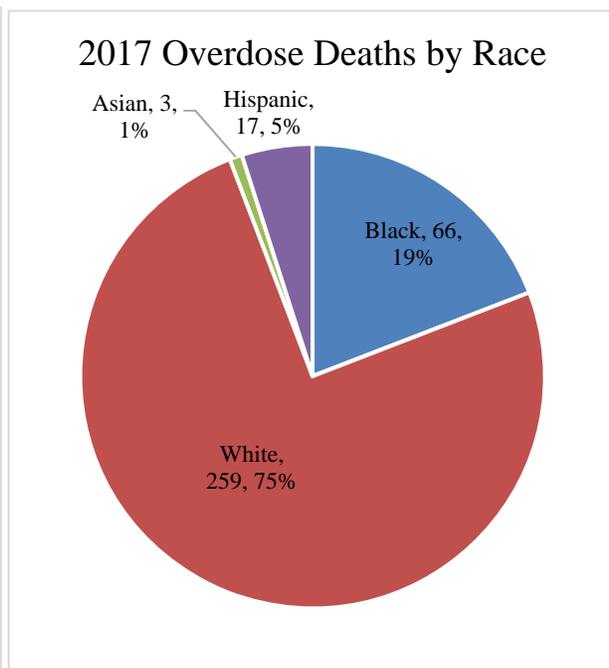
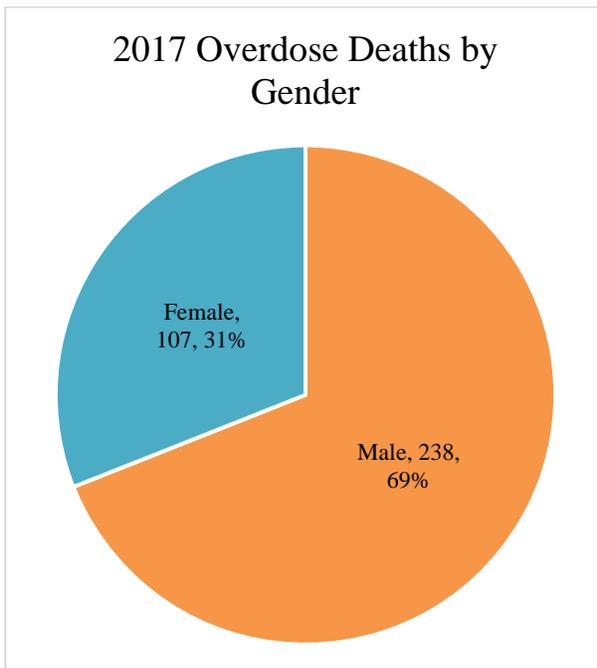
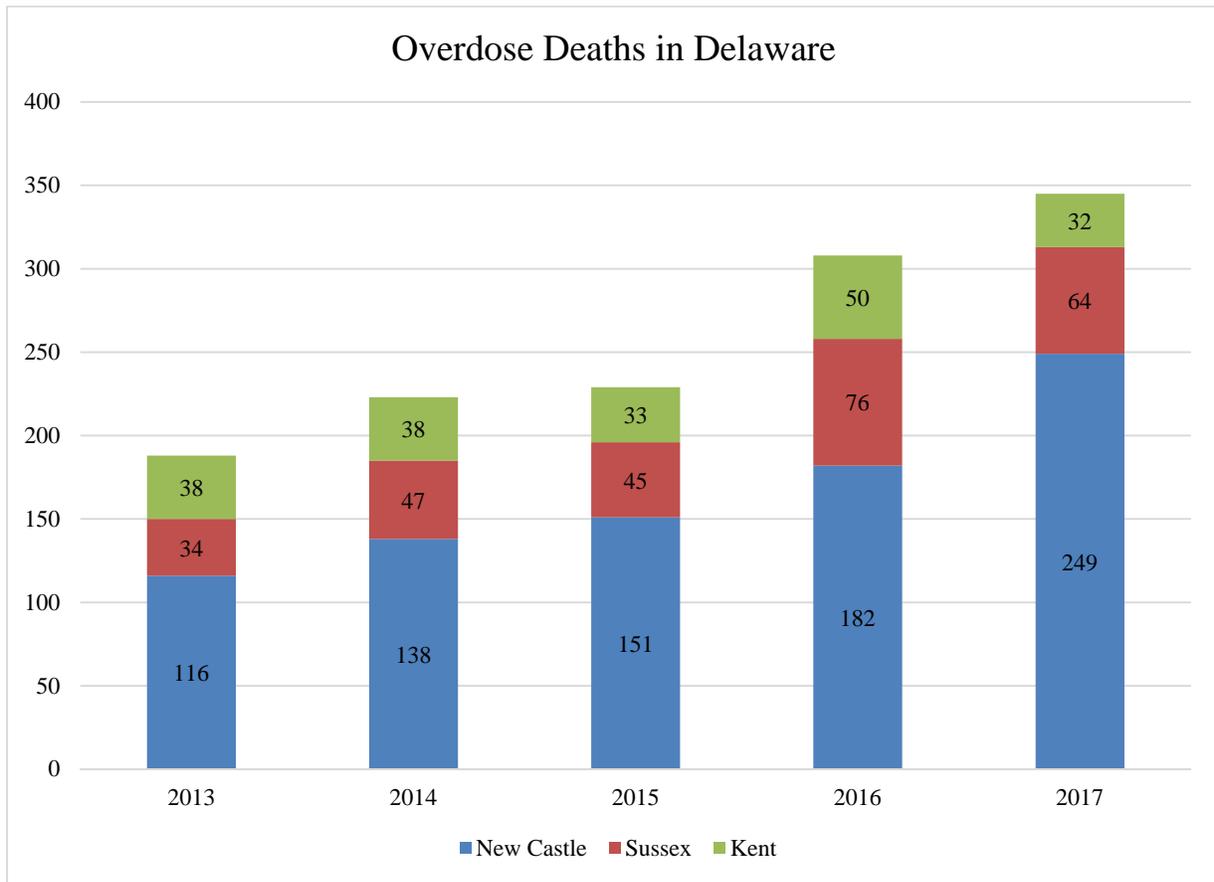


