

Tobacco, Alcohol, and other Drug Working Group Report: Analysis of Existing Strengths, Critical Gaps, and Opportunities for Collaboration
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Introduction

Tobacco, alcohol, and drug use disorders are prevalent, costly, and deadly. Use of tobacco and other substances remains the leading preventable cause of death in the U.S., and recent efforts have not put the U.S. on a path to meet Healthy People 2020 goals². In New Jersey, 16-17% of both youth and adults smoke cigarettes regularly³; 17% of adults are binge drinkers⁴; roughly 5% of New Jersey residents over age 12 report past month illicit drug use⁵, and the overdose mortality rate has risen to one incident per day⁶. Nationally, the annual costs of tobacco, alcohol, and drug use in health care expenditures and lost productivity exceed \$600 billion⁷. As the flagship university in the state, it is vital that Rutgers have a visible and effective program addressing this critical public health problem. To date, Rutgers researchers, educators, and clinicians have become nationally recognized experts in this field despite limited resources. However, their standing could improve exponentially with modest support and an infrastructure to foster collaboration among units.

Existing Strengths

Analysis

At present, there are strengths in many specific areas, but also some critical gaps that represent barriers to becoming best-in-class in tobacco and substance abuse. This analysis is detailed by level (population research, clinical research, and basic/preclinical research) followed by an analysis of educational and clinical service activities. Table 1 summarizes productivity by level of analysis.

Table 1. Summary of grant funding and publications in the past 5 years by area of research

Area of Research	Grant funding (direct costs)	Number of publications
Population: Tobacco	\$8,186,120	30
Clinical: Tobacco	\$4,152,000	40
Clinical: Alcohol	\$4,953,000	50
Basic: Human	\$7,843,000	110
Basic: Animal	\$7,095,000	105
TOTAL	\$32,229,120	335

Population Research/Public Health. Rutgers faculty have been active and successful in the area of population-level tobacco research, with complementary strengths in surveillance and measurement of tobacco use, product trends (including alternatives such as smokeless tobacco, cigars, e-cigarettes), tobacco marketing and communications, and select priority populations (e.g., young adults, physicians, South Asians). Much of this work has been led by members of the School of Public Health's Center for Tobacco Surveillance & Evaluation Research (CTSER), directed by Dr. Delnevo. Her expertise has been recognized nationally and sought by the CDC, NCI, FDA, and the Surgeon General. Dr. M. Jane Lewis (SPH) is an NCI-grant funded researcher and PI of the *Trinkets and Trash Collection* (T&T), a nationally recognized surveillance system and online archive of tobacco advertising materials, and a unique Rutgers resource used by tobacco control educators, advocates, researchers, policy-makers and enforcers (including Attorneys Generals). Dr. Wackowski is a new faculty member who has obtained multiple grants in her first three years on faculty and is leading innovative research on e-cigarettes and smokeless tobacco. Tobacco population-level research at Rutgers has been used to inform policy on topics such as legal classifications, taxation, and tobacco flavoring, with CTSER work repeatedly cited in discussions about potential FDA regulatory policies on menthol cigarette and cigars. Overall, this area has had a successful track record in securing grant funding (see Table 1), including over \$1.5 million in active funding for 2014 alone, and has excellent potential for growth given that it is thus far a relatively small (3-member) and young team. It has been successful in securing funding from newly available FDA tobacco-focused grant money. Rutgers population researchers have also formed strong collaborations with other centers of excellence in tobacco control, including UCSF (described below), University of Texas (for a funded P50), and Roswell Park Cancer Institute (with joint grant applications currently under review).

