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Introducing NDEWS: The National Drug Early Warning System

Eleanor Erin Artigiani, MA, Eric D. Wish, PhD

Center for Substance Abuse Research (CESAR), University of Maryland College Park

Abstract

Purpose of review—In 2013, NIH NIDA released a special funding opportunity to update and expand their longstanding Community Epidemiology Workgroup (CEWG) by creating a coordinating center for a new type of monitoring system that became the National Drug Early Warning System (NDEWS). This article provides an overview of four primary NDEWS components: core staff; an approach to detecting and monitoring emerging drug trends including community-based epidemiologists and national databases; small rapid follow-up studies; and innovative multi-media approaches for disseminating information.

Recent findings—The cornerstones for detecting and monitoring are the 1,700+ member NDEWS Network and a coalition of local epidemiologists. Follow-up studies are designed with local researchers, practitioners, and policymakers to focus on local trends. Among NDEWS accomplishments are developing protocols for expanded urinalyses in high-risk populations and conducting follow-up studies with local collaborators in New Hampshire, New York, Ohio, Oregon, and a tribal nation in Minnesota.

Summary—During its first six years, NDEWS has advanced its mission to develop multi-disciplinary collaborations and innovative technologies for identifying, monitoring, and following up on emerging drug trends and has contributed to the translation of science into practice.

Keywords

NDEWS; early warning; novel psychoactive substances

Introduction

The National Drug Early Warning System (NDEWS) is a source of scientific information about emerging drugs, especially synthetic compounds and other Novel Psychoactive Substances (NPS) in the U.S. NDEWS' monitoring and research efforts generate objective information about drugs and their public health consequences so that prompt, informed, and effective responses can be developed. Innovative technologies and methodologies implemented by NDEWS provide an evidence base for assessing trends across sites and over time and for supporting the implementation of more timely and culturally focused drug research. This paper reviews the historical antecedents of NDEWS, provides an overview of

Correspondence to Eleanor Erin Artigiani, CESAR, University of Maryland College Park, 4321 Hartwick Rd, Ste 501, College Park, MD 20740, 301-405-9794, eartigia@umd.edu.

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the NDEWS process and recent research results, and summarizes continuing challenges for the system.

U.S. Drug Trend Monitoring History

The National Institutes of Health National Institute on Drug Abuse (NIDA) Community Epidemiology Workgroup (CEWG) was a network of approximately two dozen local drug abuse experts from diverse geographical areas across the United States who met in person semiannually to report on emerging patterns of drug use at the community level. During its 38-year history (1976–2014), the CEWG was coordinated by Nicholas Kozel and then by Moira O’Brien in the NIDA Epidemiology, Services and Prevention Research Division. The CEWG annual reports prepared by site representatives reviewed available national and local data including admissions to drug treatment programs; drug-related deaths; drug-involved emergency department (ED) cases; arrestee urinalysis results; price, purity, prescription drug distribution, and seizure data; poison center exposure calls; and information gathered from school, household, or general population surveys of drug use [1]. Some representatives supplemented these data with information collected through ongoing research such as ethnographic studies and focus groups.

The CEWG demonstrated that existing data could yield a broader understanding of drug abuse patterns within defined geographical areas. This approach aided policymakers in making decisions regarding supply-and-demand reduction strategies. The CEWG encouraged involvement of public health agencies at the community level, resulting in hospital and law enforcement personnel receiving updates on changing drug trends, as well as the dissemination of this information to the public via print and electronic materials [2]. In an effort to move beyond reporting primarily from readily available data toward a more modern approach to collecting and reporting information using a wider range of sources and more harmonized measures focused on emerging drugs, NDEWS was launched.

NDEWS Mission

When NDEWS began in 2014, the United States was undergoing a fundamental shift in the availability of drugs. The number and type of drugs available and the methods for acquiring them were rapidly increasing. These drugs were associated with significant morbidity and mortality [3] that resulted in increasing personal and societal costs across the U.S. NIDA recognized this development and the need for a unified, data-driven, multi-disciplinary approach to identifying and monitoring emerging drugs and drug trends. The funding opportunity announcement included establishing a Scientific Advisory Group (SAG) as well as an Early Warning Network, composed of experts on local drug use in selected sentinel communities, NIDA-supported community-based researchers, and other national experts, to assist in the ongoing monitoring and interpretation of findings [4].

The NDEWS Coordinating Center (NCC) was launched in 2014 through a cooperative agreement (a grant/contract hybrid) with the University of Maryland–College Park’s Center for Substance Abuse Research (CESAR). NDEWS was built on lessons learned from both advanced international systems (e.g., EMCDDA) and prior U.S. initiatives for monitoring trends and detecting emerging drugs nationwide and locally.

