A Moment in Time
Confronting addiction as a disease during pregnancy.

Winter 2015

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Letter from the editor

**WHAT’S OLD IS NEW**

Welcome to your new quarterly newsletter.

You might be wondering what happened to your USDTL Quarterly Newborn Newsletter. Of course, as you can see, we’ve changed it. We’ve even renamed it.

Welcome to the first issue of *NeoTox*, USDTL’s quarterly newsletter of forensic newborn toxicology.

This isn’t the end of our old newsletter - the longest running newsletter of any forensic toxicology laboratory in the U.S. It’s the beginning of something better. The world of newborn drug and alcohol testing is a dynamic forum. We felt it was time to improve our newsletter, to better update you on the latest news, science, and data you need to keep up to speed.

We’re bringing you more news, more science, and better data visualization. Our larger format is easier and, hopefully, more fun to read. We sincerely hope you like it, and we’ll be looking for your feedback in the coming months. If you enjoy this new design, we hope you’ll let us know.

This first issue of *NeoTox* is about opportunities. Pregnancy is a unique moment in time, a singular connection between mother and child that never comes around again. No one ever wants drug or alcohol testing to be part of the beginning of life, but when it is, there’s just one chance to get it right.

Objective drug and alcohol biomarker testing is a tool to help the legal, healthcare, and addiction treatment professional to get valid, reliable answers when it counts - that once-in-a-lifetime test. We know you’ll find the information in this issue helpful in navigating the confusing world of newborn drug and alcohol biomarker testing.

And that’s our mission, too. To help you find simple answers in a complex drug and alcohol testing world. Connect with us through our social media and let us know how we’re doing.

Thanks for reading,
Michelle Lach, Editor-in-Chief
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NeoTox is a quarterly newsletter of newborn toxicology science, data, and news. It is our mission to distil the technical world of toxicology, drug testing, and addiction science into plain words. If you have suggestions for topics you would like to know more about, let us know.

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Cover illustration by Joseph Salerno.
A Moment in Time

Pregnancy offers a unique opportunity for treating substance abuse as a women’s healthcare issue, before it becomes a newborn substance exposure issue.

by Joseph Salerno

The beginning of a child’s life comes with countless uncertainties. Sadly, for some children, one of those unknowns is what substances of abuse they were exposed to in their mother’s womb. When this is the case, it becomes a mission to find the answer, ultimately to improve the welfare of that child going forward. Drug testing of newborn specimens, such as umbilical cord and meconium, is the primary tool for answering that question.

Yet, we sometimes get so caught up in the idea of testing babies for substance exposure that we forget there is an opportunity to make a difference sooner. We miss the opportunity to extend our mission and help mothers fight the disease of addiction before the baby is born. Why wait to find out if a child was exposed to drugs, alcohol, or cigarettes in utero, when we can try to stop it before it happens?

Substance abuse by pregnant women has increased over the past three decades. In the United States, more than 225,000 children are born each year with prenatal exposure to illicit substances. This is a conservative estimate, and does not include the number of newborns exposed to alcohol and cigarette smoking in utero.

According to the most recent statistics from the National Survey on Drug Use and Health, 5.4% of pregnant women between the ages of 15-44 years will use an illicit substance during their pregnancy. In that same group, 9.4% will consume alcohol while pregnant; 2.3% will consume enough alcohol to raise their blood alcohol level above the level of 0.08% blood alcohol concentration. 15.4% of pregnant women will smoke during their pregnancy, not including the use of vaporizer electronic cigarettes, for which there is currently no data.

Addiction is a serious disease that can improve with treatment. Pregnancy may be the one time in a woman’s life when she would be open to treating important issues like drug and alcohol abuse. Pregnant women are more likely to seek any assistance from a healthcare provider, offering physicians a unique opportunity to help women contend with substance abuse. Regard for the welfare of a growing child is a powerful driving force to help a woman make positive decisions for her own health and future.

Even in the best of circumstances, relapse can occur during substance abuse treatment. Tracking a person’s treatment progress using biomarker testing can provide powerful, practical incentive for patients to stay on course and help them withstand urges to return to patterns of abuse. Biomarker testing can inform physicians early on if relapse has occurred, potentially alerting them to the need for adjustment to a patient’s treatment plan.