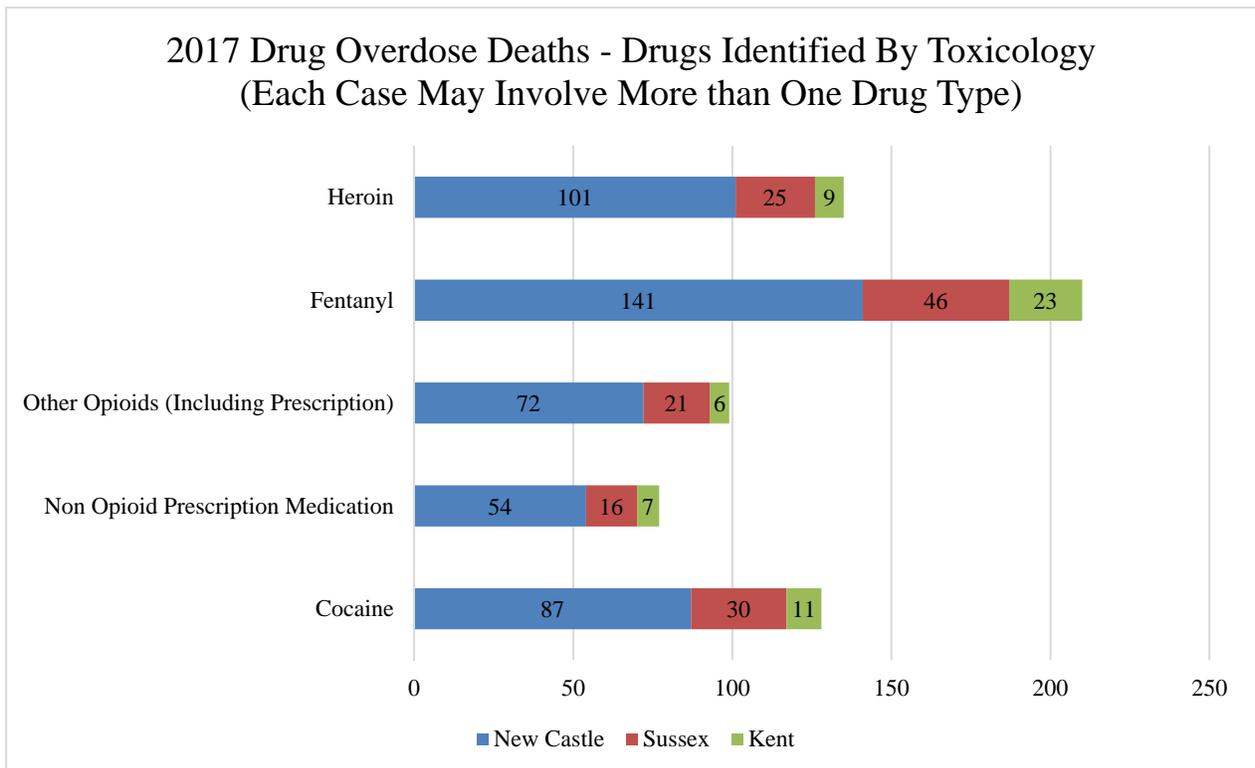
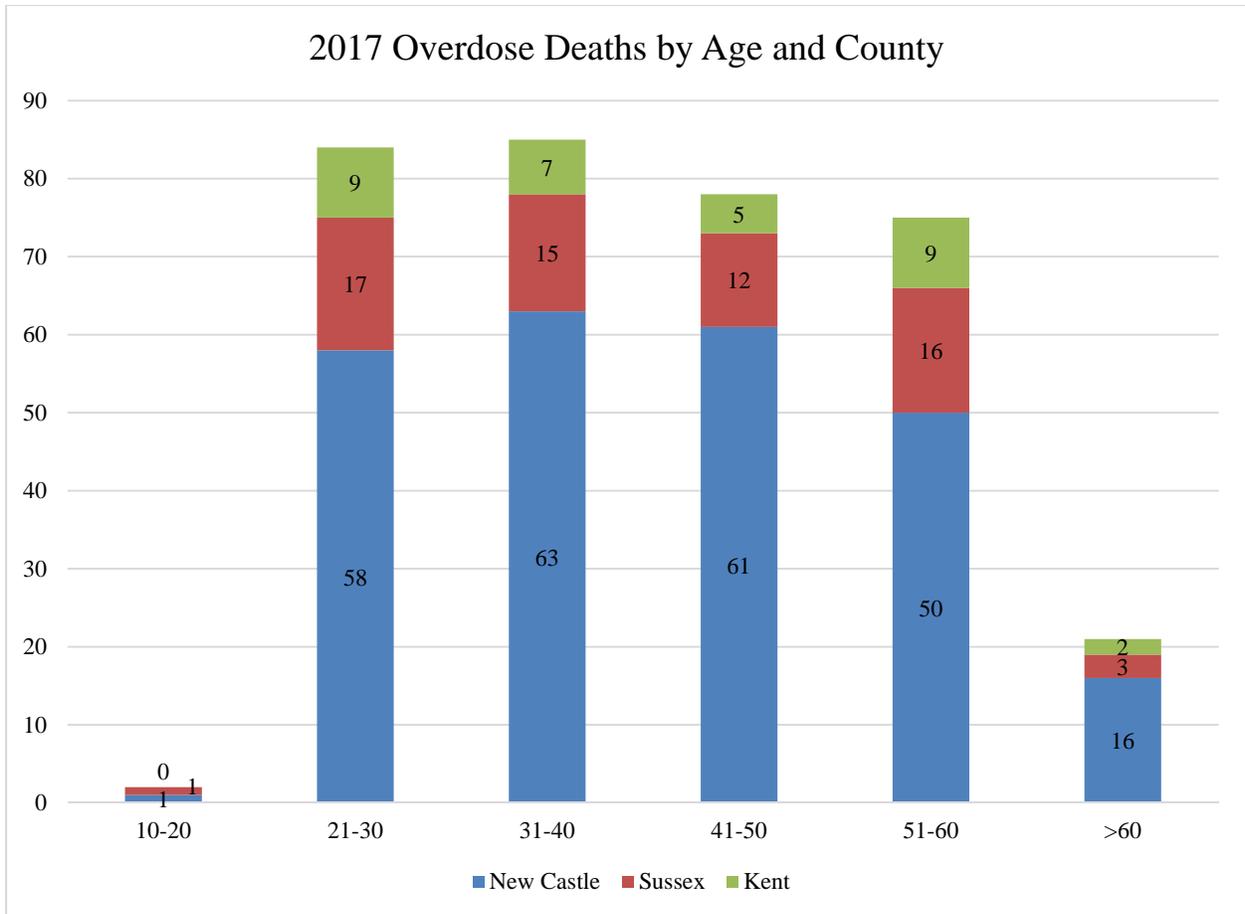