The NCC created the process, displayed in Figure 1, to detect, monitor, and follow up on emerging drugs and drug trends and to enable health experts, researchers, and concerned citizens across the country to share information and quickly prepare responses to potential drug outbreaks. NDEWS' strength as a coordinating center has been its ability to continuously evolve and incorporate recommendations from NIDA and an extensive network of advisors and collaborators. NCC staff have created and utilized a variety of sources and methodologies to achieve this mission.

During the past five years, NCC staff members have worked with experts in the drug field to explore innovative approaches including the NDEWS Network, HotSpot studies, Sentinel Community Site (SCS) reporting, state-of-the-art urine testing, geospatial modeling, and social media data mining. Some of these approaches have since been adopted and further developed by other researchers and toxicologists in the drug field. The important contributions of each are addressed in the following sections.

NDEWS Coordinating Center (NCC)

The NCC consists of a multidisciplinary team of scientists, analysts, and researchers from CESAR at the University of Maryland. This team manages the day-to-day operations of the NCC and produces and disseminates its output. The assigned NIDA Project Scientist advises on NIDA's programmatic intentions and priorities, fosters collaborations, and serves as a resource for the development, design, and coordination of research plans and study reports. NCC staff includes highly experienced social scientists, a demographer, a geospatial analyst, language scientists, a digital media manager, a biostatistician, and IT experts.

NDEWS Scientific Advisory Group (SAG)

The SAG includes 19 highly experienced federal and nonfederal representatives from across the country who lead many of the most innovative efforts underway to identify, understand, and respond to emerging drugs and drug trends. The diverse members include epidemiologists, toxicologists, ethnographers, social media experts, policymakers, and data analysts. The SAG annual meetings and ongoing discussions provide a unique opportunity to create a new paradigm for identifying and understanding emerging drugs and drug trends. Coordinating Center staff, NIDA, and SAG members collaborate to build and shape each component of NDEWS.

National Sources

NCC staff members have used national sources, including school and household surveys, drug intoxication death data, and law enforcement seizures and toxicology results, to track increases in drug use and availability across the country. Analyses of social media enabled us to identify new slang terms from tweets and provide information about where and how people discuss emerging drugs [5]. Geospatial analyses were conducted to assess access to public health services and explore dynamic spatial associations between socio-environmental variables and ED visits for acute overdose [6*]. The Drug Outbreak Testing Service (DOTS) pilot study was conducted in 11 sites to provide free, expanded, state-of-the-art urine testing to local public health and criminal justice programs [7]. Other efforts

have focused on using machine learning and big data together with spatiotemporal autocorrelation and time-series analysis to investigate the changes in the locations of activities relating to different drugs in an urban context. Efforts such as these provided much needed assistance to local officials to more accurately understand the use and availability of drugs in their communities and to determine how best to spend their limited resources.

Drug Outbreak Testing Service (DOTS) Pilot Study

NCC staff designed the DOTS pilot study to explore the feasibility of providing free, expanded retesting of routinely collected de-identified urine specimens to local programs at no cost. The urinalysis results for 11 participating programs revealed extensive poly-substance use and provided useful information about their limited testing protocols and the drugs being used. For example, the Palm Beach County, FL, Medication Assisted Treatment (MAT) program reported the “large number of non-opioid drugs detected underscores the complexity of treating these persons using opioid-focused MAT” [8]. A Baltimore, Maryland, hospital concluded that the “fact that most of these specimens contained eight or more drugs suggests that the number of drugs taken by these patients could be more important to their presentation and response to treatment than any one drug” [9]. As a result of the DOTS study, this hospital has since revised its testing protocol and implemented fentanyl test strips. The pilot study developed an innovative methodology for identifying the range of drugs used in a community.

NDEWS Network

The NDEWS Network was launched in 2015 to support a virtual community of experts in medicine, drug treatment, toxicology, ethnography, epidemiology, prevention, drug policy, and law enforcement. As of February 2020, it includes more than 1,700 members from across the U.S., Canada, and other countries. Members can use the Network to engage in real-time cross-disciplinary discussions to get rapid access to information on emerging drugs and drug trends, learn about new resources and successful local solutions, ask questions, and build collaborations. Network members provide information for developing NDEWS studies such as HotSpots, identifying emerging drugs, and focusing NDEWS’ detecting and monitoring efforts.

Drug monitoring systems around the world and NDEWS now regularly share information and reports as part of conferences and with the NDEWS Network to support the development and use of cutting-edge methodologies to monitor the availability and spread of drugs internationally. In 2017, representatives from around the world participated in a special series of NDEWS webinars coordinated by researchers from New Zealand.

Sentinel Community Sites (SCSs)

The 12 SCSs were carefully selected to represent urban, suburban, and rural areas in all regions of the U.S. (Figure 2). The SCSs range in size from a single city or county to an entire state, and each has committed local resources and experienced local epidemiologists (SCEs) able to access, analyze, and report on data such as mortality, treatment admissions,

poison center exposure calls, and drug seizures. The SCEs prepare annual reports and regular presentations to provide updates to NCC staff. This information is used to assess regional differences in drug use and availability, identify emerging drug trends, and detect HotSpots for further study.

