Building a Learning Marijuana Surveillance System

Colorado, Washington, and Alaska have legalized marijuana, thus allowing a commercial industry to develop and market a product that has been, in effect, illegal since 1937. Commercialization of other addictive substances such as alcohol and tobacco created a cascade of negative public health consequences, leading to reactive and ineffective attempts at regulation of a mature industry. Although there are calls to study the effects of marijuana legalization, survey data have generated mixed results thus far. For example, Stolzenberg et al reported amplified adolescent use in states that legalized marijuana, while Hasin et al found no significant changes. These conflicting results highlight the need for a learning marijuana surveillance system that uses varied, robust, and real-time inputs to connect use rates, acute harms, and more subtle prediagnostic indicators of morbidity to changes in policy and product.

While often portrayed as "safe," marijuana use is associated with morbidity and mortality. Altered senescence may be experienced as pleasurable, but also increases reaction time and risk of car crashes, particularly among inexperienced drivers. Exposure to highly concentrated marijuana products can result in acute psychotropic reactions, which can in turn result in suicide or other injuries. Systems for tracking acute harms rely on reports from a network of hospital emergency departments that may not connect clinical presentations with changes in product potency, formulation, or use patterns. For example, an uptick in the use of synthetic cannabinoids created a public health crisis, as thousands of users experienced severe adverse reactions, a pattern that health officials were slow to recognize. This illustrates our poor ability to spot and respond to acute harms from shifting drug epidemics using population survey data and case reports.

Acute harms make up only a small fraction of consequences from marijuana use. The real challenge of learning surveillance lies in detecting effects of long-term use. Repeated exposure to marijuana during critical windows of brain development is associated with marked anatomical changes, poor functional outcomes, and serious mental health disorders. Marijuana surveillance systems are poorly configured to detect these downstream sequelae, relying primarily on largenational data sets that track self-reported use. While effective for detecting large trends, these systems are relatively insensitive to fine shifts in use that may unfold in response to state or local policy change. They do not distinguish between single-occasion and frequent past-month use that falls below a daily threshold, nor do they account for potency, product type, or quantity of consumption. These factors define dose and therefore outcomes, which vary with state-level policies.

A learning marijuana surveillance system is needed to augment traditional survey surveillance with novel approaches such as mining social media content and crowdsourcing product reports. By inferring information from public communications or by engaging social media users who intentionally share information, an augmented system would significantly expand the volume of information about use, fostering high-resolution views into demographic, temporal, and spatial trends. Using a model that is flexible and designed for continuing improvement, this system could extend across social sectors to enable quantification of school, workplace, and interpersonal outcomes not currently evaluated. These approaches could illustrate marijuana use patterns in relation to other health behaviors (eg, use while driving), events (eg, parties, holidays, or birthdates), or harms (eg, missing class, failing examinations, or unintentional injuries that do not rise above threshold for emergency treatment). Content analysis of communications could shed light on the diffusion of opinions and beliefs across social networks, elucidating both problems and sentiment and allowing policy makers to act from evidence while remaining sensitive to popular convictions. Such an approach is revolutionizing infectious disease surveillance and has alerted the public health community to shifting sentiment about diverse health issues such as fluoridation and vaccination. Better surveillance would also prepare health care professionals to respond to patient questions and address safety concerns. Where data are sufficiently granular, findings from a learning marijuana surveillance system could alert researchers and policy makers to shifts in consumption and associate them with regional and possibly even local interventions, enabling policy course correction.

A learning marijuana surveillance system would engage stakeholders across social sectors. Partnership with educational systems could enable investigation of traditionally collected reports of school outcomes in relation to reports of marijuana use trends. This might reveal problems stemming from chronic marijuana use that are not typically quantified or factored into policy decisions about legalization and availability. If executed well, an expanded marijuana surveillance system would be comprehensive, tuned to detect harms from recreational as well as unregulated medical use, a gap area. As the market unfolds, information about mental health, medical, or school outcomes might suggest we impose restrictions on maximal tetrahydrocannabinol content or bans on certain products that are particularly attractive to youth. With an accurate assessment of downstream consequences in hand, communities may decide to forgo legalization even where state law permits it, as has occurred in Colorado.

Commercialized marijuana is a rapidly moving target. High-potency marijuana plants and products, new...
consumption methods, and wide-scale promotion have significant potential to create unforeseen harms, with risks most pronounced for youth. With no real surveillance system, it took more than 50 years to firmly establish that smoking tobacco causes lung cancer despite the very strong relationship. Delayed response afforded opportunity for youthful cohorts of smokers to mature, to devastating health consequences and profound social cost.

Effective monitoring is easier said than done. Designing a thoughtful system that coordinates myriad information inputs into a coherent picture requires creative new surveillance approaches, cooperation across public and private sectors, and citizen engagement. Considerable market-driven momentum around policy change requires action, lest the proliferation of product outlets, promotion, and pressure from a growing industry outdistance our capacity to forestall harm. A number of states will vote on marijuana legalization well before meaningful results from early adopter states are in. The time for building infrastructure to advance our understanding of marijuana legalization is now.

ARTICLE INFORMATION
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REFERENCES