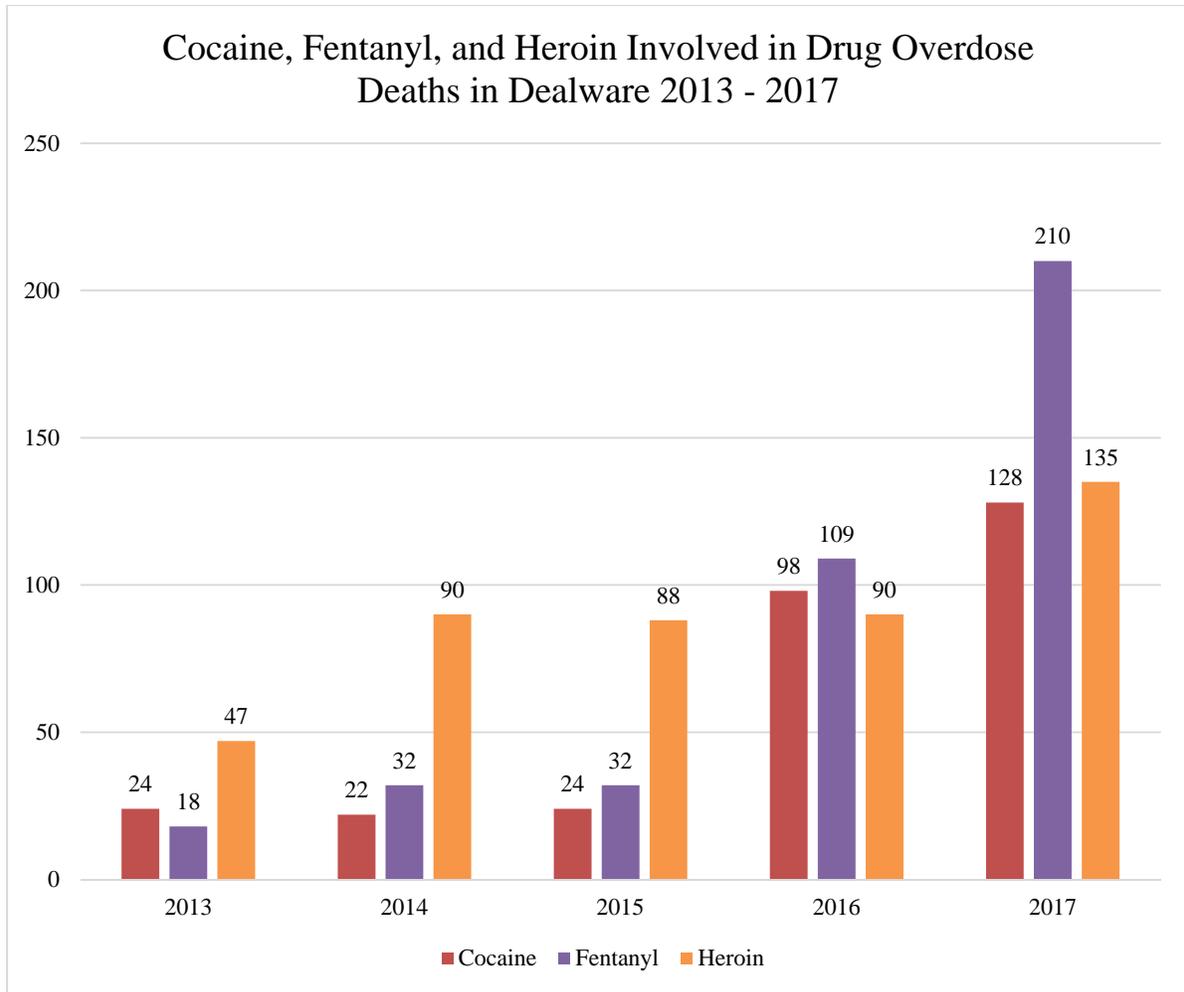
Suicides



Drug Overdose Deaths







Toxicology

Overview

The Toxicology 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 eight positions: the Chief Forensic Toxicologist, the Laboratory Supervisor, four Analytical Chemists, and two Laboratory Technicians (one full-time and one part-time). Most cases (including all DUIs) begin with a preliminary ELISA (Enzyme-linked Immunosorbent Assay) Drug Screen, which tests qualitatively for the following 12 drugs/drug classes: Amphetamine, Methamphetamine, Opiates, Phencyclidine, Carisoprodol, Methadone, Benzodiazepines, Cocaine, Barbiturates, Cannabinoids, Oxycodone, and Fentanyl. 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 11 confirmatory procedures for the following drug classes/drugs (and their metabolites), which provide quantitation (concentrations or amounts of drugs): Antidepressant (ADP), Cannabinoid, Cocaine, Fentanyl, Methadone, Opioid, Phencyclidine, and Alkaline Drugs (Benzodiazepines, Cyclobenzaprine, Diphenhydramine, and Tramadol). All confirmatory procedures utilize Gas Chromatography-Mass Spectrometry (GC-MS) except the ADP method, which uses Liquid Chromatography-MS/MS (LC-MS/MS).

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

The Toxicology Unit had some staffing changes in 2017. Our new Research Analyst position was filled at the beginning of February. An Analytical Chemist who had been working in the unit for five and a half years was promoted to the Laboratory Supervisor in March. This vacancy was posted as an open competitive recruitment, and an employee who worked as a part-time Laboratory Technician III in the Toxicology Unit was selected for this full-time Analytical Chemist II position. This vacancy was then filled, so the unit has been fully staffed since May 30, 2017. Furthermore, two Analytical Chemists were promoted from IIs to IIIs in March as well.

The Chief Forensic Toxicologist voluntarily became board certified through the American Board of Forensic Toxicology (ABFT). Her professional certification is as a diplomate (D) in forensic toxicology (FT) and was effective December 1, 2017.

Projects and Grants

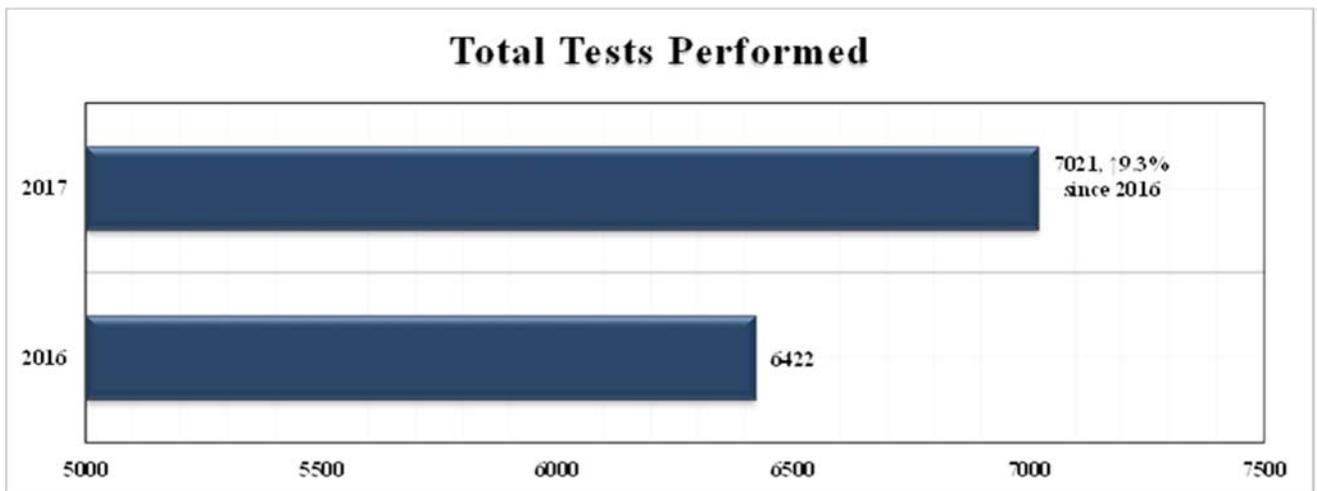
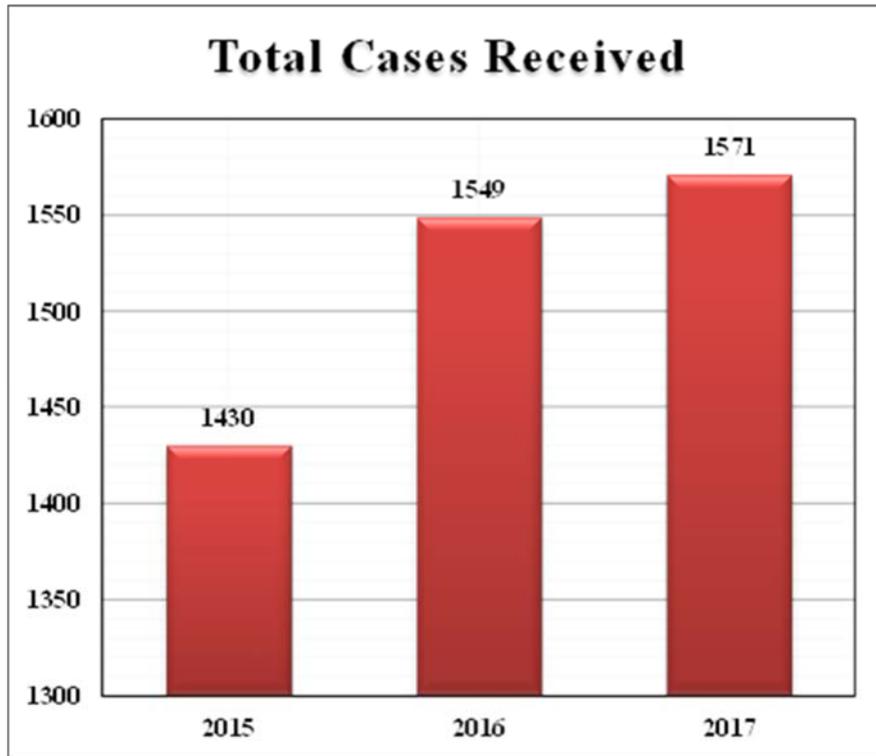
The Toxicology Unit was fortunate to receive two grants through Delaware's Office of Highway Safety (OHS) targeting drug-impaired driving. The first grant was for five three-day consultation sessions with Agilent Technologies to work on method development of amphetamine and benzodiazepine panels on LC-MS/MS with our Research Analyst. During 2017, we completed two of the five consultation sessions with Agilent. These new panels will increase the number of drugs quantitated in the toxicology laboratory, leading to even more information about drug use for drug-impaired driving as well as postmortem cases. The second grant was for the revalidation and expansion of our ELISA Drug Screen panel. Expanding this initial drug screen means getting more information quickly, increasing the likelihood that all drugs of abuse will be detected, and ultimately providing a better service with regards to drug detection in the Toxicology Unit. Both projects are still ongoing. We would like to sincerely thank OHS for these opportunities and look forward to continuing to work together.

Data

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

Total Cases Received and Total Tests Performed (and Thus Workloads) All Increased

In 2017, the Toxicology Unit tested **825 postmortem cases** (and received an additional 113 cases that did not require testing) and **746 DUI/other cases**. This equated to a total of 1571 total cases tested and 7021 total tests run in 2017, which is a 9.3% increase in tests performed versus 2016 (when 6422 tests were run). Because each case may have multiple samples and/or require more than one test, and because the unit also runs 40+ 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. The below bar graphs show how the number of cases received and the number of tests performed have steadily increased.