Clinical Research. Clinical substance use researchers at Rutgers have gained national recognition in numerous areas of tobacco, alcohol, and other drug studies, having received approximately \$9 million in grant support and producing nearly 100 manuscripts in the past 5 years. Clinical tobacco research activities have explored components that contribute to tobacco dependence and cessation, including variations of nicotine intake and smoking topography (Williams, Marc Steinberg), distress tolerance in early nicotine withdrawal (Leyro), phenotypic markers of cessation and the process of relapse (McCarthy), and task persistence and motivational interventions (Marc Steinberg). In addition, tobacco researchers have demonstrated successful collaboration between RWJMS, SPH, SAS, and NJMS and are exploring cessation influences at the individual and group levels, including novel psychosocial influences and nicotine inhalation devices (Michael Steinberg, Williams, Marc Steinberg, Cooperman, McCarthy, Lewis, Delnevo), healthcare provider attitudes and behaviors (Michael Steinberg, Delnevo, Schwab, Hymowitz, Leyro) and health systems integration of tobacco treatment, such as integrating into primary care and behavioral healthcare (Michael Steinberg, McCarthy, Delnevo, Williams). Finally, the tobacco clinical research group has gained expertise on tobacco use and cessation among priority populations such as smokers with mental health and substance use co-morbidities (Leyro, Williams, Marc Steinberg, Cooperman), smokers with medical co-morbidities including hospitalized smokers (Michael Steinberg), and ethnic and racial minorities (Michael Steinberg, Williams). These avenues of research have been funded through a variety of sources including NCI, NIDA, RWJF, state, and industry.

Rutgers also hosts nationally-recognized researchers in clinical alcohol studies and other substance use disorders. These include projects involving physiological measures, such as baroreflex and heart rate variability biofeedback for alcohol use (Vachillo), examining mechanisms of change in alcohol treatment (Bates), performance-enhancing drug use and its disorders (Langenbucher), and novel statistical models to understand the development of substance use (Mun). In addition, researchers at the Center of Alcohol Studies also explore issues in priority populations such as women and couples (Epstein) and youth (Johnson, White).

Basic Research. Nicotine, alcohol, opioids, and cocaine share overlapping mechanisms of action, especially regarding mechanisms underlying dependence, which are key to addiction and relapse. Within a translational science framework⁸⁻⁹, the basic scientists working in tobacco, alcohol, and drugs use both animal models and human subjects to focus on the early stages of discovery science and its translation. These basic scientists comprise a small but highly accomplished group of junior and senior investigators whose research interests extend to all drugs of abuse listed above. Scientists at Rutgers/RBHS have produced and studied the largest collection of opioid ligand/receptor knock-out mouse strains in the world (Pintar) and have also developed a world-class program to study epigenetic effects of alcohol (Sarkar). Scientists have introduced cutting-edge approaches to directly study the effects of cocaine on neuronal activity in vivo (West), developed innovative approaches to study neuroimmune effects on stress and alcohol consumption (Kusnecov), and are pioneering studies to use human induced pluripotent stem cells (iPSC) to study human opioid receptor gene variants that have been associated with nicotine and alcohol addiction (Pang). This group of five investigators has, on average, published 20 papers/PI since 2009 and received greater than \$250K direct costs/yr/investigator from NIH (including one NIH Merit Award), NJ state agencies, private foundations, and several private sector companies during that period. Scientists contribute to numerous national scientific advisory boards (Sarkar, West, Pintar) as well as to the local educational efforts of several graduate programs including the directorship of the RBHS/Rutgers joint program in Neuroscience (Pintar). Innovative relevant work is occurring on other campuses as well, such as Joan Morell's animal research on drug effects on maternal motivation and early life development. Finally, School of Public Health (SPH) scientists (Meng, Schwander) are researching vapor particles generated from e-cigarettes and the impact on pulmonary cells.

