

Division of Forensic Science 2016 Annual Report

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

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DEPARTMENT OF SAFETY AND HOMELAND SECURITY
OFFICE OF THE SECRETARY
P.O. BOX 818
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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 men and women of the Division of Forensic Science (DFS) highlighted in this year's annual report. Their dedication and professionalism has resulted in numerous accomplishments as they carry forth the mission of the Division in serving our State.

One of the most noteworthy undertakings of the past year was a change in leadership in October when retired Delaware State Police Major John Evans was appointed as Director. Director Evans brings his many years of experience investigating homicides and other major criminal cases to the DFS. This practical experience in the realm of forensic science and his time serving on the Commission of Forensic Science give him a unique familiarity with DFS as he prepares to address the challenges that lay ahead.

In 2016, all Units within the Division saw a significant increase in the number of case submissions they received. To manage the growing demand several new chemists joined the DFS Forensic Chemistry team in 2016 and additional chemists will be hired in 2017. Sophisticated instrumentation required to support the additional chemists will also be purchased. This year the DFS has plans to improve the accommodations at its Wilmington facility through significant morgue renovations that will provide a state-of-the-art work area to perform autopsies. Other planned building upgrades include a new sprinkler system and an improved ventilation system.

In the past year, the Division expanded its information and data sharing efforts in collaboration with state, federal and other stakeholders to benefit the health and safety of the citizens and visitors of our State. The Delaware Drug Monitoring Initiative is just one example of several collaborative projects, which allow DFS to share data with its law enforcement, emergency medical services, and substance abuse and mental health treatment partners in response to the drug epidemic affecting our State.

Please join me in extending a sincere thanks and congratulations to the men and women 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:

As the Director, and on behalf of the men and women of the Division of Forensic Science, it is my privilege to present the 2016 Annual Report.

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.

Since first being established in 2014, the Division of Forensic Science has evolved significantly from the former Office of the Chief Medical Examiner in an effort to maintain the highest scientific standards and to ensure both organizational and individual integrity. This positive change would not have been possible without the focus, commitment and flexibility of the members of the Division of Forensic Science team.

Although the Division continues to make significant advances, we have not yet reached our goal of being independently capable of providing accurate, timely and responsive forensic science services to all of our stakeholders in Delaware. Limited staffing in the Forensic Chemistry Unit during 2016 has caused the Division of Forensic Science to continue to outsource some of the controlled substances evidence testing to a private laboratory. It is the goal of the Division to become independently capable of accommodating all of the controlled substances testing needs in Delaware by year-end 2017.

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. As you read the statistics on the following pages of this Annual Report, you will see a significant increase in the number of case submissions from 2015 to 2016. Despite these increasing demands across the board in each of our units, the dedicated staff remains committed to decreasing turnaround times on test results and meeting Court established deadlines.

With the support of Governor Jack Markell, Secretary of the Department of Safety and Homeland Security James Mosley and members of the General Assembly, several advancements and

opportunities were realized within the Division of Forensic Science during 2016. Not only did several new chemists fill vacancies in the Forensic Chemistry Unit, but the Unit will be increasing its complement of chemists by six in an effort to fully meet the increasing demands of controlled substances testing. Sophisticated instrumentation and equipment has been purchased to accommodate the additional chemists as well. Plans are underway for a renovation of the outdated morgue suite, which will result in a state-of-the-art facility, and a satellite office for our Forensic Investigators has opened in Kent County in an effort to better serve our partners.

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 2017.

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 2016, the DFS continued to enhance operations and administration, embracing every challenge as an opportunity to improve. The hiring of additional Forensic Investigators statewide, filling vacancies in the Forensic Chemistry Unit, filling the Quality Assurance Manager position, creating an internal bar coding system to track evidence from the time it is initially collected to its final disposition and maintaining our lab accreditation with the American Society of Crime Lab Directors Laboratory Accreditation Board (ASCLD/LAB), all go toward our commitment to providing accurate, timely, and responsive forensic science service to all members of the criminal justice community in Delaware. In addition, the Pathology Unit has maintained its accreditation with the National Association of Medical Examiners (NAME) and for the first time, the Toxicology Unit was accredited by the American Board of Forensic Toxicology (ABFT).



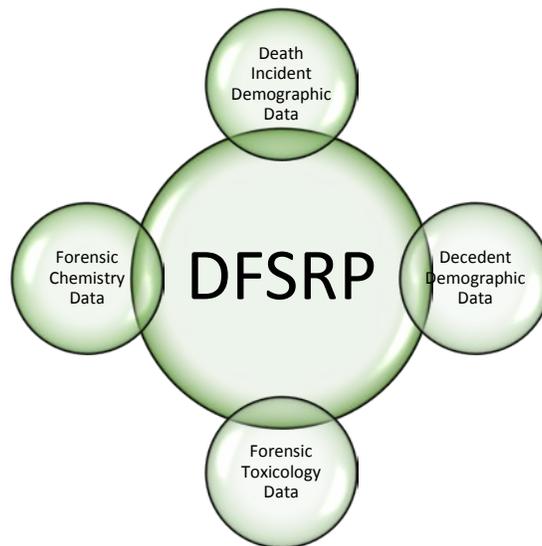
2016 DFS Organizational Chart. (Note that vacant positions are included in totals.)

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; a National Governors Association Action Committee; and several other forensic data driven projects.

To forward the mission, the Division is working on a comprehensive reporting project aimed at producing standardized information to key government and private sector stakeholders statewide. This project is titled 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:



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 should be able to link to both OEMS and DELJIS data.

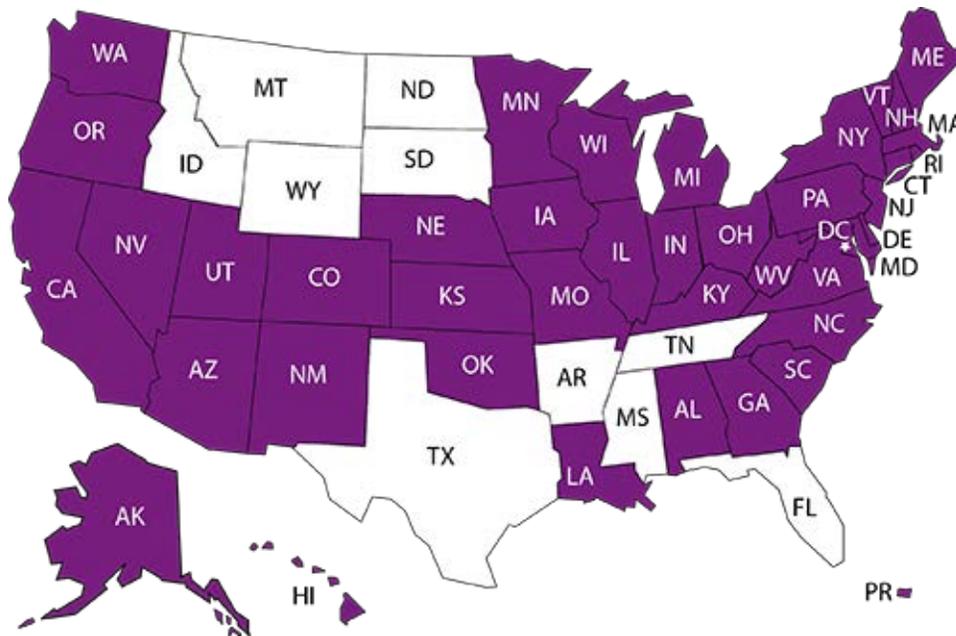
Decedent Demographic Dataset is data retrieved from the Pathology Unit. It includes data points such as: race, ethnicity, age, gender, medical history, and manner of death. A unique identifier can be assigned to each decedent in an effort to protect an individual's health information.

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.

Forensic Chemistry Dataset is data retrieved from the Forensic Chemistry Unit. It includes data related to drug testing and may take up to 90 days to complete casework before the dataset can be populated.

National Violent Death Reporting System

DFS is a key partner in the National Violent Death Reporting System (NVDRS), managed by epidemiology researchers with the Delaware Division of Public Health; Delaware Violent Death Reporting System (DVDRS). This funded project was approved in 2016 and is ongoing. Created by the Centers for Disease Control and Prevention (CDC) in 2002, the NVDRS is a surveillance system that pulls together data on violent deaths in 32 states, and now includes Delaware (see map below).



(Borrowed from DHSS, DPH, 2016)

The National Violent Death Reporting System (NVDRS) provides states and communities with a clearer understanding of violent deaths. This information guides decisions by policy makers regarding efforts to prevent violence and track progress over time. NVDRS is the only state-based surveillance system that gathers data on violent deaths from multiple sources. The NVDRS is an incident-based system that links victims and alleged perpetrators with a given incident in one record. 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

In 2016 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. An overhaul of the program was performed in late 2015, and Delaware has seen significant improvement in 2016 reporting. Sample collection is now at 88% (from 26% in 2015); consents obtained are at 93%; and of the 18 participating jurisdictions, Delaware leads the way with the highest reporting and consenting percentages in the country. 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. 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

In 2016 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. This plan was finalized and executed in September of 2016. As part of this ongoing effort to be prepared, the Division of Forensic Science has participated in two table-top disaster drills and two on-scene disaster

drills. 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.

The second step of disaster preparation is 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 completed and ready for testing in 2017.

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. The Division of Forensic Science works closely with the Department of Health and Social Services, the Division of Public Health, the Department of Justice and other law enforcement organizations statewide to accomplish this mission.

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 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 (ME) Unit, led by the Chief Medical Examiner. The unit is comprised of the Chief ME, Deputy ME, two assistant MEs, thirteen Forensic Investigators, four Morgue Assistants, and administrative support staff. This Unit is responsible for investigating all suspicious and violent deaths for the State and performs post mortem examinations on cases that fall under our jurisdiction.

There were numerous improvements within the Medical Examiner Unit (ME Unit) in 2016. A fourth pathologist was brought on board who is double board certified in both Neuropathology and Forensic Pathology. With the rise in deaths statewide, two part-time Forensic Investigators were added to our complement. Additionally, one Forensic Investigator obtained professional certification with the American Board of Medicolegal Death Investigators.