ELISA Drug Screening Data

The below tables display the ELISA Drug Screen results to show the number of positives (or None Detected) 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 results.

More than half of the DUI/other cases received in 2017 were positive for cannabinoids (marijuana). Cocaine, fentanyl, and opiates are now the next top three categories; in 2016, they were benzodiazepines, cocaine, and opiates. The percentage of postmortem cases screening positive for fentanyl was even greater at 27.8% (compared to 22.7% for DUI/other cases).

Percentage of Total DUI/Other Cases Received That Screened Positive:

Drug/Drug Class on ELISA	DUI/Other Cases Screened Positive
Cannabinoids Cross-reactives	53.1%
Cocaine Cross-reactives	25.3%
Fentanyl Cross-reactives	22.7%
Opiate Cross-reactives	21.7%
Benzodiazepine Cross-reactives	20.9%
Oxycodone Cross-reactives	9.7%
None Detected	9.1%
Methadone Cross-reactives	8.2%
Phencyclidine Cross-reactives	6.4%
Amphetamine Cross-reactives	4.3%
Methamphetamine Cross-reactives	3.8%
Carisoprodol Cross-reactives	1.1%
Barbiturate Cross-reactives	0.7%

Percentage of Total Postmortem Cases Received That Screened Positive:

Drug/Drug Class on ELISA	Postmortem Cases Screened Positive
None Detected	29.5%
Cannabinoids Cross-reactives	28.0%
Fentanyl Cross-reactives	27.8%
Cocaine Cross-reactives	20.8%
Opiate Cross-reactives	20.6%
Benzodiazepine Cross-reactives	10.9%
Oxycodone Cross-reactives	9.5%
Amphetamine Cross-reactives	8.6%
Methadone Cross-reactives	4.1%
Methamphetamine Cross-reactives	1.9%
Barbiturate Cross-reactives	1.6%
Phencyclidine Cross-reactives	1.2%
Carisoprodol Cross-reactives	0.5%

Top 10 Reported Compounds from Confirmatory Procedures

The below tables show confirmatory results. The inactive marijuana metabolite, delta-9-carboxy-tetrahydrocannabinol, was confirmed positive in 42.8% of the DUI/other cases received, and the active parent compound of marijuana, delta-9-tetrahydrocannabinol (THC), was confirmed positive in 29.9% of DUI/other casework. For postmortem cases, after ethanol, fentanyl was the top reported compound from confirmatory procedures, as the below table shows, followed by morphine.

Percentage of Total DUI/Other Cases Received That Confirmed Positive:

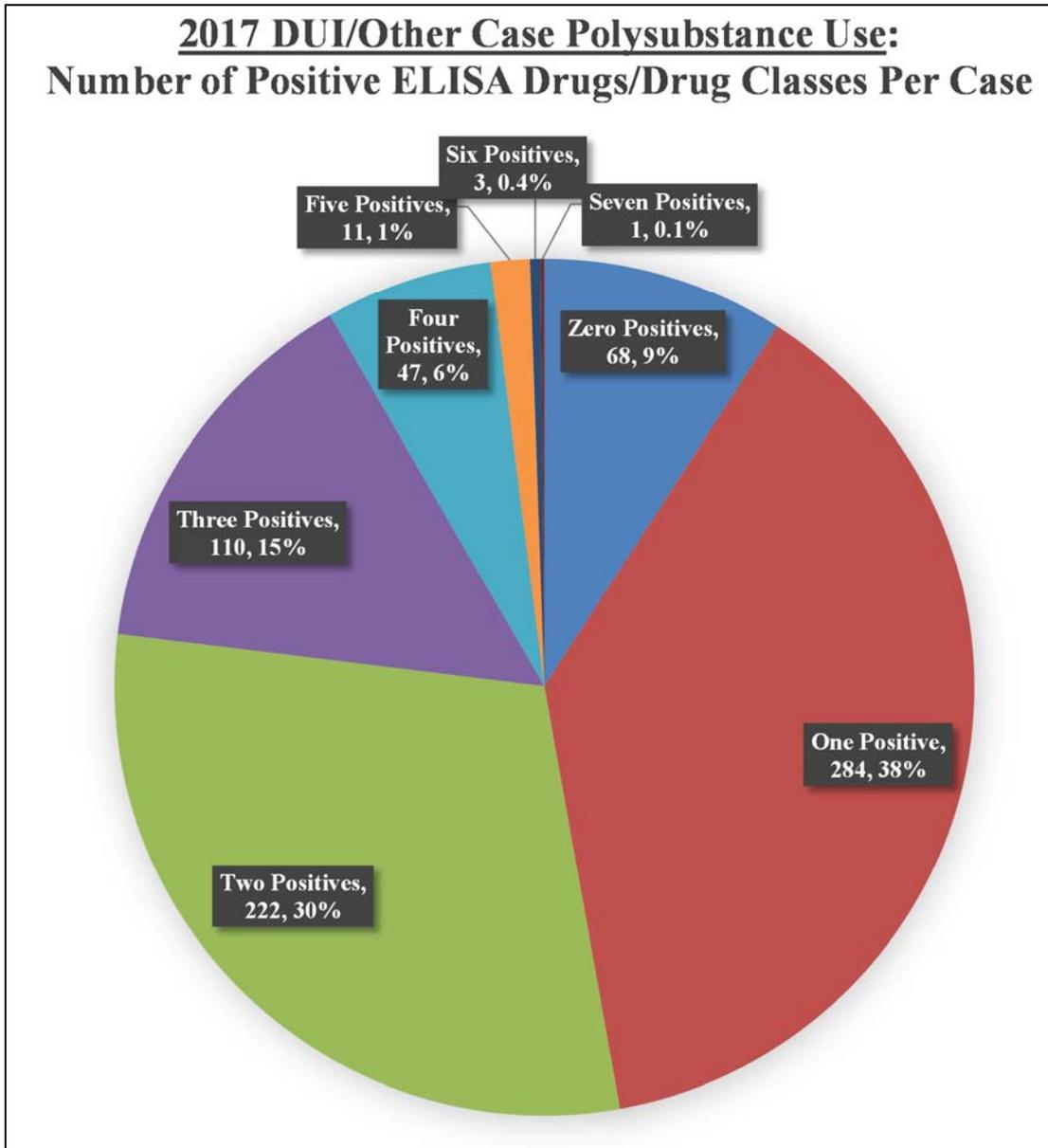
Compound	DUI/Other Cases Confirmed Positive
Delta-9-Carboxy-Tetrahydrocannabinol	42.8%
Delta-9-Tetrahydrocannabinol (THC)	29.9%
Morphine	14.8%
Benzoyllecgonine	13.6%
Cocaine	8.1%
Ecgonine Methyl Ester	7.0%
Methadone	6.6%
Oxycodone	6.6%
Alprazolam	6.5%
Phencyclidine (PCP)	6.5%