In complement, NIH-funded basic human researchers jointly working on the Newark and New Brunswick campuses are using state-of-the-art methods to study how neurocardiac signaling is interrupted by alcohol (Bates), to characterize the disruption and recovery of functional brain networks and novel brain-heart feedback mechanisms in addicted humans, and to apply cutting-edge graph theoretic approaches to uncover the nature of altered human brain connectivity in alcohol, marijuana and cocaine addiction (Bates, Ray). New quantitative approaches to capture human genetic variation in these studies' participants are being developed

to discover subtypes of neurocardiac vulnerability and treatment response (Buckman) and likely will identify additional variants relevant for iPSC studies above. In addition, basic human scientists collaborate with Rutgers/RBHS Sports Medicine in the area of concussion and substance use, and with other social scientists and clinical researchers at the Center of Alcohol Studies (Epstein, Mun, White) to apply sophisticated quantitative approaches to bi-directional translational science that integrates etiology, development, cognitive impairment, emotional regulation, and neurophysiological processes. National prominence is supported by three prestigious NIH Career Scientist Awards to our basic human researchers at multiple career stages, as well as a notable number of NIH and NJ state contracts and awards. Just the 6 researchers above are highly productive (publishing on average 22 articles per year) and effective in obtaining grants (Table 1), and this is only a sample of the researchers active in human preclinical research relevant to addiction. This work is also occurring on multiple campuses, with the Center of Alcohol Studies leading translational efforts and others in Newark, such as Mauricio Delgado leading related but independent programs of research.

Education, Training, and Policy Activities

Apart from its research mission, one of the critical aspirations for RBHS is national excellence in education. The educational, training, and policy achievements in the areas of tobacco, alcohol, and other drugs (TAOD) have been nationally recognized over the past 5 years. At the undergraduate level, courses in biology, history, pharmacy, psychology, public health, and sociology address substance use and policy. Many TAOD faculty involve undergraduates in their research programs or public health internships. At the graduate level, courses in neuroscience, mental health and psychology, and public health also address substance use and control. Several researchers mentor graduate students and two (McCarthy and Pintar) direct graduate programs. The Center of Alcohol Studies was home to an NIAAA T32 training grant. In the professional schools, TAOD use is incorporated into medical school curricula in both New Brunswick and Newark and addressed in several residency programs (e.g., pediatrics, internal medicine, preventive medicine, and psychiatry). Rutgers faculty are leaders of efforts to educate community health and mental health care providers in evidence-based and best-practice policies in the prevention and treatment of tobacco use and alcohol use disorders, with diverse sources of support including industry. Rutgers conducts nationally-recognized trainings including certified tobacco treatment specialist training, treatment in behavioral/mental health settings, and motivational interviewing, having trained over 7,000 professionals from all 50 states and 22 countries.

Clinical Services

As part of the State University of New Jersey, RBHS has an obligation to achieve excellence in clinical service delivery for the New Jersey community and beyond. Although Rutgers does not have a broad and large-scale addiction treatment program, there are many services providing high quality care to NJ citizens in need of TAOD treatment. Clinical service achievements in the areas of TAOD include: 1) Rutgers Tobacco Dependence Program (Michael Steinberg) which provides evidence-based cessation services and has treated over 6,000 highly dependent and co-morbid new clients since 2000; 2) NJMS HIV Tobacco Program (Chew) which provides tobacco treatment for HIV+ tobacco users; 3) Program on Addiction, Consultation, and Treatment (Rotgers) which provides assessment and treatment to individuals mandated to or seeking alcohol use treatment; 4) Department of Psychiatry – NJMS (Levounis, Kennedy) which provides excellent treatment for various addictions and mental illness; 5) Rutgers ADAP (Alcohol and Other Drug Assistance Program) (Laitman) which offers outpatient and residential life services for students who are concerned about alcohol or other drug use; 6) Rutgers Recovery House (Laitman), a unique university housing and support program for students in recovery from substance use disorders; 7) Center for Great Expectations (Bates) which provides a continuum of addiction services to mothers and their children; 8) NJ Poison Information and Education System (NJPIES) (Marcus) which tracks overdoses statewide; and 9) University Behavioral Health Care (Mann), an outpatient substance abuse program specializing in co-occurring disorders.