The number of cases handled by the Medical Examiner Unit increased in 2016. This was attributed partially to the 42% upsurge in deaths caused by drug intoxication. Most of these were related to the heroin and fentanyl crisis in Delaware. Even with the overall increase in workload, and the consolidation of activities to the Wilmington office, the ME Unit has remained compliant with accreditation standards for timeliness of examination, death certification, and report completion. Overall, in 2016 the ME Unit certified 1,283 deaths, which accounts for 14% of the 8,978 deaths registered in the state.

	2015	2016
Autopsies	580	649
Inspections	331	329
Total Examinations	911	978
Inquiries*	245	305
Total Deaths Certified	1156	1283
Non-Jurisdiction Investigations*	902	816
Total Medical Death Investigations	2058	2099
*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.		

Training and Outreach

The Division has promoted education and training among the staff in the ME Unit. In the spring of 2016 the entire unit participated in a day of training, which centered on blood borne pathogen exposure, universal precautions, and highly infectious disease preparedness. To realize a return on the State's

investment, all members of the Medical Examiner Unit who attended training were required to present what they learned to the rest of the Unit. 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 stay up to date by participating 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 Meetings. The pathologists stay up to date by attending conferences sponsored by the American Society of Clinical Pathology, National Association of Medical Examiners, Delaware Funeral Directors Association, and the International Homicide Investigators Association.

The ME Unit 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.

The Division as a whole actively participates in multiple mortality review committees and research projects. These projects utilize data collected from case investigations to aid in disease and injury prevention, disease surveillance programs, health improvements 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. Other Federal agencies that have partnered with DFS include the Consumer Product Safety Commission (CPSC) and Occupational Safety and Health Administration (OSHA).

One responsibility of the medical examiner is to approve organ and tissue donations. In 2016, we approved 21 of the 46 individuals that were organ donors and 134 of 139 tissue donors. Organs procured included heart, liver, kidney, and lungs while tissues procured include cornea, skin, long bones, and heart valves.

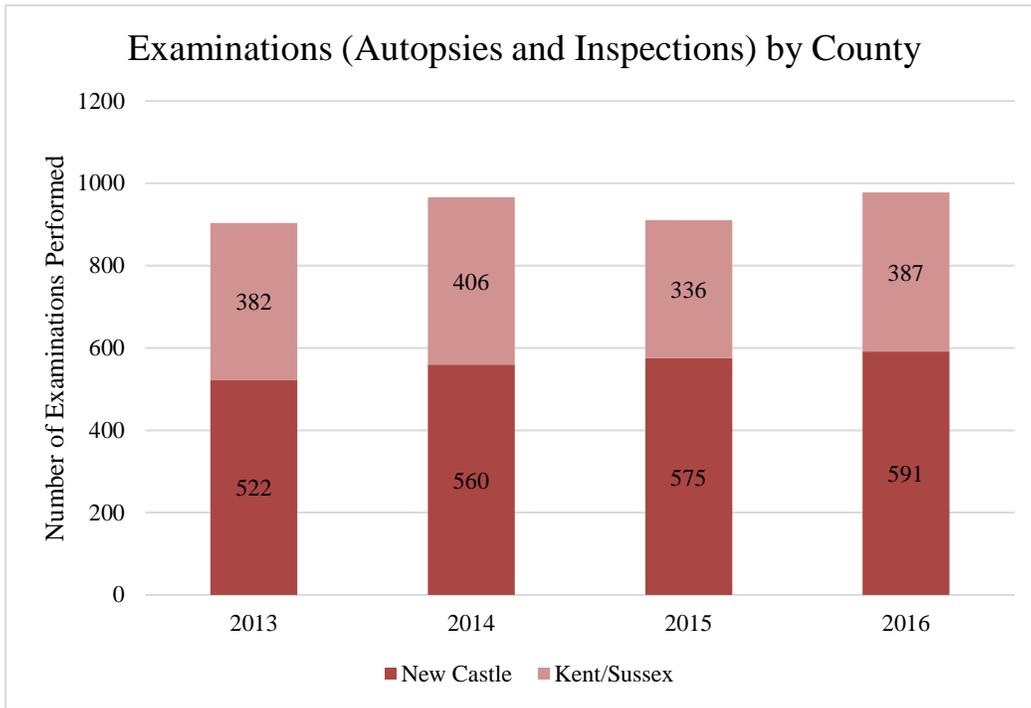
Partners

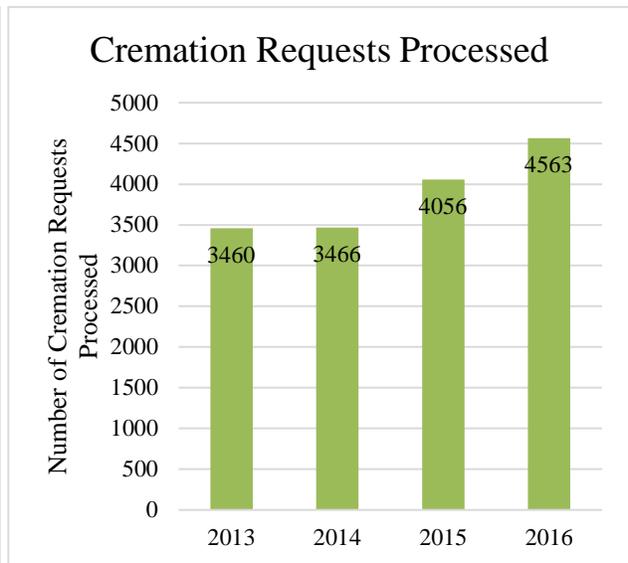
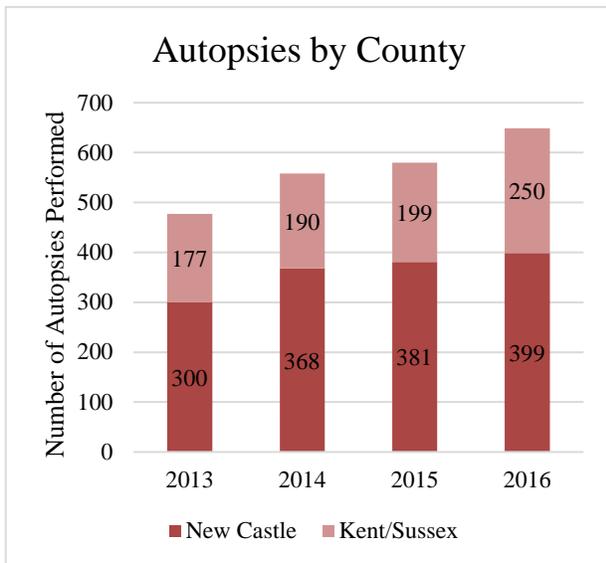
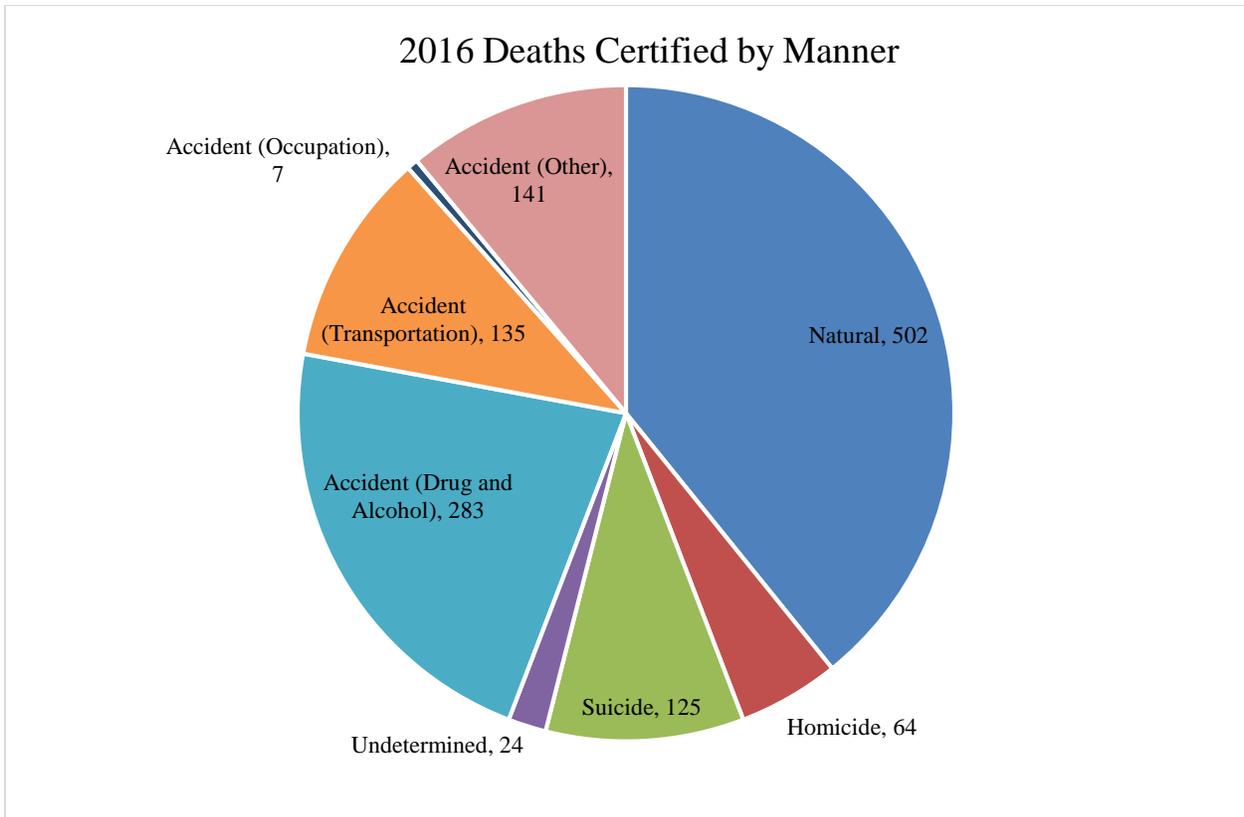
The Medical Examiner Unit could not accomplish this important work without the support of the Department of Safety and Homeland Security and the Delaware General Assembly. In addition it is important to note the many agencies who assist in providing services to Delaware. These agencies include: Delaware law enforcement agencies, the Attorney General's Office, the staff 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.