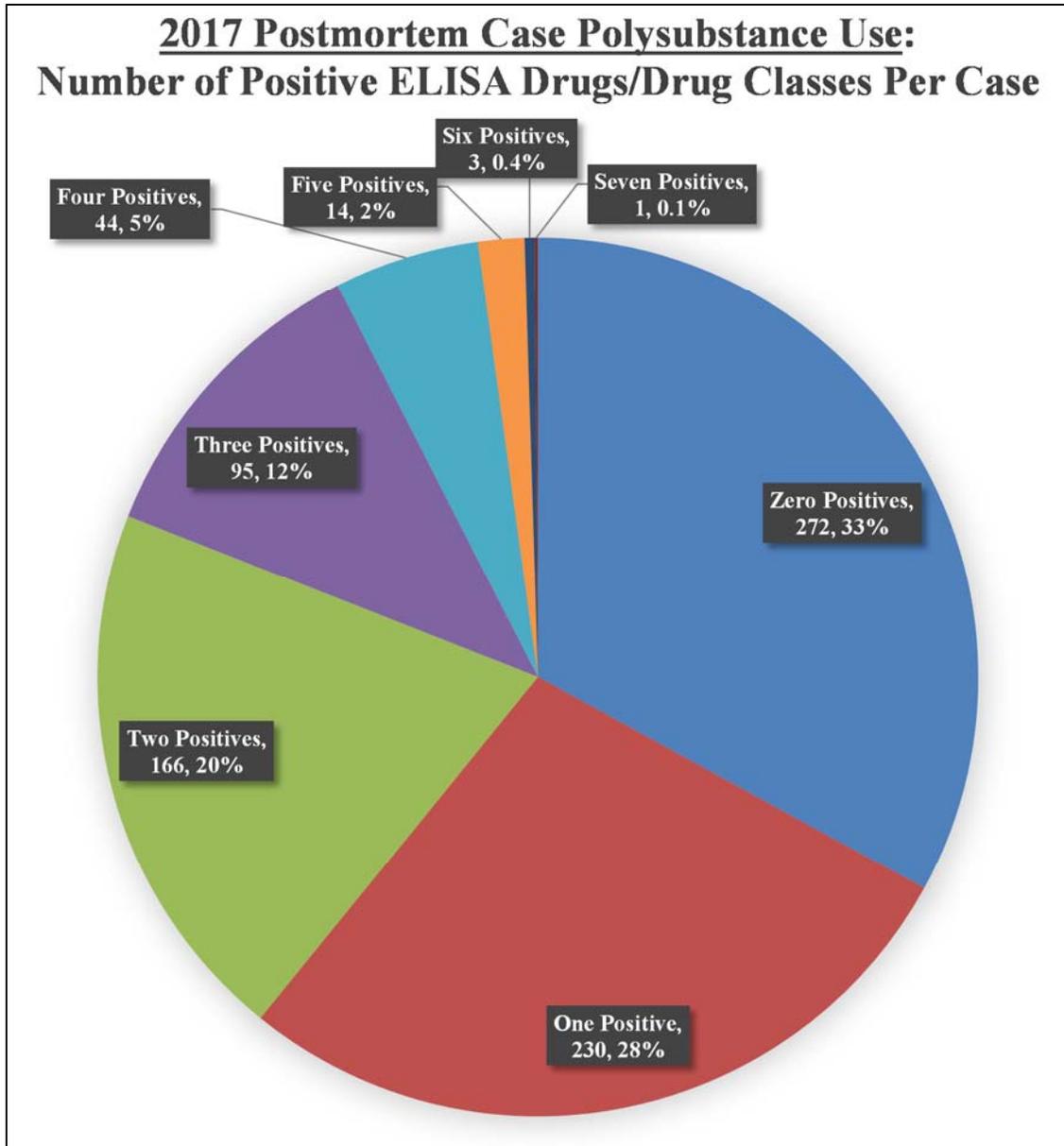
Percentage of Total Postmortem Cases Received That Confirmed Positive:

Compound	Postmortem Cases Confirmed Positive
Ethanol	26.5%
Fentanyl	26.3%
Morphine	25.0%
Benzoyllecgonine	18.8%
6-Monoacetylmorphine	17.1%
Ecgonine Methyl Ester	14.9%
Cocaine	13.6%
Oxycodone	9.6%
Codeine	6.2%
Delta-9-Carboxy-Tetrahydrocannabinol	5.7%

Polysubstance Use

The below pie charts give us a glimpse into the issue of polysubstance use in the state of Delaware. Thirty percent of the 2017 DUI/other cases screened positive for two out of 12 drugs/drug classes, and 15% of the cases screened positive for three drugs/drug classes. Twenty percent of postmortem cases screened positive for two drugs/drug classes on ELISA, and 12% screened positive for three drugs/drug classes.

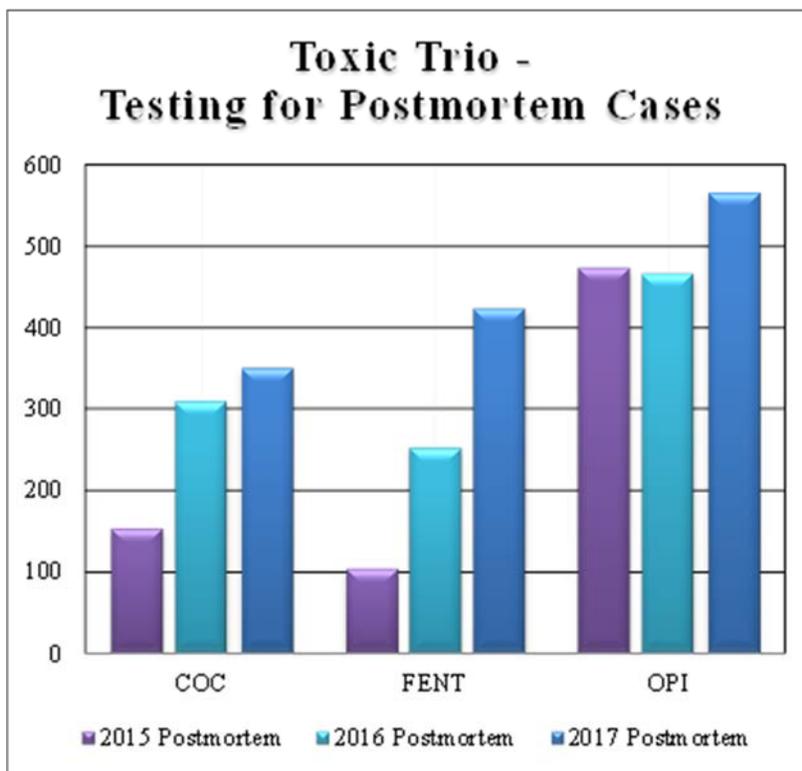
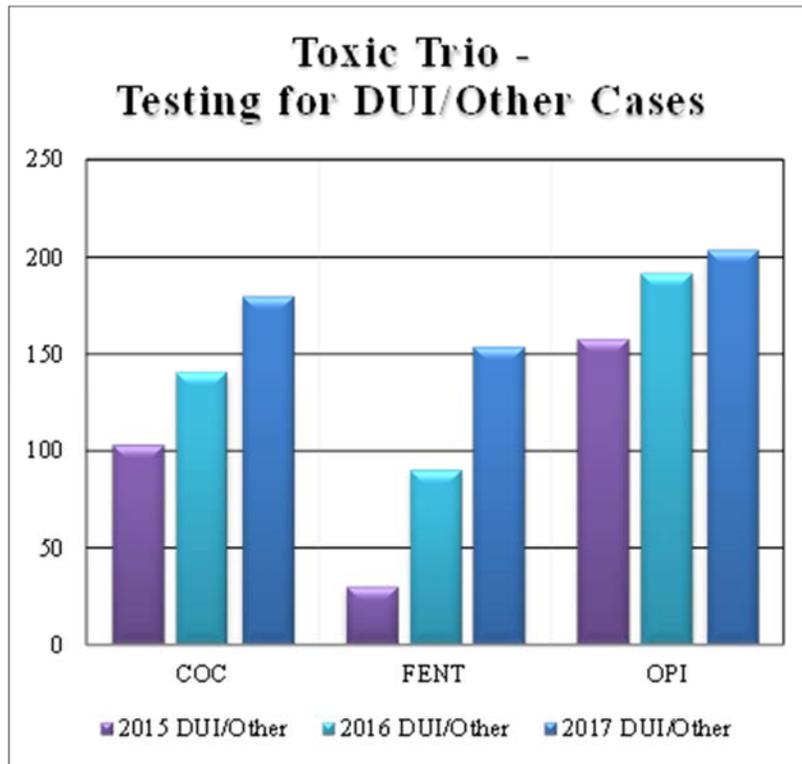




Toxic Trio

Testing for cocaine (COC), opioids (OPI), and fentanyl (FENT) continue to increase as the below bar graph illustrates. We are seeing many suspected heroin cases that are involving fentanyl, heroin/opioids, and/or cocaine (including just one of these up to combinations of all three), which is why the Chief Forensic Toxicologist has dubbed these the “**Toxic Trio.**” From 2016 to 2017, the number of DUI/other samples tested for COC, FENT, and OPI increased 21.7%, 41.6%, and 5.9%, respectively. Similarly,

from 2016 to 2017, the number of postmortem samples tested for COC, FENT, and OPI increased 12.0%, 40.6%, and 17.5%, respectively.