Substance abuse treatment plans typically rely on maternal self-report, use of a universal screening tool (questionnaire), or positive urine toxicology results. Maternal self-report can be severely limited by patient concerns about social stigma or possible legal implications of substance abuse. Questionnaire screening tools require skill and training to develop effective interview techniques,
and yet, can still be limited by social stigmas and patients’ legal concerns.

Urine toxicology is not an effective tool in identifying alcohol abuse and has limited value with other substances of abuse. With the exception of marijuana, urine generally provides only a 1-3 day window of exposure for substance use. The most effective antenatal drug or alcohol treatment program includes objective drug and alcohol biomarker testing to support the patient's progress.

**Changes for the Better**

Expecting mothers under the influence of substance dependence are often part of high risk populations that require a greater degree of support during pregnancy. Biomarker testing during substance abuse treatment has the potential to provide reinforcing milestones that keep patients on course.

The effects of substance abuse on a mother’s child are certainly worth avoiding. Children exposed to alcohol in the womb run the risk of suffering from Fetal Alcohol Spectrum Disorders (FASD), including Fetal Alcohol Syndrome (FAS), the most extreme case. FASD and FAS may require a lifetime of extra support services for children born with those conditions.

Babies exposed to nicotine in the womb may be born premature or with low birth weight. Congenital anomalies, such as cleft lip, have been linked to in utero cigarette exposure. Some studies have linked smoking during pregnancy with restricted growth for a child later in life, as well as behavioral changes that may last well into adulthood.

Newborns exposed to drugs in the womb may also be born premature or with low birth weight. Some substances can cause Neonatal Abstinence Syndrome in newborns, who may experience severe drug withdrawal once they are no longer exposed to a narcotic from their mother’s system. Cognitive delays have been linked to prenatal drug exposure. A limited number of studies have also linked drug exposure in the womb to an increased predisposition to addiction later in a child’s life.

**Alcohol Biomarker Testing**

Alcohol biomarker testing can be accomplished in several ways. The most effective testing measures the molecule phosphatidylethanol (PEth) in blood specimens. PEth is an abnormal phospholipid formed in the membranes of red blood cells when they are exposed to ethanol. It identifies hazardous drinking levels (enough to raise blood alcohol levels up to or above 0.08% blood alcohol concentration) occurring within the previous 2-3 weeks prior to testing. The PEth test is simple, and can even be done using blood drops from a finger stick such as those used for insulin testing.

Ethyl glucuronide (EtG) testing in fingernails and hair is another alternative for alcohol testing. EtG is produced in the liver, and can identify hazardous drinking within the three months prior to the test. Testing is carried out using fingernail or hair specimens. Fingernails are the preferred specimen, since they eliminate testing bias that can occur due to some cosmetic hair treatments and hair pigmentation.

**Nicotine and Drug Biomarker Testing**

Testing for illicit substance abuse and cigarette use can also be accomplished using fingernail and hair specimens. For substances other than alcohol, fingernails can provide a window of detection up to six months prior to testing. Hair samples are able to look back on a three month history of use. As with alcohol biomarker testing, fingernails are the preferred specimen, to eliminate bias that occurs when testing some substances.

*Continued on page 14, Opportunities.*
The need for opiate and opioid drug testing has grown in the last three decades. 2.4 million people in the United States abused opioid pain relievers in 1985, the year before President Ronald Reagan announced his Federal Drug-Free Workplace Program. That number swelled to 4.9 million - a 104% increase - by 2012. During that same time, the population of the United States grew only 32%.

The original opiate testing panel created in 1986 is an incomplete tool for today’s drug testing needs. No other category of drugs has evolved as much as opiates and opioids. Addiction to high strength pain relievers and newer opioid compounds has eclipsed codeine, morphine, and heroin addiction addressed by the original 1986 five-panel drug test.