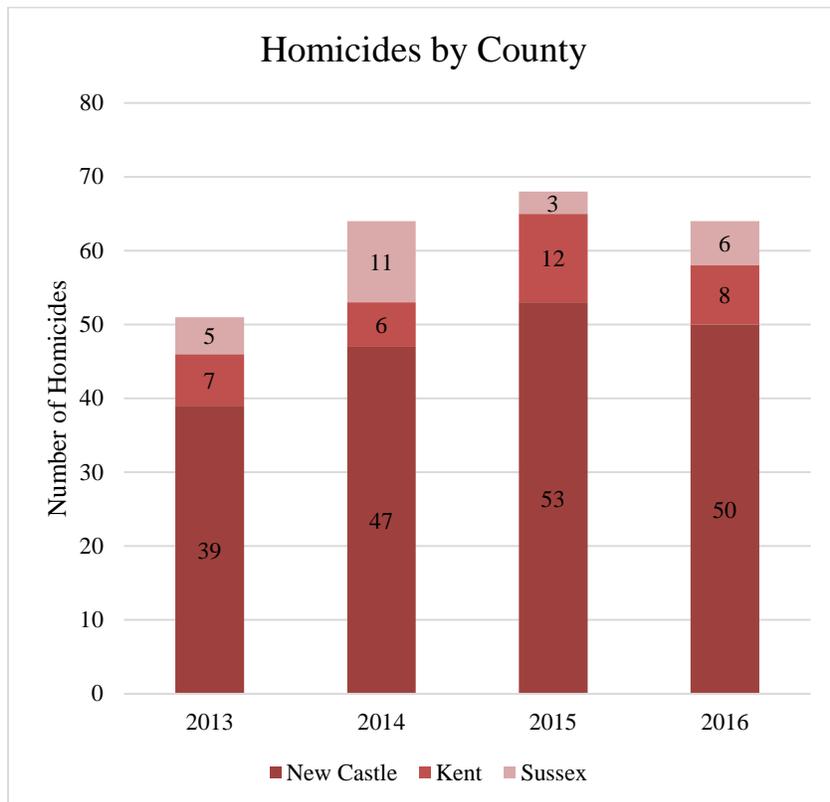
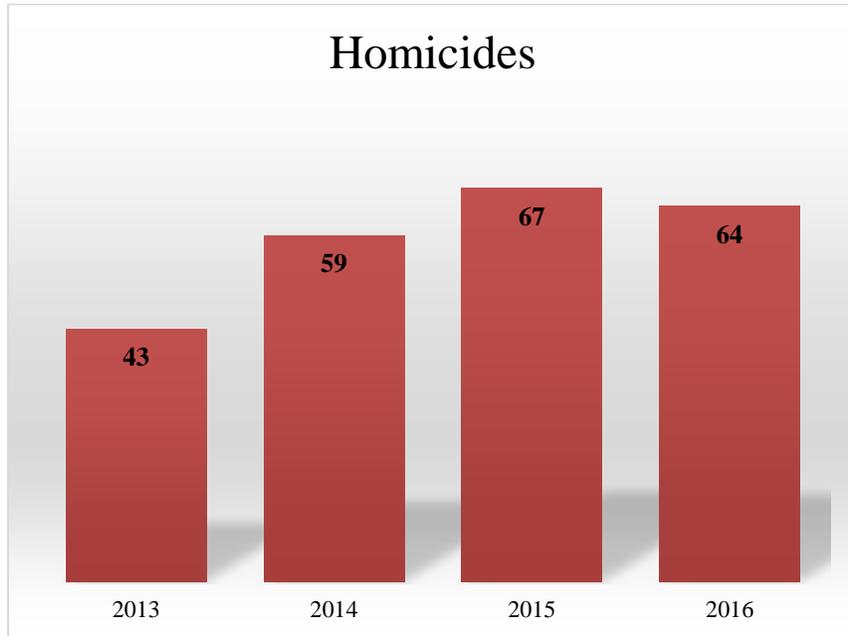
Data

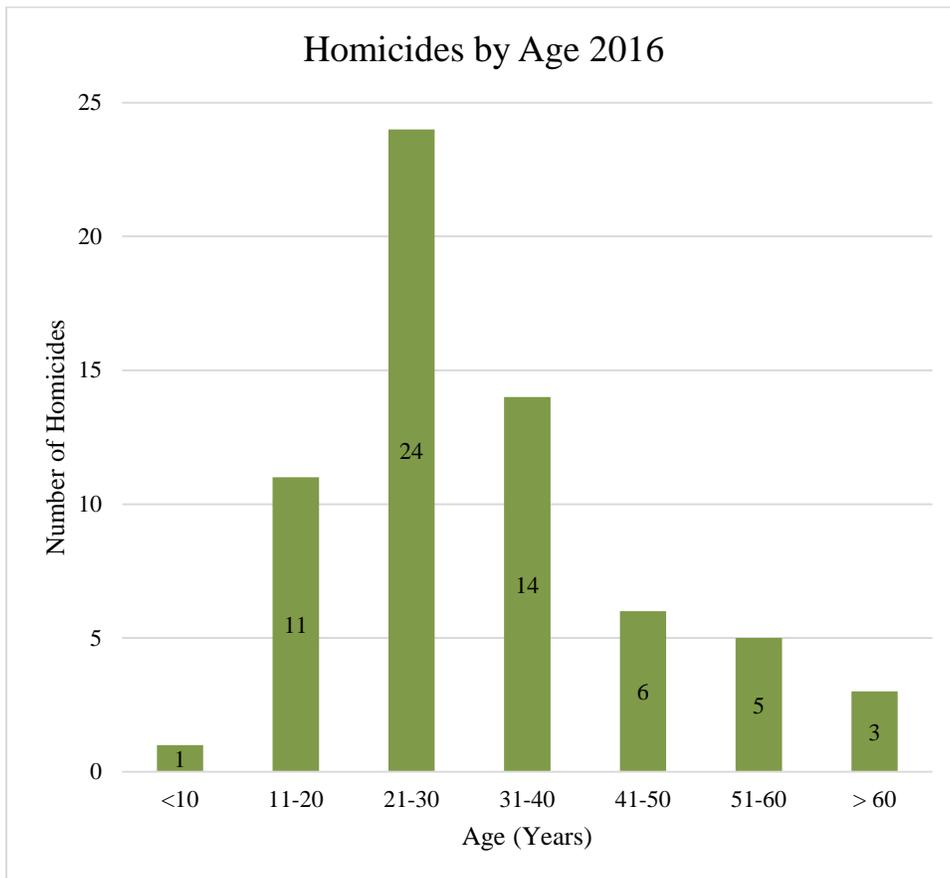
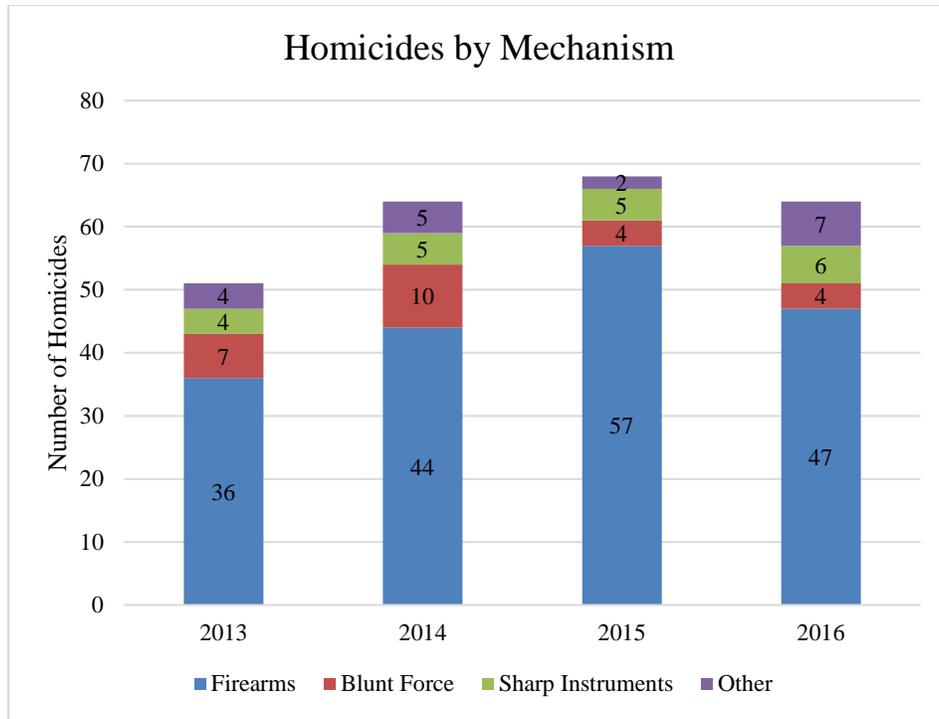
Cases Reviewed