DNA

Overview

The DNA laboratory consists of two sections, the CODIS (COmbined DNA Index System) section and the Casework section. The CODIS section processes all of the convicted offender samples submitted to the laboratory from the Delaware State Police/State Bureau of Identification (DSP/SBI) and the Department of Corrections (DOC), and uploads the DNA profiles generated into the National database. 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 cases ranging from theft and property crimes to homicides and sexual assaults. The DNA profiles generated from processing casework may also be entered into the State and National databases.

CODIS

The backlog of convicted offender samples at the beginning of 2017 was approximately 101. During 2017, the CODIS section received an additional 2363 offender samples. The laboratory received 215% more samples in 2017 than in 2016 (received 751). The increase in the number of samples received was due to DOC collecting samples from offenders serving long sentences and collecting at intake, as opposed to release, of the offender.

The turn-around-time (TAT) for uploading offender samples into the National database increased about 23% from an average of 35 total days (26 working days) in 2016 to an average of 43 total days (31 working days) for the present year. This increase can be attributed to the increased number of samples that were received. In 2017, 2171 offender samples and 248 casework samples were uploaded into the State and National databases. Offender samples were processed on a monthly basis and by the end of the year, the backlog was reduced to 98 samples for a 3% reduction from 2016. All of the remaining convicted offender samples are on-schedule to be processed during the first quarter of 2018. In 2017, the DNA laboratory had 88 CODIS hits or “matches” from either the State or National databases.

Delaware has received Sexual Assault Kit Initiative (SAKI) Grant funds for testing sexual assault kits that were collected prior to April 30, 2015. These kits are being tested by a private laboratory but any kit that results in a DNA profile foreign to the victim is reviewed by DFS for upload into CODIS. We began receiving profiles from the laboratory in May 2017. By the end of the year, we reviewed and uploaded 90 unknown profiles into CODIS. Those profiles have resulted in 20 hits in the state database and 9 hits in the national database. Additionally, there have been 11 national sexual assault cases that hit on a DE convicted offender.

The table below reflects the types of cases that have hit in CODIS for 2017.

CODIS Hits	Type of Case	CODIS Hits	Type of Case
3	Assaults	5	Robbery
20	Burglary	9	Sexual Assaults
1	Fleeing the Scene	40	Sexual Assaults (SAKI)
7	Homicides	2	Theft
1	Leaving the Scene – Resulting in Death		

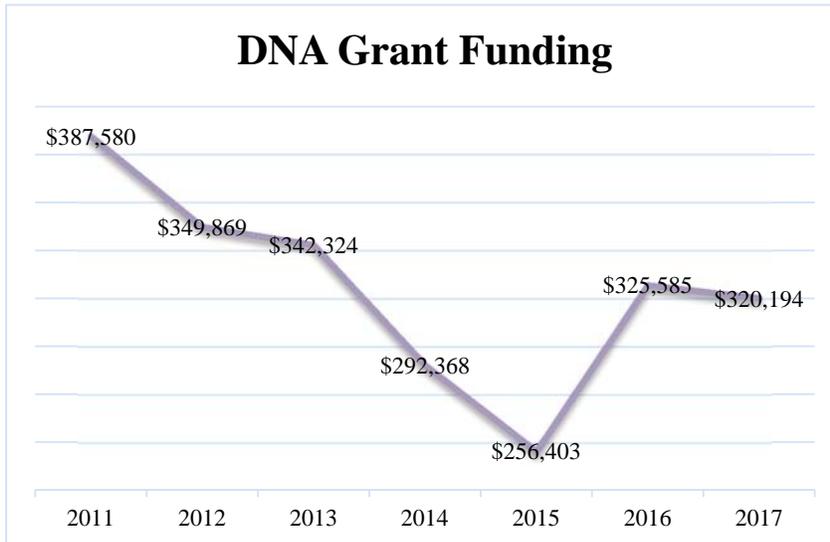
Casework

In the beginning of 2017, twelve (12) cases were unassigned, this included those with suspects and unknown suspect cases. In 2017, the DNA unit received 508 new case submissions and 41 subsequent submissions for a total of 549 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 a 23% increase in the total number of submissions from the previous year. By the end of 2017, the number of unassigned cases was 29, this is a 142% increase from the previous year. These numbers are due to the increase in the number of cases that were submitted and also to a loss of a casework DNA Analyst. The table provides a breakdown of the types of cases received during 2017.

Although, we had an increase in the number of cases we received and the casework section was not fully staffed, our average turn-around-time (TAT) decreased slightly.

Types of Cases Received in 2017	New Submissions	Supplemental Submissions
Homicide / Att. Homicide	46	14
Sexual Assault	128	9
Assault	14	2
Burglary	50	5
Robbery	42	4
Missing Person	1	0
Death Investigation	0	0
Miscellaneous	53	1
Possession of Firearms	158	6
Proficiency Tests	16	0

The Casework Manager continues to handle the DNA Backlog Reduction Grants. In September, the DNA Backlog Reduction Grant FY2015 ended. The closeout documentation by the laboratory was due to the National Institute of Justice (NIJ) by January 31, 2018. The laboratory is currently managing the DNA Backlog Reduction Grant for FY 2016, which closes in September 30, 2018. In October, the DNA unit



was awarded a DNA Backlog Reduction Grant for FY 2017.

Grant funds have allowed the DNA unit to remain current with innovative advancements and improvements in the field of Forensic DNA testing. Grant funding is down when compared to last year and to funding received prior to 2014.

With the DNA FY2015 grant

funds, the laboratory was able to purchase reagents for casework and convicted offender samples, provide required continuing education training for each DNA Analyst, and upgrade the CODIS server.

Again this year, there was an increase in the number of cases the laboratory received. Because of this, there was an increased need for Analysts to work on cases as opposed to validation. Therefore, several validation projects are underway but were not completed in 2017. Validation is a critical part of forensic DNA work, and at this time, the DNA Laboratory does not have an individual primarily dedicated to perform validation studies. Validations are done by Analysts in the DNA Unit. Projects underway include validation of the thermal cycler instruments and Armed Xpert software. The studies must be completed, policies must be in place, and laboratory staff must be trained before these procedures are to be used in casework. Validation studies and training are also required to maintain laboratory accreditation. During annual audits, validation study documentation is reviewed to determine the sufficiency of evaluative work performed to support use in casework. Training documentation is also reviewed during annual audits.

As of January 1, 2017, the DNA laboratory is using a new testing system. Our updated testing system examines 27 DNA markers, seven more than the FBI requirement. The DNA laboratory had an external audit based on the FBI's Quality Assurance Standards in July 2017. DFS received notification from the FBI that the laboratory is in compliance with FBI Director's Quality Assurance Standards.

In 2017, all DNA quality control documents can be accessed in Qualtrax. This will allow future auditors to access all documents easily. The DNA laboratory is also paperless.