Critical Gaps

Our analysis demonstrates areas of excellence throughout the spectrum of work on TAOD use, but they need to be integrated. We have strong population and clinical researchers in tobacco, but no basic animal or preclinical human researchers in this area. We have particular strengths in basic animal models of drug motivation and learning for stimulants and opioids, but a lack of clinical or population research in these areas.

Alcohol research at the Center of Alcohol Studies is better integrated and more translational than research on other substance, but needs to be broadened and expanded for Rutgers to be best in class. We have considerable expertise in both prevention and treatment, but in separate, small networks that limit cross-fertilization of ideas and direct collaboration.

What is notably lacking is integration across levels of analysis, substances, and campuses. We need to build bridges to foster translational and transdisciplinary work by building infrastructure and technical expertise. As described below, we propose to start this effort with the establishment of a Center for Tobacco Studies, while concurrently building the foundation toward a broader Rutgers Institute. Hiring faculty in specific target areas will help build these bridges in tobacco. Hiring a basic researcher developing animal models of nicotine addiction, an expert in the pharmacology of novel tobacco and nicotine products, and an additional population researcher would facilitate development of a broad and sustainable translational tobacco research program.

In addition, the changing epidemiology and decriminalization of marijuana use creates urgent needs for research to inform prevention, treatment, regulation, and policy in this area. Marijuana use is now more prevalent than tobacco use in youth, and the short- and long-term health effects of marijuana are less well understood than those of tobacco. Although there is research on marijuana occurring at some of the peer institutions we reviewed, this is not a robust area of research generally. This combination of factors presents a unique opportunity for Rutgers to build a leading program of research in marijuana use. Two of our faculty (Bates and Leyro) are already working in this area and could serve as leaders in the development of such a program at Rutgers along with experts in addiction and prevention at NJMS (Thomas, Kennedy, Levounis).

In terms of education and training, we need to cross the boundaries of disciplines and campus to enrich the training about TAOD use at all levels. We also need to blend research and clinical training to help prepare our trainees to lead translational and transdisciplinary research programs of their own. For example, basic research trainees developing rodent models of drug motivation may benefit enormously from exposure to clinical phenomena and challenges in treatment research. Because almost all of our research and training occurs within single units at the University, this kind of cross-fertilization is rare currently.

Our assessment also revealed that the Rutgers clinical services for TAOD use disorders are insufficient to meet the needs of our communities. Although we have small specialty services providing excellent care, they have limited reach. Our large University Behavioral Health Services unit offers limited TAOD services. The State tobacco control program's funding is one of the worst in the nation according to the American Lung Association. Despite high-profile connections (e.g., faculty on the advisory board of the Governor's Council on Alcoholism and Drug Abuse), Rutgers needs to expand its reach to serve the NJ community in terms of substance use treatment, especially in communities most in need, such as Newark.

Opportunities for collaboration

The goal of our collaborative effort is to reduce the burden of TAOD use on NJ residents and beyond through prevention, research, education, and treatment. Existing efforts have been very successful to date, but what is needed is a structure to link together these individually outstanding components in order to reach a "best in class" level. This will be accomplished through leveraging the resources of RBHS and other Rutgers units. Tobacco researchers at Rutgers span the spectrum from basic science to populations and have already formed collaborative connections with support from various units, such as CINJ, SPH, RWJMS, NJMS, and the Institute for Health, Health Care Policy and Aging Research (IHHCPAR). In addition, faculty members in New Brunswick have formed an addictions consortium that meets monthly to share research ideas and develop collaborative projects. In Newark, a high-need and under-resourced community, Petros Levounis is leading efforts to build the program of clinical research on addiction at NJMS. Expanding collaborations with NJMS and New Brunswick faculty will be critical for substance use prevention, especially among youth (Thomas, Schwab) and HIV+ tobacco users (Chew). The Center of Alcohol Studies has a history of fostering collaboration among alcohol researchers and was home to a NIDA Transdisciplinary Prevention Research Center. As such, many initial connections needed to build productive collaborations have already been formed and can be expanded. This strategic planning process has also highlighted the potential for new collaborations

(e.g., linking basic epigenetics researchers with clinical researchers interested in epigenetic effects of drug withdrawal; linking clinical researchers studying e-cigarettes with population and marketing/communication researchers to determine the scope of adoption of these products).