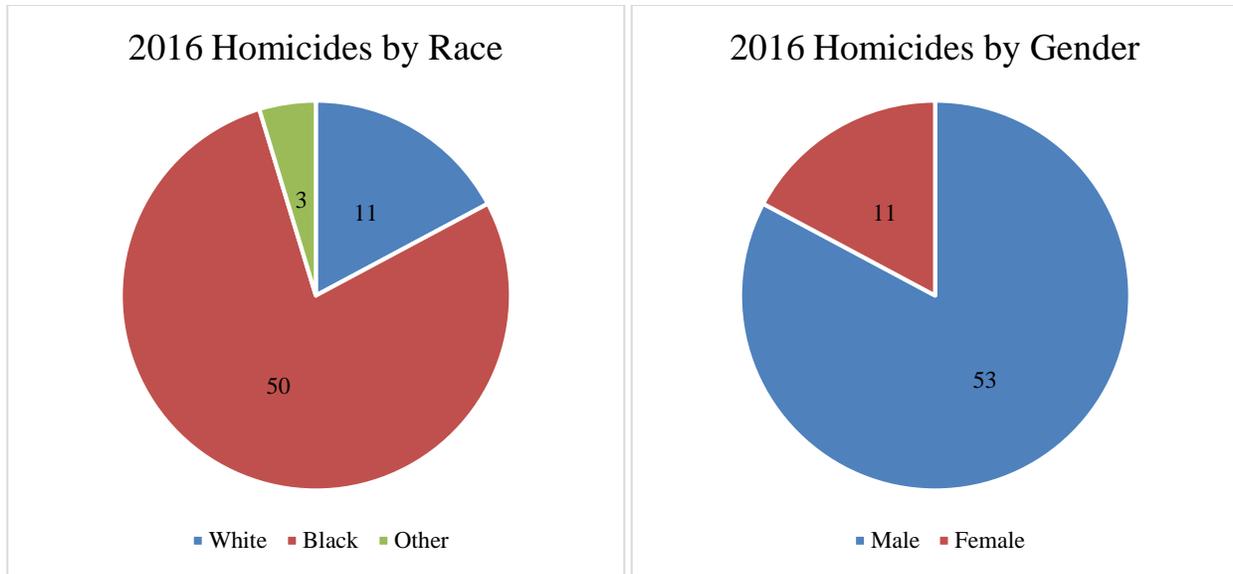




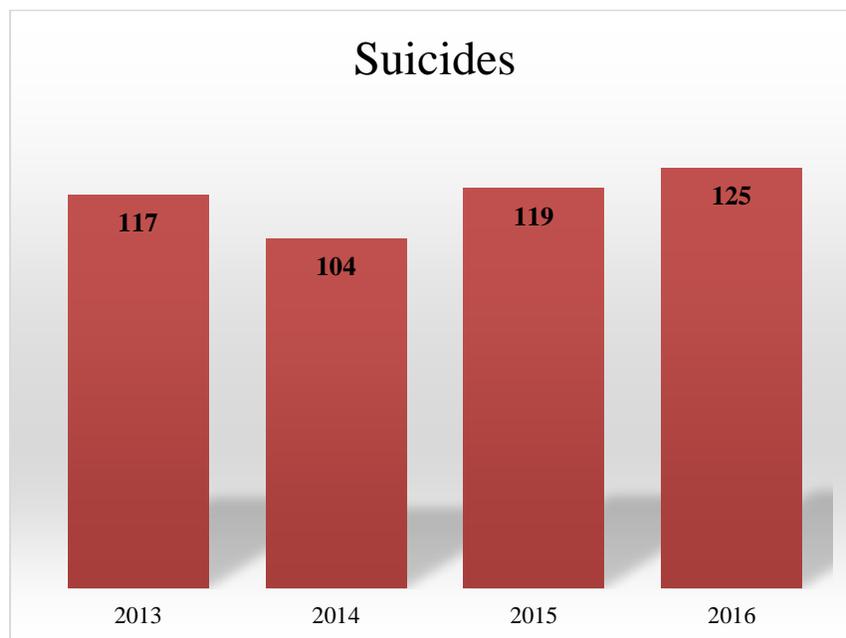
Homicides

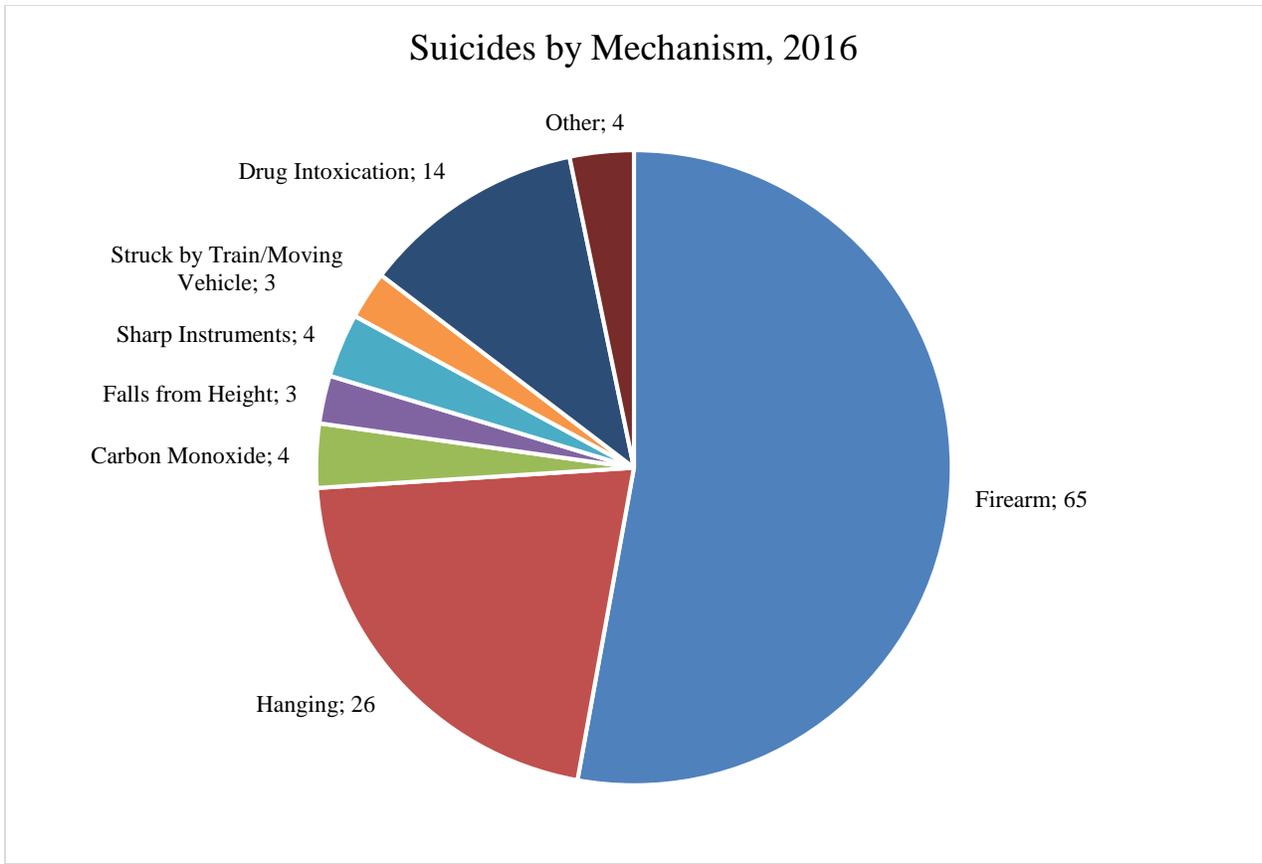




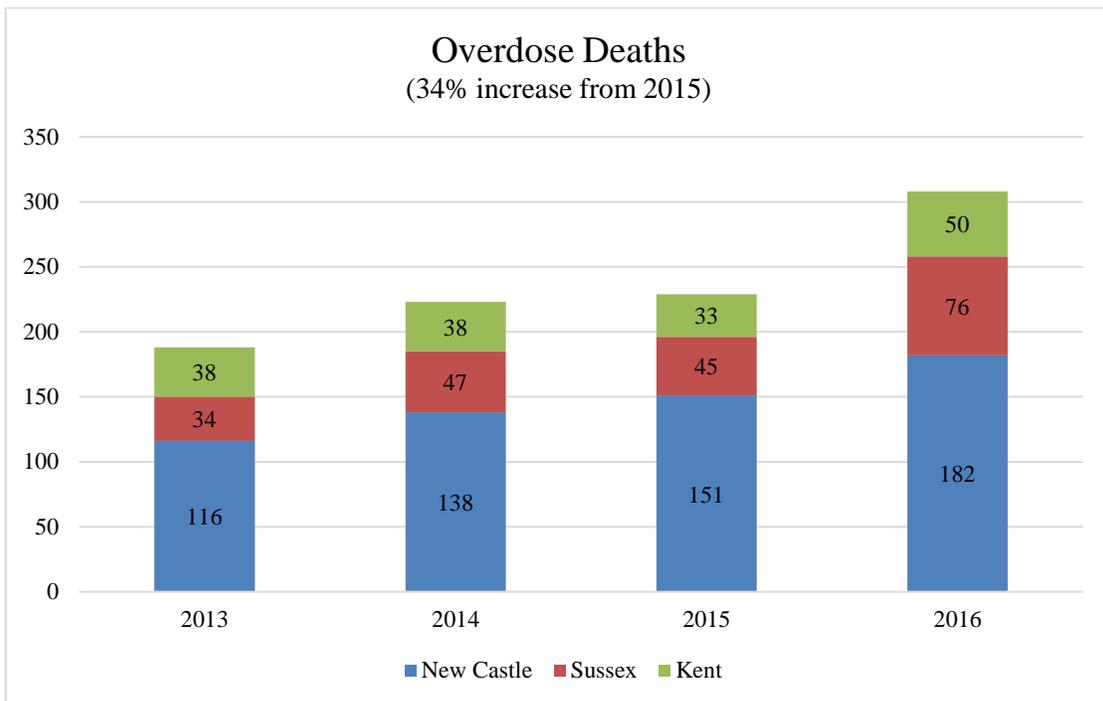


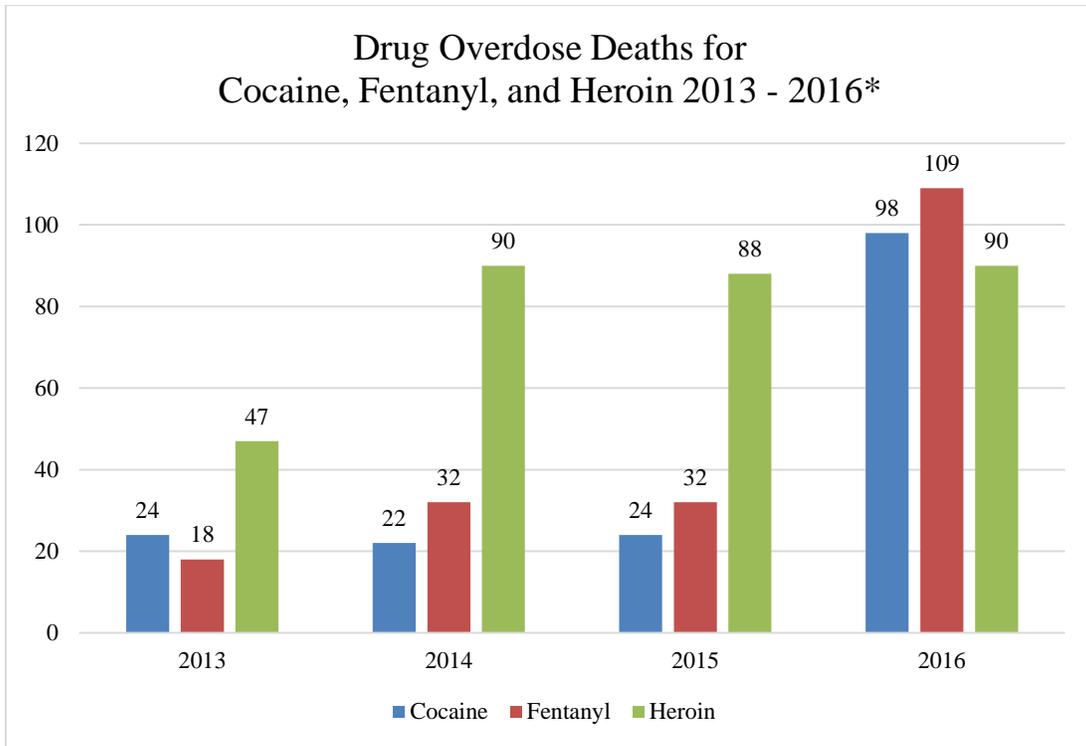
Suicides



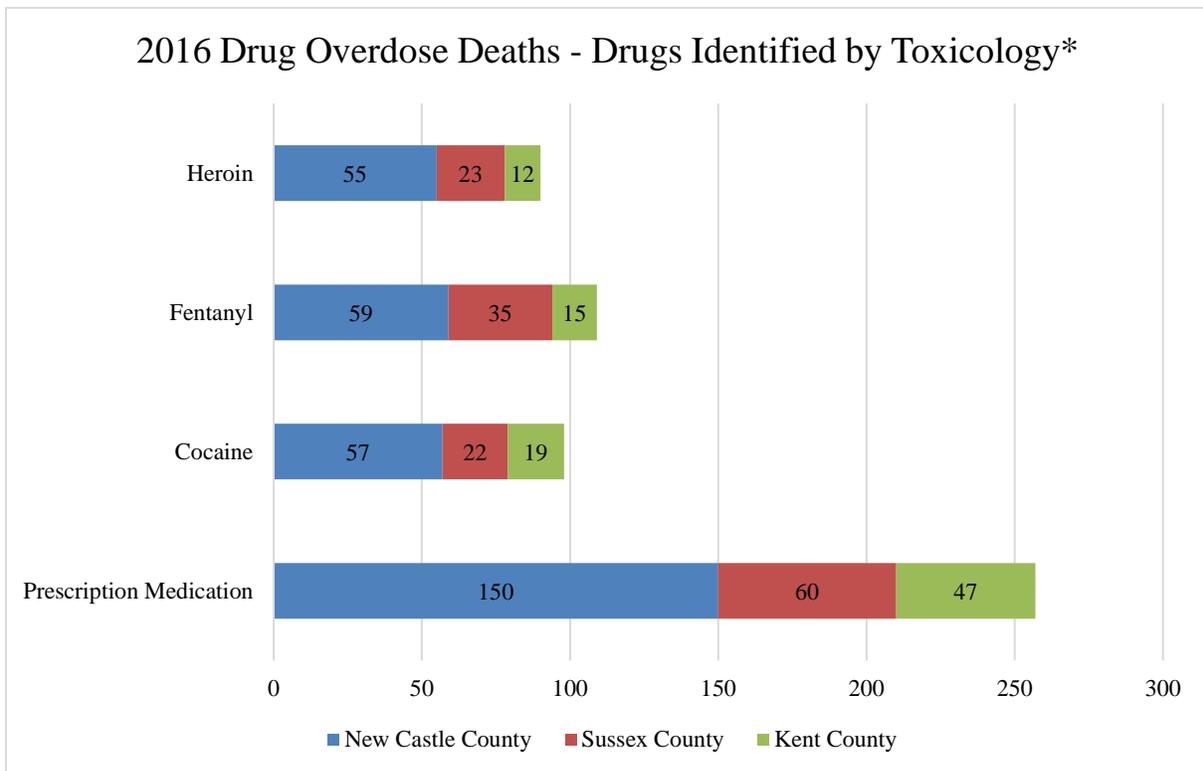


Drug Overdose Deaths

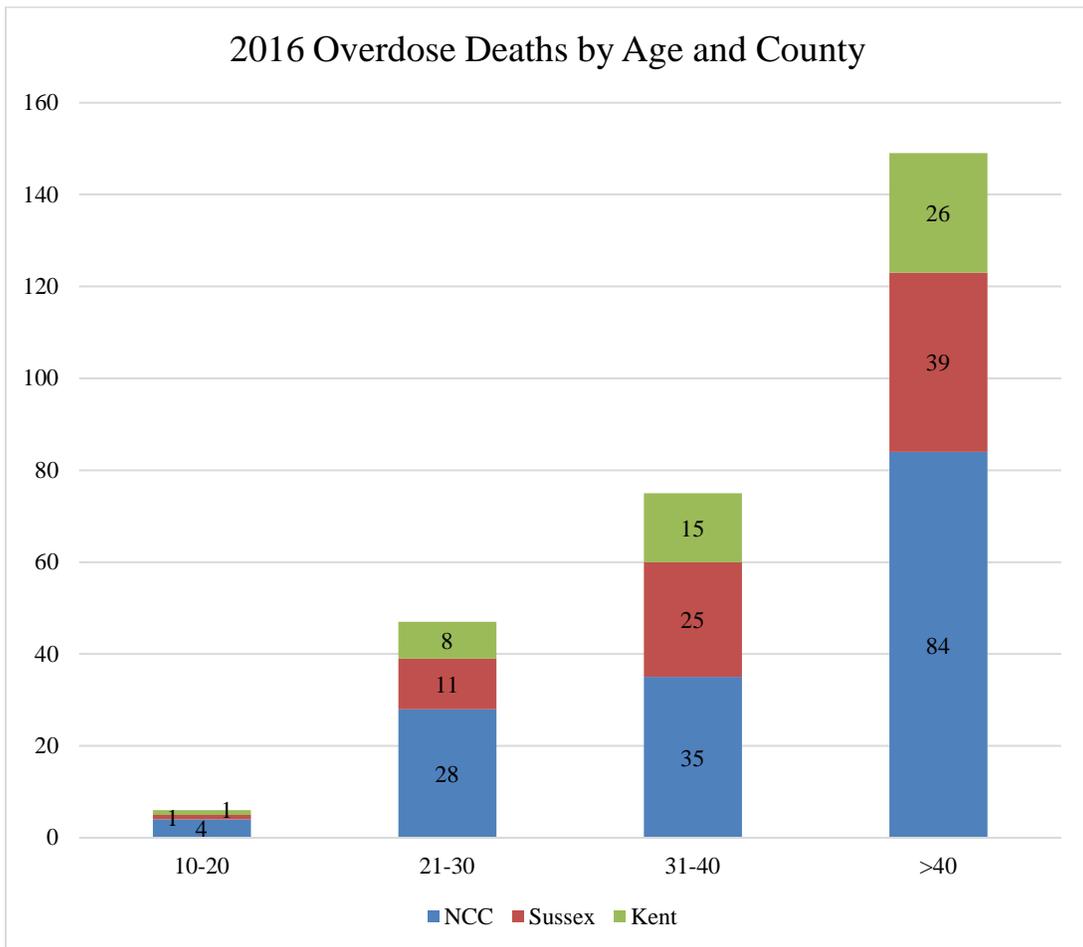
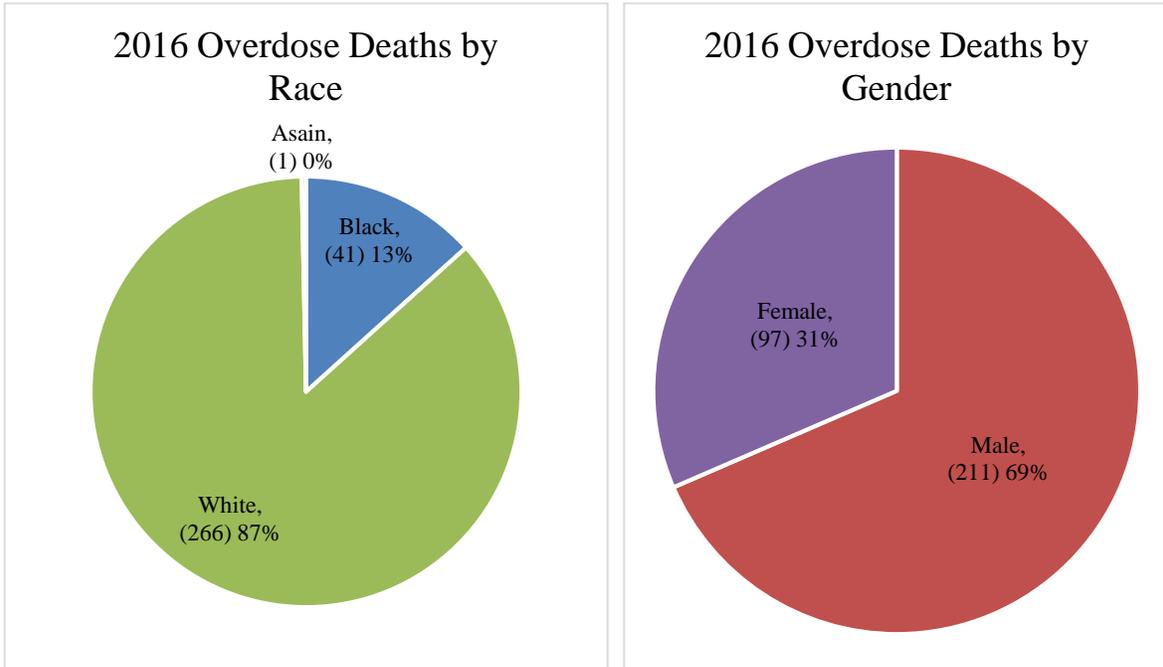




*This data is reflective of overdose deaths only.



*Data may reflect more than one drug identified per death.



Toxicology

Overview

The Toxicology Unit examines two types of cases: Postmortem cases (from the Medical Examiner Unit), and Driving Under the Influence (DUI)/other cases (these cases are predominantly DUIs where drugs were suspected and alcohol was less than the legal limit). The unit has a complement of eight staff members: the Chief Forensic Toxicologist, a 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: Benzodiazepines, Cocaine, Opiates, Phencyclidine, Carisoprodol, Methadone, Amphetamine, Methamphetamine, 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).