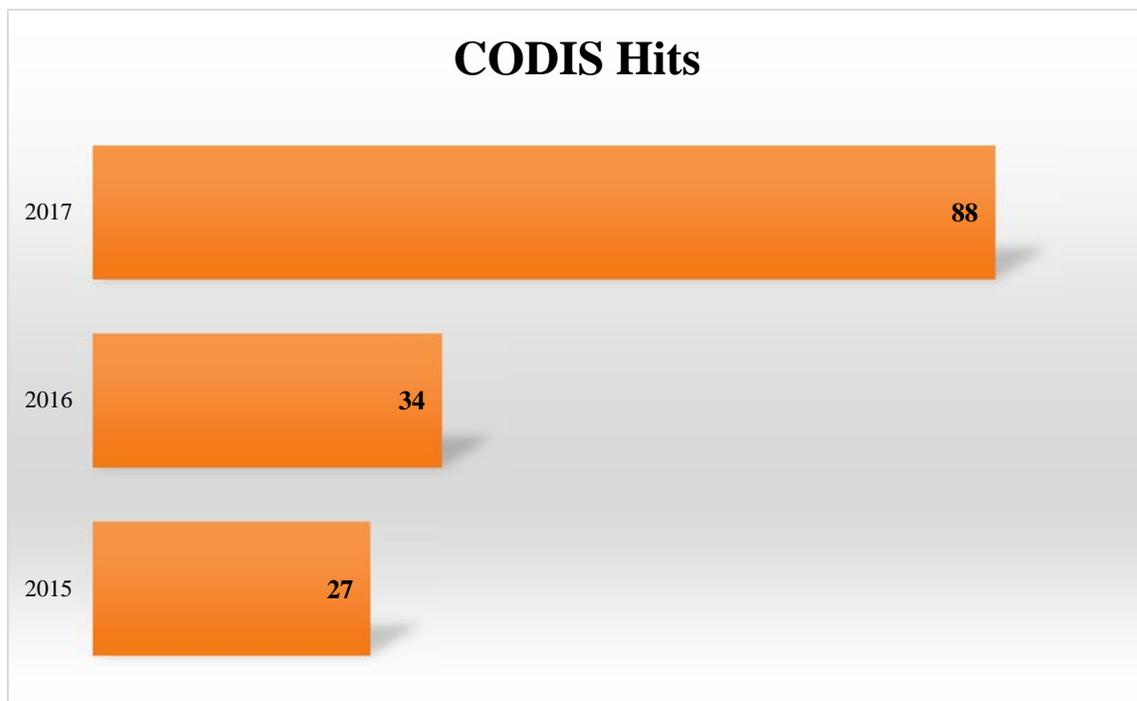
The following chart provides a comparative analysis of casework for 2015, 2016, and 2017 (The percentages in parenthesis show year-over-year changes):

	2015	2016	2017
Total Case completions	361 (+21%)	475 (+32%)	526 (+11%)
Turnaround Time (Total days submission to completion)	120.6 (-35%)	83 (-31%)	66.4 (-20%)
Case submissions	362 (+49%)	448 (+24%)	549 (+23%)
Staffing	4.3 (-28%)	5.25(+22%)	5 (-5%)

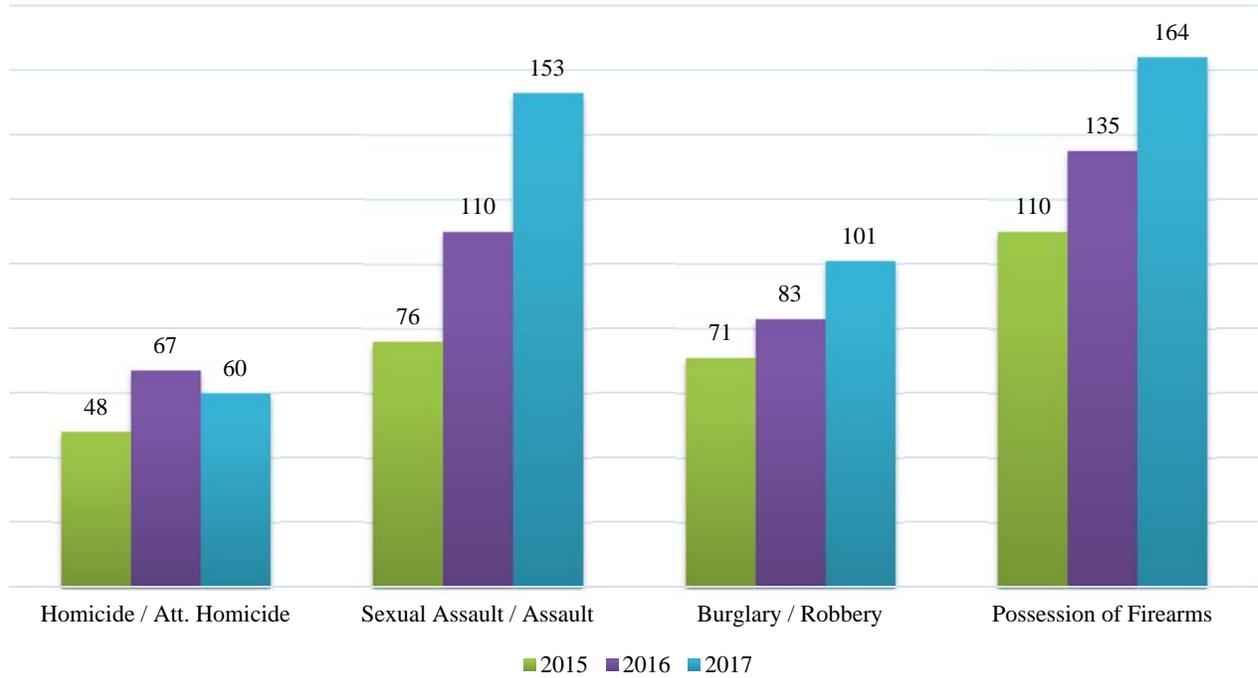
In summary, the DNA laboratory, in 2017, received 23% more cases submissions than the previous year. In the past 2 years, there has been a 52% increase in the number of DNA submission received by the laboratory.

The DNA laboratory has also increased the number of cases completed, to keep up with the increase in case submission. The DNA laboratory has reduced overall TATs for casework. With the increase demands in casework and the needed validations, we hope to keep our backlog to a manageable level in the next year.

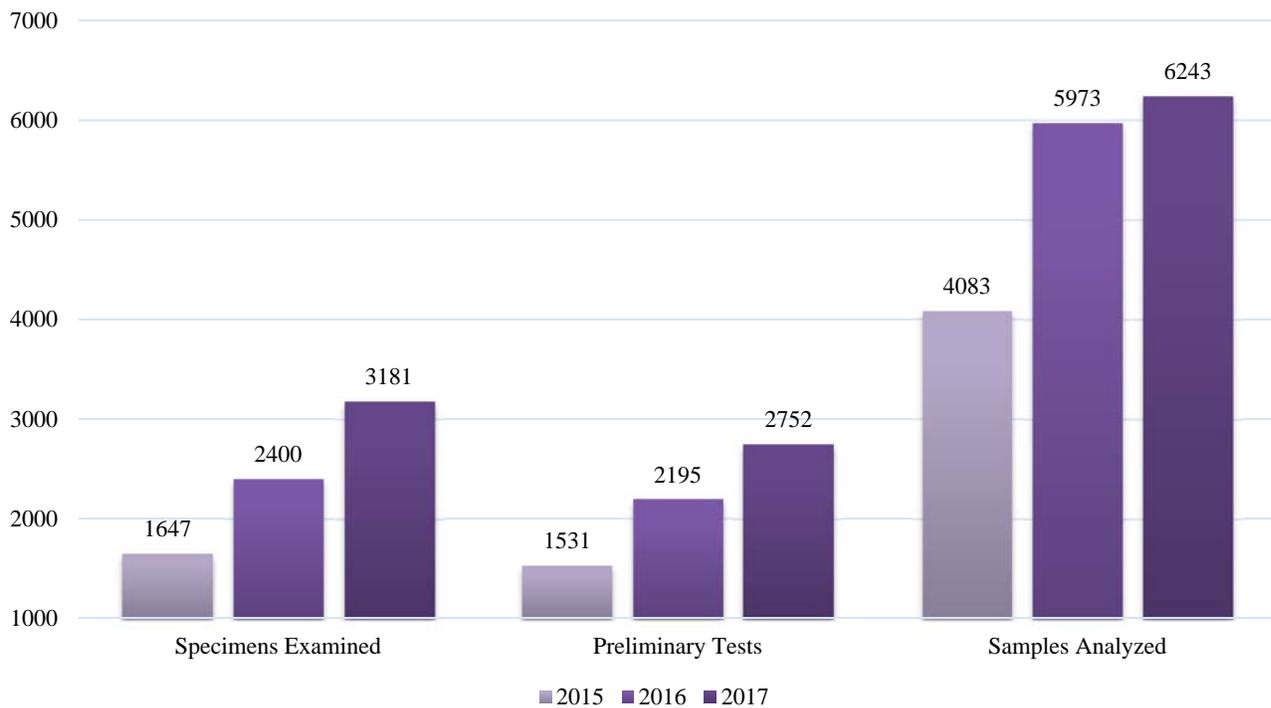
Data



DNA Casework by Top Four Case Types (Includes New and Supplemental Submissions)