In addition, all members of the team of clinical and population tobacco researchers share interests in studying tobacco prevention, dependence, and cessation among priority populations of smokers including those with co-occurring mental and physical health disorders, including alcohol (Epstein), anxiety (Leyro in New Brunswick, Marmorstein in Camden), HIV/AIDS and opioid dependence (Chew, Cooperman), schizophrenia (Williams, Marc Steinberg), hospitalized and medically-ill smokers (Michael Steinberg), minorities and youth (Michael Steinberg, Delnevo, Lewis, Schwab). Several of these researchers have experience developing novel treatments (Marc Steinberg, McCarthy, Epstein, Cooperman), conducting randomized clinical trials (McCarthy, Epstein, Marc Steinberg, Michael Steinberg, Williams), and studying behavioral mechanisms of change (Bates, Epstein, McCarthy). This team is well poised to establish a center for the study of smoking cessation in these priority populations. This will also offer an opportunity to integrate clinical and population research programs across substances by examining ways to promote smoking cessation in alcohol and other drug treatment programs. Dr. Williams is already leading a state-wide effort to promote smoking cessation services in drug treatment centers. Collaborations focusing on other priority populations have already been funded including an NCI funded grant on South Asian tobacco use (Delnevo, Michael Steinberg).

There is ample opportunity for population-level tobacco researchers at Rutgers to collaborate with others both within and outside of the University. The explosive growth in the marketing and use of e-cigarettes also poses an opportunity to foster collaborations among basic (Meng, Schwander), clinical, and tobacco control researchers. Through funding from Rutgers-CINJ, researchers across clinical and population disciplines (Michael Steinberg, Delnevo, Lewis) have studied e-cigarettes as a potential nicotine delivery substitute. Also, since 90% of adults who smoke began before age 18, primary prevention is a pediatrics issue, and NJMS Pediatrics is studying the role of non-cigarette tobacco in later tobacco dependence and cigarette use (Schwab). There is an urgent need for research in this area. The recent authorization of the FDA to regulate tobacco is unprecedented in that it requires the FDA to consider the effects of tobacco products on the general public in addition to tobacco users. Fulfilling this mandate requires broad and intensive research at many levels of analyses. There are new funding mechanisms through the FDA that are supporting new tobacco regulatory science centers (e.g., at Yale). Given our strength in tobacco control research at the School of Public Health, Rutgers is well poised to contribute in this area and to attract FDA funding. More resources, faculty, and collaboration would allow us to take additional advantage of these opportunities. Funding from Rutgers-CINJ has allowed population researchers (Delnevo, Lewis) to gather pilot data from clinical populations treated at the Rutgers-Tobacco Dependence Program (Michael Steinberg). Other collaborations across RBHS and non-RBHS Rutgers units have been ongoing. Tobacco researchers (Michael Steinberg) have worked and continue to work with faculty from the School of Social Work and IHHCPAR in health services tobacco research (Akincigil and Crystal) and to integrate tobacco treatment in Accountable Care Organizations (ACOs) (Crabtree). Dr. Delnevo is also collaborating with basic environmental science faculty from the SPH Environmental Health Department to study e-cigarette vapor particles. There are also other likely relevant faculty for collaborating in complementary areas, such as communication, marketing, anthropology, and education that need exploring and cultivating. Finally, close ties with the NJ Department of Health have allowed tobacco researchers to influence policy decisions, as well as surveillance efforts, across the state.

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