HotSpot Studies

HotSpot studies were implemented by the NCC to follow up on emerging drugs and drug trends. Four studies have been conducted, and a fifth is underway. These rapid local studies were designed to answer specific research questions. Each was conducted as part of an innovative collaboration with local researchers, practitioners, and policymakers using a combination of methodologies selected to meet local needs. Methodologies used included discussions with Network members, focus group and interviews with drug users and first responders, analyses of mortality and other administrative data, geospatial analyses, and urinalyses. Comprehensive urinalyses for more than 240 substances have become an essential part of NDEWS HotSpot studies because the testing provides objective identification of the drugs used by study participants. The results of each HotSpot study have improved the understanding of local drug trends and have supported the implementation strategies to improve public health. The New Hampshire HotSpot study, for example, revealed (before it was widely known) that some opioid users actively sought fentanyl and often reported that they could distinguish fentanyl from other drugs. Decedents were found to have used an average of 6.2 drugs prior to their fatal overdose [10,11,12]. Geospatial analyses conducted as part of this HotSpot study revealed a “marked variation in access to opioid use disorder treatment services across the state with higher access mainly located in the southern part of the State following the trend of where the larger population centers exist” [6]. The Ohio and Oregon HotSpot studies explored the newly developing connection between the use of illicit opioids and stimulants first detected in urinalyses and further studies through interviews and focus groups [13*,14*]. The Minnesota HotSpot study marked the first time that opioid fatality reviews were conducted by a Native American population [15*].

Leveraged Studies

Leveraged studies add harmonized questions about timely topics to ongoing field research. The first NDEWS leveraged study focused on rapidly exploring knowledge, attitudes, behaviors, and practices related to bystander naloxone in three sites. Sixty current or recent opioid users were interviewed across the sites, and similar findings were obtained in all three sites. Participants from all sites were knowledgeable about naloxone, and most had at least some experience being revived or reviving others. Participants from all sites, however, were adamant that naloxone does not affect their day-to-day drug use, describing it as a “safety net” or tool to be used in emergencies [16*,17*,18*]. Expanded studies with larger samples are currently underway in two sites.

Information Exchange and Dissemination

The sharing and dissemination of information occurs through four primary venues: the NDEWS Network described earlier, *NDEWS Presents* webinars and *Timely Topics* videos, the NDEWS website, and social media. NDEWS staff have worked with leading experts to provide 32 webinars on emerging drugs and timely drug-related topics, including data collection tools, drug mortality, novel synthetic opioids, illicit stimulants, prescription drugs such as gabapentin, vaping related lung injury, and annual updates on drug threats in the U.S. The NDEWS website, www.ndews.org, includes all NDEWS study reports and webinars, SCS reports, DOTS bulletins, and other briefs. It is also a forum for presenting reports developed through NDEWS collaborations with agencies such as the Drug Enforcement Administration (DEA), the American Association of Poison Control Centers, and the American College of Medical Toxicologists. This site also provides interactive presentations of DEA drug seizure data. The website receives approximately 3,300 page views per month. The NCC also maintains an active social media presence through Twitter. @NDEWSnews currently has nearly 1,300 followers who regularly comment on and retweet NDEWS posts.

Conclusion

During its first six years, NDEWS has built on the CEWG model to expand available knowledge about emerging drugs and drug trends. NDEWS has achieved a number of research accomplishments including developing protocols for expanded urinalyses in a variety of at-risk populations and conducting HotSpot and leveraged studies that follow up on emerging drug trends. Improvements in the dissemination and sharing of information have also been made, including the establishment of the NDEWS Network, *NDEWS Presents* webinars, the NDEWS website and social media efforts, and a variety of scientific reports designed to support and encourage the translation of science to practice.

NDEWS has supported studies to address local needs and rapidly collect and disseminate information. Formal and informal global components such as the NDEWS Network, *NDEWS Presents* webinars, and informal information sharing to identify and track emerging drugs have also been fostered. NCC staff and collaborating scientists have identified and monitored emerging NPS such as synthetic cannabinoids, cathinones, and synthetic opioids; emerging trends involving illicit drugs such as methamphetamine and fentanyl; the adverse health effects from administering substances through vaping devices; and the misuse of licit drugs such as gabapentin and loperamide. NDEWS research was among the first to demonstrate the need to identify NPS through expanded urinalysis, to show that opioid users were more knowledgeable about fentanyl than previously assumed, to identify new trends in polysubstance use and opioid users' current rationales for using opioids and methamphetamine, and to emphasize the extent of polysubstance use among opioid users and the services needed by people with substance use disorder.