DNA Casework On the Rise



Forensic Chemistry

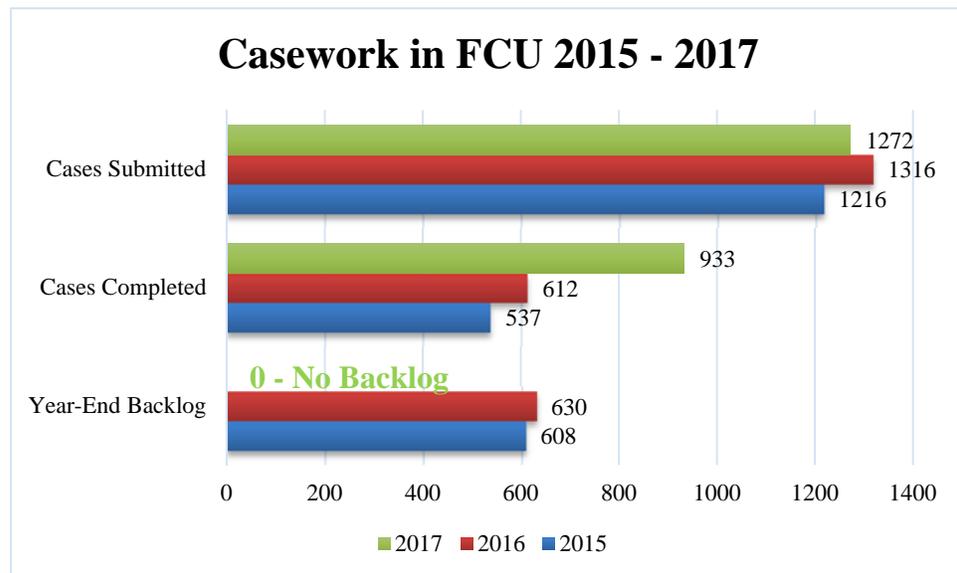
Overview

The Forensic Chemistry Unit (FCU) analyzes evidence for the presence of controlled substances. Controlled substances may be present in substrates such as powders, solid materials, liquids, and plant material. In addition, the FCU examines pharmaceutical preparations in the form of tablets and capsules. The process of identification is two-pronged: the preliminary or presumptive test(s) and the confirmatory testing. The presumptive tests routinely involve screening the submitted evidence using color tests and/or microscopy, followed by the confirmatory phase accomplished through the use of GC-MS.

Casework and Accomplishments

The number of cases submitted for testing for controlled substances remains relatively steady; however, the backlog was at zero in December 2017, which is unprecedented. With the laboratory now fully staffed, the unit was

able to complete testing on 933 cases in 2017 and end the year with zero backlog. Note that 343 cases were cease tested (four of which had already been completed prior to receiving the cease testing



notice). We continued to see some very large cases this year, including one in which 79,666 exhibits were counted and photographed (and nearly 2,000 samples were tested) and two others where more than 15,000 exhibits were submitted, counted, and photographed. These large cases take up significant analyst and reviewer time.

In addition to eliminating the backlog, there were several other noteworthy accomplishments in FCU in 2018. For example, all of the FCU quality documents were transferred into the new quality assurance software program, Qualtrax, which will help assure complete, accurate, and up-to-date documentation of all policies and procedures. Additionally, three new gas chromatographs/mass spectrometers were validated and brought online for casework to accommodate the six new analytical chemists.

Staffing and Limited Services

In 2017, the FCU hired six new Analytical Chemist I's (ACI) and one upper level Analytical Chemist III (ACIII). Additionally, one new Forensic Evidence Specialist (FES) was brought on board. However, an ACI, ACIII, and two FES personnel resigned. Thanks to an increase in the number of analytical chemist positions in the laboratory, the full complement of the Forensic Chemistry Unit is now two manager-level positions, fourteen full-time chemists, and two evidence specialists. The staffing issues that contributed in large part to the backlog in previous years have been dealt with and the additional staffing has allowed the FCU to not only eliminate backlog but also to begin accepting drug evidence from all police agencies in the state (as of 12/14/17) eliminating the need to outsource a portion of the drug cases to private laboratories. Prior to November, some police agencies were sending out cases for outsourced testing, so we expect our caseload to increase significantly in 2018 now that all casework is being brought to the DFS.

At this point, all Fire Debris cases are being outsourced, however, one goal for 2018 is to bring Fire Debris testing back in-house as well.

Data

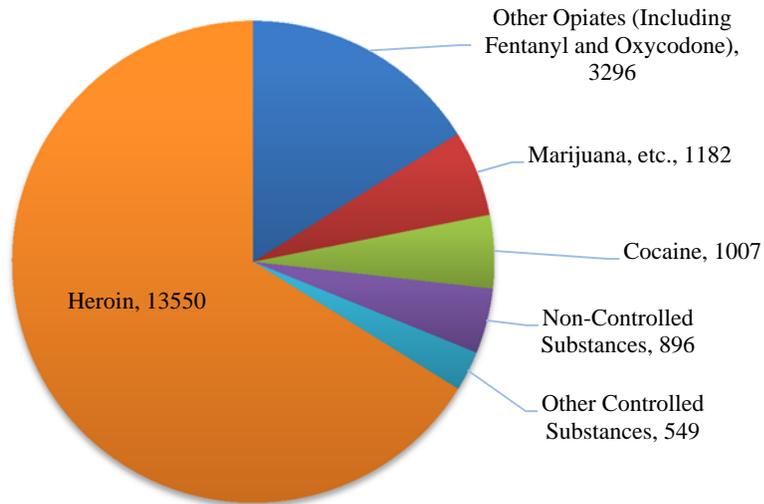
Casework and Turnaround Time Data		
Cases Submitted	1,272	
Exhibits Submitted	239,219	(counted, photographed, and documented)
Cases Completed	933	
Exhibits Analyzed	17,683	
Cases Cease Tested	343	
Cases Backlogged	0	(no backlogged cases by end of the year)
Turnaround Time*	58.5	Days from Submission to Complete Litigation Packet (includes the very large cases)

*Note that this turnaround time is for the whole year, including the first several months where the unit was understaffed and/or the majority of the staff was still in training. TAT has fallen drastically since all staff are fully qualified and online.

The following data reveals the testing that was done within the Division of Forensic Science's Forensic Chemistry Unit in 2017. Note that, because many cases were outsourced by the police departments, this data does not show the full picture of drugs being confiscated in Delaware. Additionally, this data only captures results from exhibits that were actually tested. "Exhibit" means, for example, one packet of white powder. A case may contain dozens or up to thousands of glycine bags containing white powder and each of those bags is individually considered one exhibit. While 239,219 exhibits were submitted to the laboratory, and all of those exhibits were counted and documented, only 17,683 of those exhibits were actually tested. The DFS FCU utilizes a statistical sampling plan, accepted and used by the forensic drug community, to reduce the number of exhibits that require testing and confirmation. This statistically-

based sampling plan allows for logical inferences to be made from a sample of items to the larger population with an associated, quantifiable, degree of confidence.

Drugs Confirmed Positive at the DFS FCU in 2017 (Note that each exhibit may contain more than one drug.)



		Number of Exhibits
Drugs Tested and Confirmed Positive (Exhibits may contain more than one drug.)	None Detected	129
	None Identified (beginning 3/13/17)	306
	Non-Controlled Substance - Logo ID Only	293
	Non-Controlled Substance - Confirmed	896
	Heroin	13,550
	Oxycodone	82
	Other Opiates (Including Fentanyl)	3,214
	Marijuana	1,182
	Cocaine	1,007
	Amphetamine	19
	Methamphetamine	202
	MDMA, etc.	44
	Benzodiazepines	94
	PCP	7
	LSD, etc.	5
	Synthetic Cannabinoids	1
	Synthetic Cathinones	62
	Other Controlled Substances	115