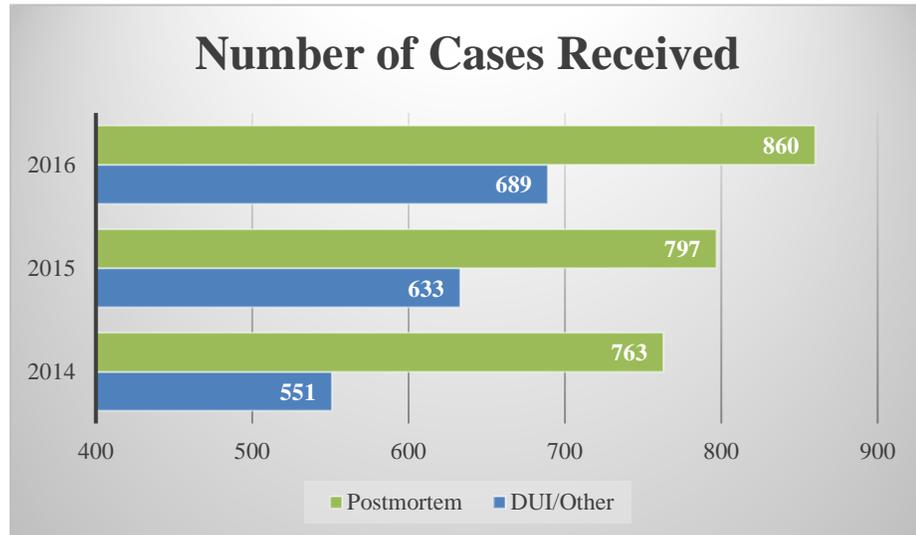
In addition to the ELISA Drug Screen, the Toxicology Unit has two confirmatory (but qualitative) drug screens. The Alkaline Drug Screen procedure covers approximately 200 different compounds, and the Acidic/Neutral Drug Screen covers another approximately 20 compounds. Alcohol/Volatiles Analysis using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

Dual Accreditation

The Toxicology Unit became dually accredited in 2016. The unit successfully underwent its first inspection for accreditation by the American Board of Forensic Toxicology (ABFT) on June 14 and 15, 2016. The unit also had its first audit by the American Society of Crime Laboratory Directors/Laboratory Accreditation Board (ASCLD/LAB) several months earlier in February to maintain its ISO 17025 accreditation.

Data

In 2016, the Toxicology Unit tested **860 postmortem cases** (the other 124 cases received did not require testing) and **689 DUI/other cases**. This equated to **6235 separate tests run in 2016, which is a 21% increase in tests performed versus 2015** (when 5134 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. It is important to note though that the number of cases received has also



steadily increased in recent years for both case types.

The Chief Forensic Toxicologist serves on the statewide *Impaired Driving Prevention Taskforce* and its *Drugged Driving Prevention* subcommittee. In providing data for this taskforce, the analysts have hand-tallied statistics on the DUI/other cases, because automatic retrieval of such statistics from the database system is not possible at this time.

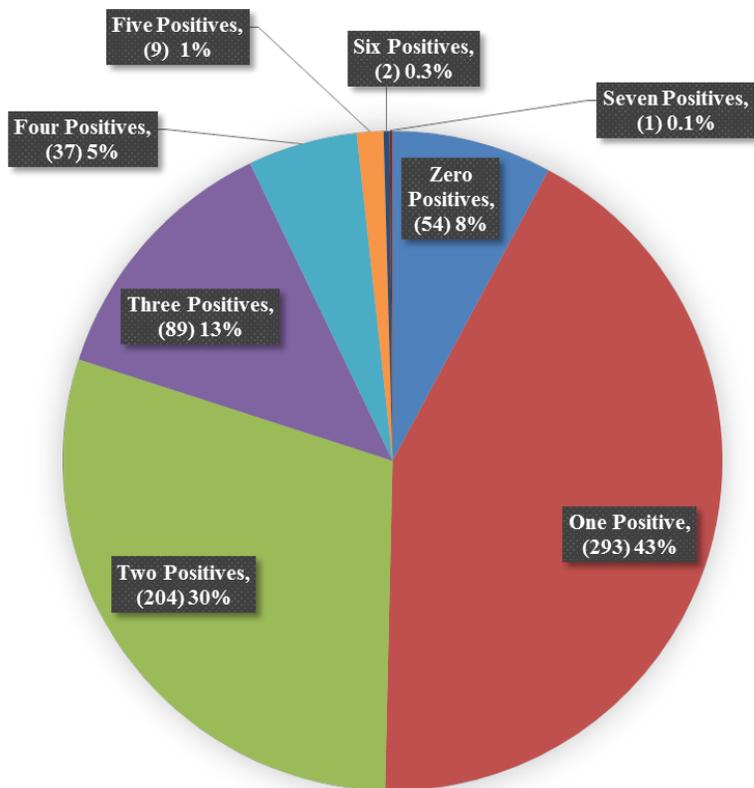
The below table displays the ELISA Drug Screen results for each drug/drug class for all 2016 DUI/other cases as percentages of the total cases received. More than half of the DUI/other cases received in 2016 were positive for cannabinoids (marijuana). Benzodiazepines, cocaine, and opiates were all similar in their percentages (between 20 and 23%).

DUI/Other Cases Positive for the Cross-reactives of Each Drug/Drug Class Listed; Percentages are of the Total DUI/Other Cases Received in 2016			
Cannabinoids	(380) 55.2%	Phencyclidine	(45) 6.5%
Benzodiazepine	(158) 22.9%	Methadone	(42) 6.1%
Cocaine	(148) 21.5%	Amphetamine	(32) 4.6%
Opiate	(142) 20.6%	Methamphetamine	(27) 3.9%
Oxycodone	(91) 13.2%	Carisoprodol	(19) 2.8%
Fentanyl	(89) 12.9%	Barbiturate	(7) 1.0%
None Detected	(53) 7.7%		

The following pie chart gives us a glimpse into the issue of polysubstance use in the state of Delaware.

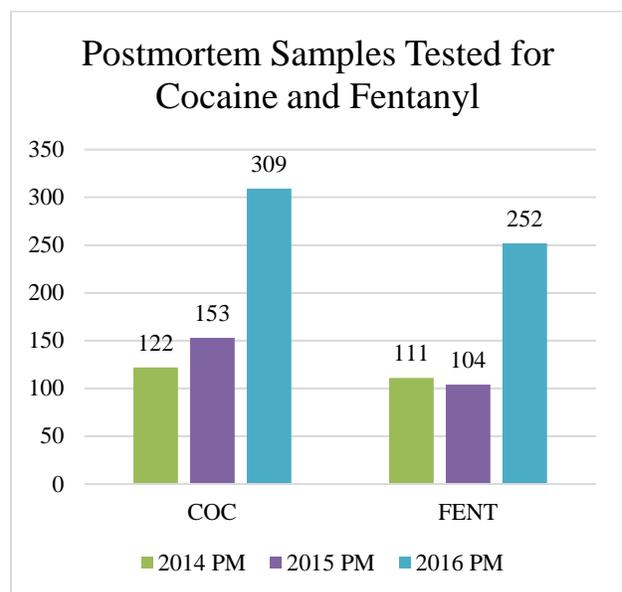
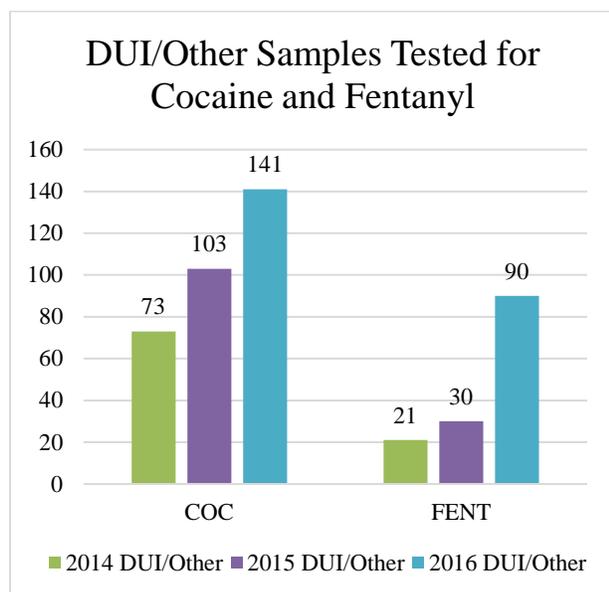
Forty-three percent of the 2016 DUI/other cases were positive for 1 out of 12 drugs/drug classes, while many of the other cases were positive for two, three, and four drugs/drug classes, respectively. For the first time in the Unit's history, Delaware saw a case that tested positive for seven out of 12 drugs/drug classes.

**2016 DUI/Other Case Polysubstance Use:
Number of Positive ELISA Drugs/Drug Classes Per Case**



To support the importance of the sharp increases in fentanyl and cocaine related cases, the below bar graphs illustrate that the number of DUI/other samples tested for fentanyl was up 200%, and for cocaine was up 37% compared to the number of samples tested in

2015. Further, the number of postmortem samples tested for fentanyl was up 142% and for cocaine was up 102% during the same time period.



Improvements in 2016

The Toxicology Unit made several process improvements in 2016. In January, an air tank was added to the GC-FID instrument upstairs in the Unit's instrument room. This has resulted in less air being used and has eliminated the issue of leaks in the lines. Also in January, the unit's specimen retention policy was changed to one year (down from two years). This decrease in specimen storage time has prevented overcapacity issues in the Unit's secure specimen refrigerator and freezer.

In March, the computer and software for the LC-MS/MS instrument was updated, and this update included a day of training by the manufacturer. Per the recommendations from the ASCLD/LAB audit, the *Estimation of Uncertainty of Measurement* policy was updated in April of 2016. The *Drug Screen by ELISA* standard operating procedure was also updated at that time so that Benzodiazepine Confirmation by GC-MS would be automatically added for all DUI/other cases when benzodiazepine cross-reactives are positive on ELISA. Previously, this confirmatory procedure was only added on a case-by-case basis. September was an exciting time for the laboratory staff as all three chemists were able to attend a weeklong training course at the Chemical Heritage Foundation in Philadelphia, PA titled: *The Robert F. Borkenstein Course on the Effects of Drugs on Human Performance and Behavior*.