Based on the most recent data on emergency department visits related to illicit substance abuse, it is clear that opiate and opioid abuse has shifted dramatically. Screening for opiate abuse using only 1986 drug testing guidelines for the opiate drug class misses the past 30 years of pharmaceutical and drug testing advancements.

See page 15, Opioids, for references.
LOST OPPORTUNITIES

Numerous studies have shown that meconium specimens are too often unavailable for substance exposure testing. Universal collection of umbilical cord specimens offers a solution.

by Joseph Salerno

Unable, despite her best efforts to shake her addiction, a woman exposes her unborn child to drugs in the womb. The baby is born, healthy and beautiful with all the promise the future holds. Three days later, the withdrawal symptoms kick in. The baby wails, flush with the pains of withdrawal and inconsolable, unable to sleep, experiencing seizures. The NICU physician wants to know what the baby has been exposed to, but now it’s too late. The meconium has already been passed and discarded, and the umbilical cord is gone, lost opportunities for concrete answers. Now it’s a guessing game.

This isn’t just a “what-if” scenario, unfortunately, but a potential reality in a surprisingly large number of newborn substance exposure cases. Withdrawal symptoms in substance exposed newborns can be delayed up to three, five, even seven days after the baby is born. Cases of in utero barbiturate exposure may not manifest withdrawal signs until 14 days post-delivery. By that time it’s too late to test any of the baby’s specimens for biomarkers of substance exposure, because the specimens are gone.

Universal collection of umbilical cord specimens offers a solution to avoid this dilemma. Umbilical cord is the only universally available specimen for substance exposure testing. Numerous studies have shown meconium is not available for testing in up to 27% of births. Meconium may be passed in utero. In some cases, there is not enough meconium volume to test even when it is able to be collected.

And again, meconium may have been passed by the newborn and discarded well before they begin to exhibit withdrawal symptoms. Unfortunately, this can also be a problem when the signs of in utero substance exposure emerge after the umbilical cord has been discarded. Newborn urine testing is not a viable option in these cases, because urine provides only a 1-3 day window of detection for substance exposure biomarkers, compared to the 20 week look-back of umbilical cord.

Universal collection of umbilical cord specimens for every birth ensures there are no lost opportunities should the need for substance exposure testing arise. Umbilical cord collection is extremely easy, requiring very little additional effort during post delivery procedures. Only six inches of the cord is required for substance testing, taking up very little storage space.

Umbilical cord tissue is a very stable and reliable specimen. Cord tissue is stable up to 1 week at room temperature, and up to 3 weeks when refrigerated, without jeopardizing the testing results. This is ample time for the emergence of newborn withdrawal symptoms, even in the most extreme cases. Enough time to avoid a missed opportunity for real answers. Only one donor and one collector are present during the umbilical cord collection - in contrast to the multiple collections and multiple collectors involved with meconium - greatly improving chain-of-custody integrity. Umbilical cord specimens are ready for transport just minutes continued on page 15, Universal.
The Onset of Newborn Withdrawal Symptoms is Highly Variable

- Alcohol: 3-12 hours
- Barbiturates: 1-14 days
- Diazepam: hours to weeks
- Heroin: 24 hours
- Methadone: 1-7 days
- Opiates: 1-7 days
- Sedatives: 1-3 days

Not All Newborn Specimens are Available for Testing

- Meconium: 73% Available
- Umbilical Cord: 100% Available

27% of Meconium samples are unavailable for neonatal substance exposure testing.
AFTER EFFECTS

Rumors abound that marijuana has no effect on the unborn child, and that it is safe to smoke while pregnant. But research has shown that maternal marijuana use can cause numerous adverse effects on newborns and growing children, some of which can linger into adulthood.

by Joseph Salerno

According to the 2013 National Survey on Drug Use and Health, 5.4% of women in the United States used an illicit drug at some point during their pregnancy. Marijuana was the primary drug of abuse. Overall marijuana use in the U.S. has increased by more than 30% since 2002.

Many studies have identified the potential for fetal harm as a result of marijuana use during pregnancy. Human and animal studies have identified issues with brain development and cognitive function. Marijuana use in pregnancy has been linked to low birth weight, preterm labor, shortened birth length and an increased likelihood for a newborn to be admitted to the NICU. Marijuana exposed newborns may exhibit signs of anxiety or depression.