NDEWS still faces similar challenges to other national drug monitoring systems, however [19]. These include the lack of timeliness and completeness of data available, the need for

more accurate methods for identifying NPS, and the need to harmonize data from diverse sources.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Points

- NDEWS generates objective information about drugs and their public health consequences so that prompt, informed, and effective responses can be developed.
- Innovative methodologies implemented by NDEWS provide a means for assessing trends across sites and over time, and HotSpot and leveraged studies support the implementation of more timely and culturally focused drug research.
- NDEWS has demonstrated the need to use comprehensive urinalyses to identify emerging drugs.
- NDEWS has developed new ways to disseminate information rapidly to constituents around the world.
- Other countries might benefit from the lessons learned by NDEWS over the past six years.

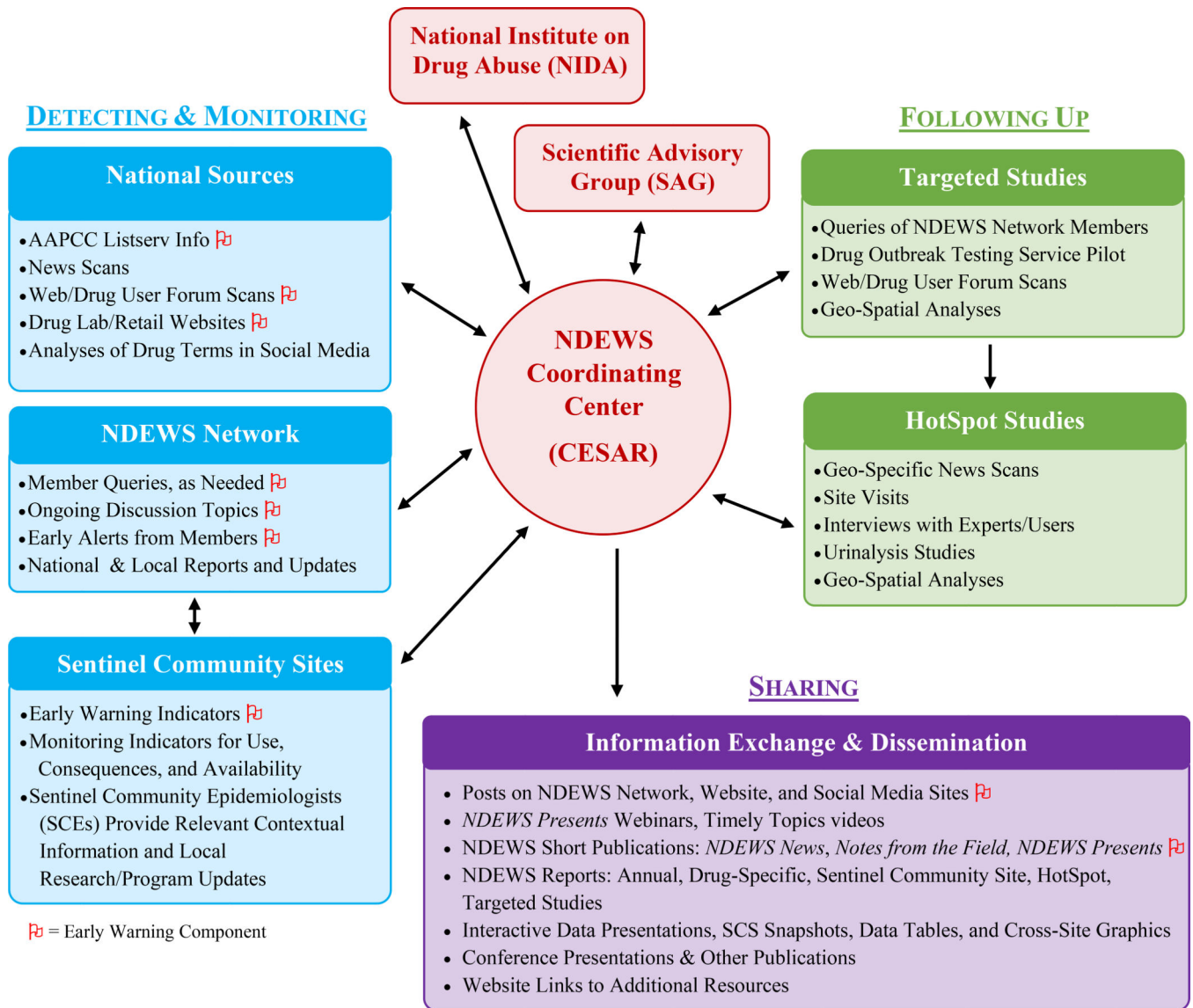


Figure 1:
NDEWS Organizational Chart



Figure 2:
The National Drug Early Warning System Sentinel Community Sites, HotSpot sites, and leveraged study sites.