A research analyst was added to the team to focus on method research, development, and validation. In November, several updates were made as preventive actions; additional maintenance was done on the Unit's deionized water system and air compressor.

The Toxicology Unit's goals for 2017 are to continue working to expand their ELISA Drug Screen panel from 12 to 20+ drugs/drug classes and to make significant progress in developing new methods on LC-MS/MS.

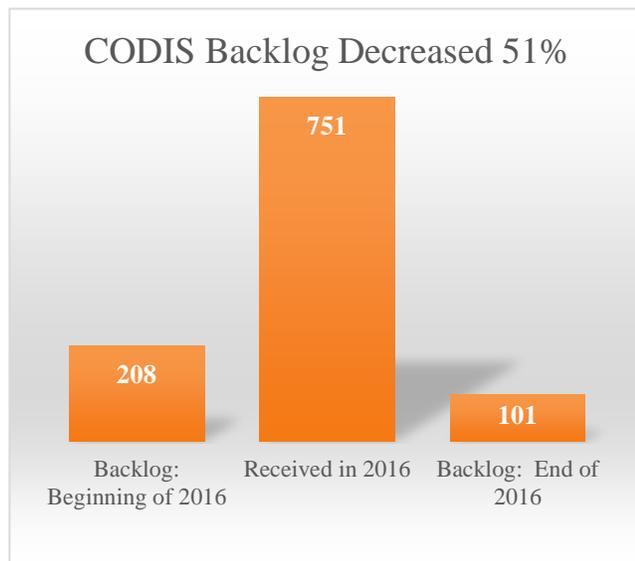
DNA

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 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 2016 was approximately 208. During 2016, the CODIS section received an additional 751 offender samples. In 2016, 777 offender samples and 145 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 101 samples for a 51% reduction from 2015. Note that a number of convicted offender samples were duplicates and thus not uploaded into CODIS. All of the remaining convicted offender samples are on-schedule to be processed during the first



quarter of 2017. In 2016, the DNA laboratory had 34 CODIS hits or “matches” from either the State or National databases. The table below reflects the types of cases that resulted in CODIS matches in 2016.

CODIS Matches	Type of Case	CODIS Matches	Type of Case
9	Burglary	1	Vehicle Pursuit
1	Homicide	1	Possession of Firearm
2	Home Invasions	4	Robbery
10	Sexual Assaults	1	Stolen Vehicle
3	Criminal Mischief	1	Strangulation
1	Theft		

Casework

In the beginning of 2016 there were 65 unassigned DNA cases, which included those with suspects and unknown suspect cases. In 2016 the DNA Unit received 415 new case submissions and 33 subsequent submissions, for a total of 448 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. **The total number of submissions and subsequent submissions increased 24% from the previous year.** By the end of 2016, the backlog (assigned but not completed, as well as unassigned cases) was 83. From the previous year, the number of unassigned cases decreased to 12 in 2016. The table below provides a breakdown of the types of cases received during 2016.

	New Submissions	Supplemental Submissions
Homicide / Att. Homicide	48	19
Sexual Assault / Assault	104	6
Burglary / Robbery	77	6
Missing Person	0	0
Death Investigation	0	0
Miscellaneous	34	1
Possession of Firearms	134	1
Proficiency Tests	18	0

The following table provides a comparative analysis for caseload and staffing from 2015 to 2016:

	2015	2016	Percent Change
Case Completions:	361	365	+1%
Case Submissions:	362	448	+24%
Staffing:	4.3	5.25	+22%
Backlog:	121	83	-31%
Specimens Examined:	1647	2400	+31%
Preliminary Tests:	1531	2195	+43%
Samples Extracted:	2827	4204	+49%
Samples Amplified/Analyzed:	4083	5973	+46%

Funding, Improvements, and Validation in 2016

The Casework Manager continues to handle the Federal DNA Backlog Reduction Grants. These grant funds have allowed the DNA unit to remain current with innovative advancements and improvements in the field of Forensic DNA testing. Federal grant funds increased in FY2016 to \$325,585; however, with the recent downward trend in funding, this is still less than the \$340,000 that was received back in

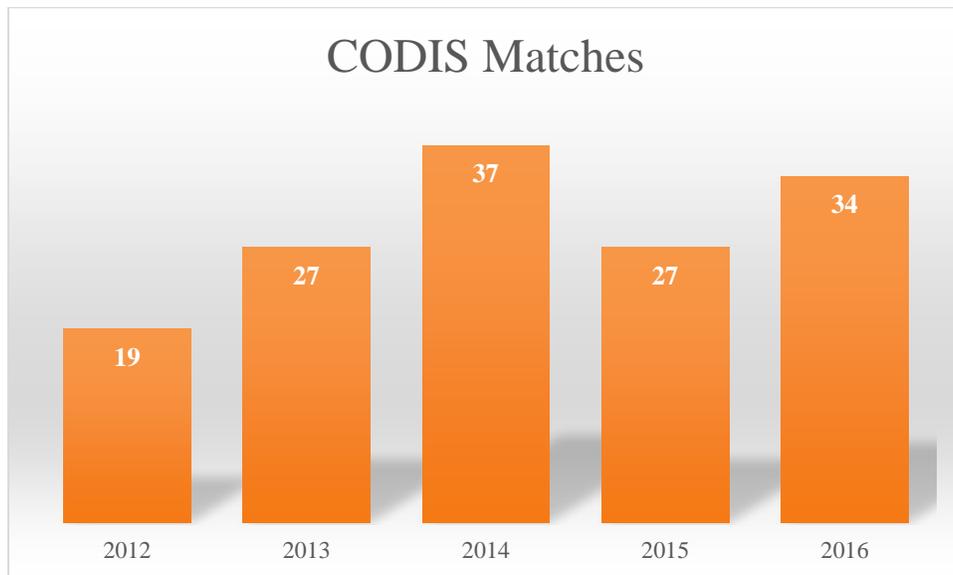
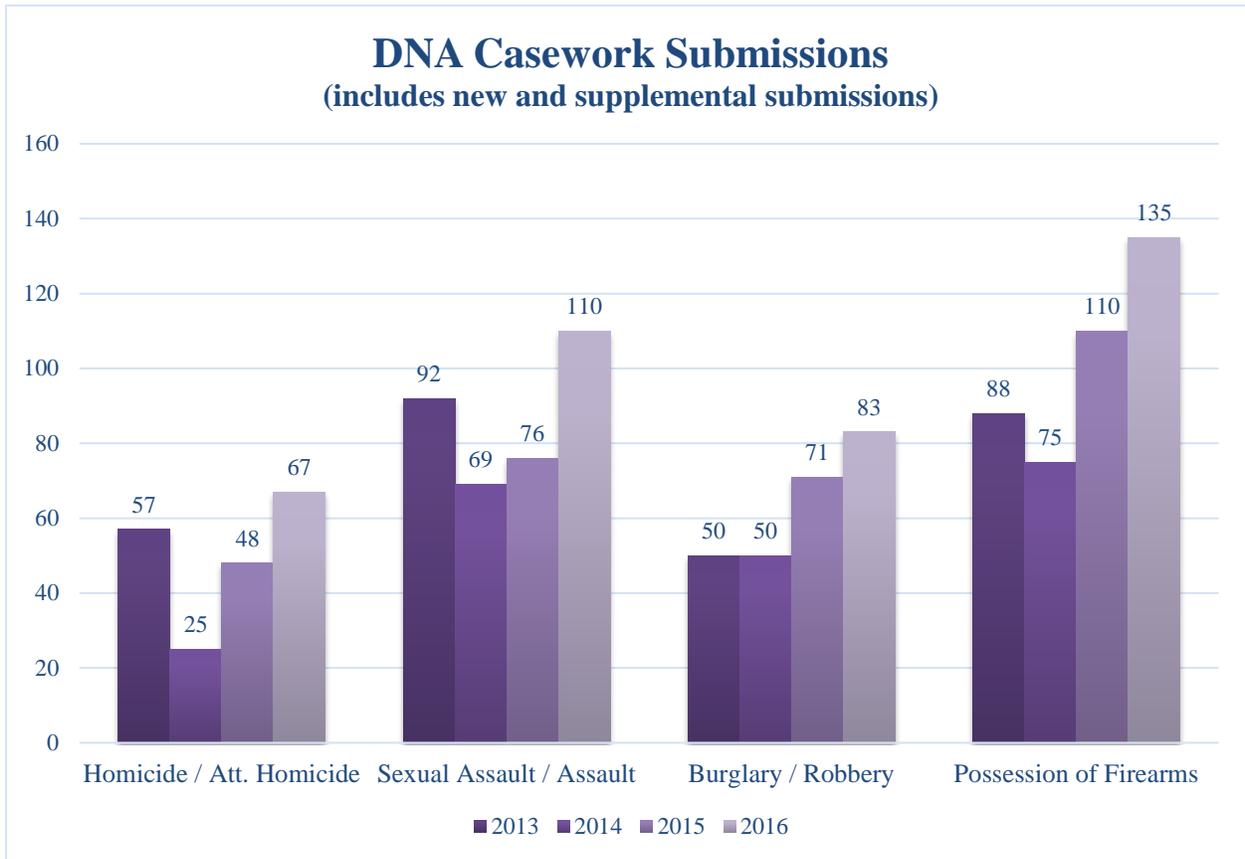
FY2013. In addition to the purchase of reagents for casework and convicted offender samples, in 2016 grant monies were used to replace aging equipment, improve safety and prevent down time, and also to purchase reagents necessary for validation, which improves the services offered by the laboratory.

The FBI Laboratory mandated that, as of January 1, 2017, all forensic DNA laboratories upload 20 DNA markers (up from the previously required 13) in the National CODIS database for each sample. The DFS-DNA Unit, after completing all validations for the new markers and instrumentation as well as all analyst training, is now in compliance with this mandate. Exceeding the requirement, our testing system, which includes the newly validated 3500xL Genetic Analyzer, now examines 27 DNA markers. As an added improvement, the new analyzer can run 24 samples at a time, which reduces the overall run time for a sample. However, with 27 markers, analysts now must spend more time analyzing the data.