Delta-9-tetrahydrocannabinol (THC), the primary psychoactive component in marijuana, binds with partial neurological effect to the CB-1 cannabinoid receptor sites located primarily in the central nervous system, as well as CB-2 receptors of the immune system. Several animal studies have demonstrated THC’s ability to alter neural development, resulting in changes to motor activity and cognitive function in THC-exposed offspring.

Several studies have reported negative long-term, developmental outcomes. Marijuana exposure in utero has been linked to problems with hyperactivity and impulsivity, attention deficit, diminished memory, and reduced problem-solving skills during adolescence. Altered brain functions and problems with working memory associated with maternal marijuana use during pregnancy, have been measured well into adulthood, at least as far as age 22.

References
Long-term Health Effects of in utero Marijuana Exposure

**Newborns:**
- Low birth weight and premature delivery
- Increased anxiety and depression symptoms
- Increased emotional reactions
- Reduced separation anxiety

**The Developmental Years:**
- Less branching in nerve cells
- Reduced ability to pay attention
- Diminished problem-solving skills
- Difficulty with detail-oriented memory
- Decreased ability to organize and prioritize

**Adulthood:**
- Altered brain functions and problems using working memory

**22 Years and Beyond**
NATIONAL POSITIVITY RATES

Umbilical Cord Specimens

- Cannabinoids: 15.6%
- Narcotics: 11.0%
- Amphetamines: 2.7%
- Cocaine: 2.0%
- Barbiturates: 1.8%
- Methadone: 3.5%
- Benzodiazepine: 2.6%
- Oxycodone: 4.6%
- Meperidine: 1.1%
- Tramadol: 1.2%
- Buprenorphine: 11.8%
- Ethyl Glucuronide: 2.4%
- Cotinine: 46.7%

Not shown: Phencyclidine 0.0%, Propoxyphene 0.0%
Quarterly report date range: October 1, 2014 – December 31, 2014

These data report national positivity rates for newborn toxicology tests conducted by USDTL on behalf of external clients and are not reflective of systematic research results.

Meconium Specimens

- Amphetamines | 4.4%
- Cocaine | 3.3%
- Opiates | 9.4%
- Cannabinoids | 17.3%
- Barbiturates | 0.9%
- Methadone | 5.0%
- Oxycodone | 2.5%
- Meperidine | 0.8%
- Tramadol | 1.0%
- Buprenorphine | 6.3%
- Fatty Acid Ethyl Esters | 13.9%

Not shown: Phencyclidine 0.1%, Benzodiazepine 0.1%, Propoxyphene 0.0%
Opportunities, continued from page 6.

There is an opportunity that exists early on, to provide substance dependent mothers with the tools to positively impact their own health and the health of their children. Changes for the better can be made before the mother or child face the consequences of in utero substance exposure. How much better would it be to give a mother a chance to support her own healthful changes now, and reduce the impact on her child later?

References
Universal, continued from page 8.

after the birth, greatly improving turnaround time for results reporting. Meconium passages can be delayed for days before being sent to the lab.

References


References

Opioids, continued from page 7.

Do you have questions regarding perinatal toxicology? We have answers.

**Contact our Perinatal Testing Group**
perinataltesting@usdtl.com  |  847.235.2367

Our experts can help you discover the correct testing solutions for your situation. And our toxicologists are always available to answer your most pressing drug and alcohol testing questions.
EVENTS & EXHIBITS

- March 9-10 – 40th Annual March of Dimes Perinatal Nursing Conference – Lombard, IL
- March 12-14 – National Advanced Practice Neonatal Nurses Conference – Chicago, IL
- March 28-30 – 2015 Medical Directors’ Meeting – San Diego, CA
- April 25-28 – Pediatric Academic Societies Annual Meeting – San Diego, CA
- April 26-28 – Wisconsin Association for Perinatal Care Annual Statewide Perinatal Conference – Appleton, WI
- April 29-30 – 2015 AWHONN Oklahoma Section Conference – Oklahoma City, OK