Unfortunately, although the validations required to comply with the FBI mandate were completed, because of the increase caseload, there were other validations which are ongoing. Although validation is a critical part of the forensic DNA work, and is required to maintain laboratory accreditation, at this time the DNA Laboratory does not have an individual primarily dedicated to perform validation studies. Validation of the thermal cycler purchased in 2015 to replace aging instrumentation and of the statistical analysis software Armed Xpert was not completed.

In summary, the DNA laboratory received 24% more cases than were submitted in 2015. The number of samples submitted increased, but the number of cases in the backlog decreased. With the necessary focus on cases, pending validations will be ongoing in 2017.

Data



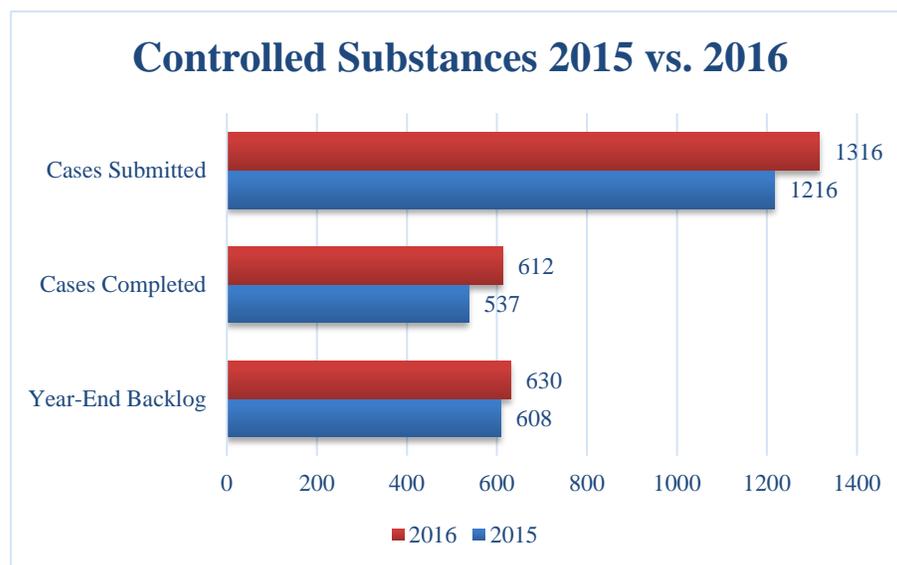
Forensic Chemistry

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 continues to increase. Although caseload has increased, and even with limited resources, the backlog has remained unchanged from the end of 2015.



The Laboratory Manager I position was filled and an

Analytical Chemist (AC) I was promoted to an ACII.

We continue to see significant increases in case size. The largest case ever received and analyzed by the DFS was completed in 2016, containing over 74,000 exhibits. This case took 41 days of analyst time plus another 21 days in review to complete.

Staffing and Limited Services

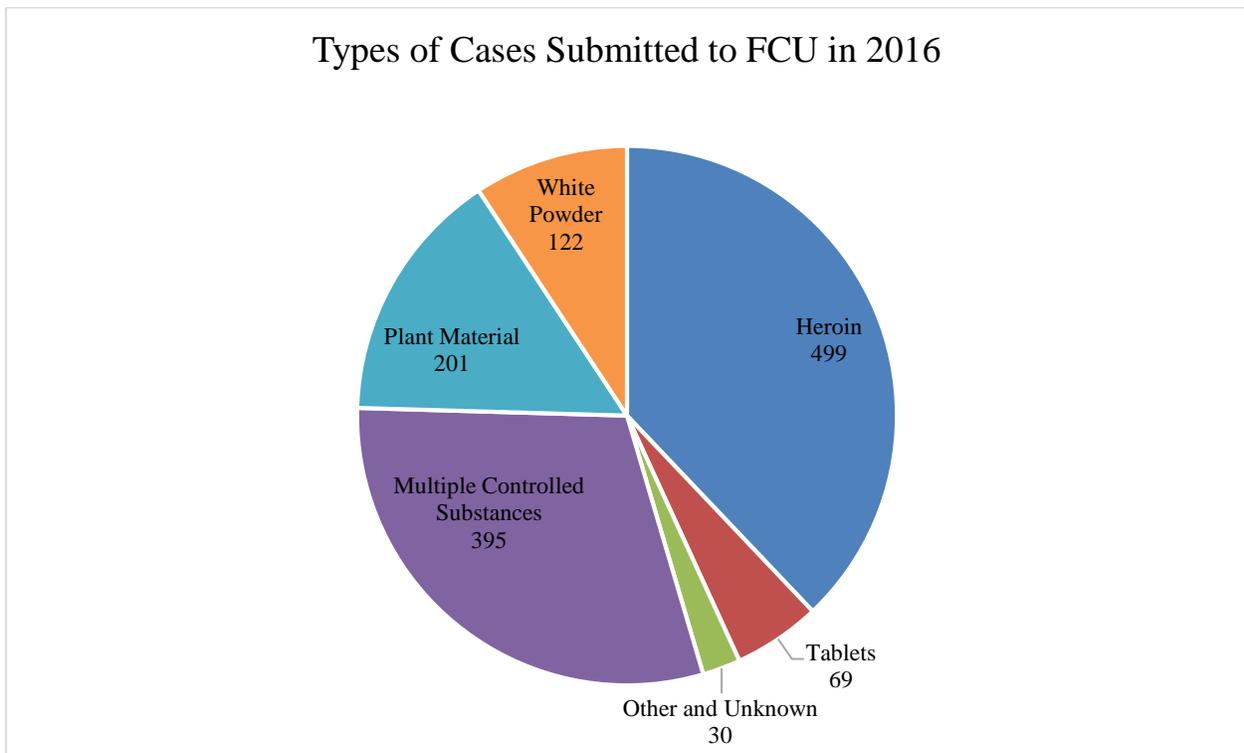
The full complement of the FCU is two manager-level positions and nine full-time chemist positions; however, as the table below indicates, the unit was severely understaffed throughout 2016. Staffing issues have contributed in large part to the backlog described above.

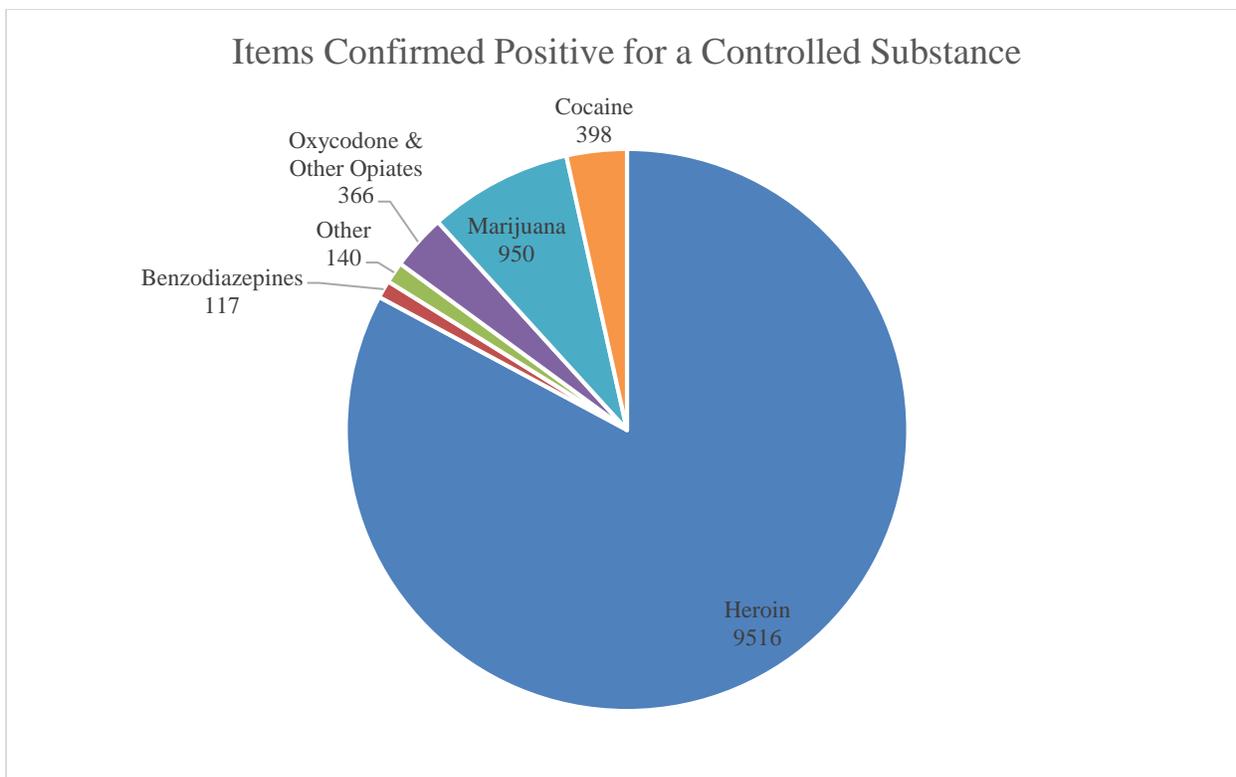
# Full-Time Chemists	Timeframe in 2016	Cases Completed by Analytical Chemists	Cases Completed by Lab Managers
4	Jan. 1 – Jan. 15	22	9
3	Jan. 16 – July 22	286	89
2	July 23 – Sept. 13	40	6
3	Sept. 13 – Dec. 31	144	16

Note: One chemist was dedicated to processing one case (more than 74,000 exhibits) from June 27, 2016 – September 23, 2016.

These resource limitations have required FCU to outsource a portion of the drug cases and fire debris cases to private laboratories.

Data





Casework Data		
Cases Submitted	1,316	
Exhibits Submitted	199,410	(counted, photographed, and documented)
Cases Completed	612	
Exhibits Analyzed	12,391	
Cases Cease Tested	428	(134 outsourced)
Cases Outsourced	803	(includes 2015 cases)
Cases Backlogged	630	(includes 2015 cases)

Controlled Substance	Number of Items Submitted in 2016
Heroin	9516
Oxycodone	120
Other Opiates	246
Marijuana	950
Cocaine	398
Benzodiazepines	117
Amphetamine/Methamp./MDMA	55
Other	45
Synthetic Cathinones	30
PCP	8
Synthetic Cannabinoids	2