Prevention of Opioid Addiction

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Ameliorating the factors that cause and sustain opioid addiction is essential for effective prevention. Accordingly, this discussion begins with a brief review of the etiological components, developmental pathways, and phases of addiction across the lifespan. Next, assessment of risk for addiction is discussed as to the basis of objective determination of prevention tactics. The main prevention tactics are succinctly noted. Lastly, the challenges that need to be surmounted to increase access to and success of prevention interventions are considered. Recommendations that may improve effectiveness of prevention of opioid addiction conclude this article. In particular, it is argued that successful prevention is contingent on shifting resources from the criminal justice system to the health care system.

The modern practice of medicine is anchored to the principle that intervention effectiveness, whether prevention or treatment, is contingent on ameliorating the factors that cause and sustain the particular disease. Prevention of diseases that have one causal factor is straightforward, involving either strengthening the person's resistance (e.g., inoculation) or eliminating the etiological agent from the environment (e.g., water and air purification). Multifactorial diseases, on the other hand, technically termed *complex*, do not have a single causal determinant. Rather, these diseases,

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including opioid addiction, ensue over a period of time from the continuous interplay of three etiologic components: (1) genetic and biobehavioral vulnerability of the individual; (2) quality of the physical and social environments; and (3) pharmacological properties of the specific substance. A three-pronged strategy is therefore required to prevent opioid addiction, defined herein as consumption behavior *that is beyond voluntary control* (Dirckx 2001). Compulsive drug seeking, usually embedded in physical dependence, captures the original Latin meaning of the term *addiction*, namely, the once master becoming the slave, in this case to the drug.

Etiology of Addiction

Opioid addiction, as shown in Figure 1, has manifold etiological influences spanning characteristics of the individual, environmental circumstances, and particular type of opioid. Accordingly, the population of opioid addicts is very heterogeneous. Diverse etiological pathways leading to clinical disorder (opioid addiction), termed *equifinality*, illustrates the importance of deploying individualized intervention.

A person-centered approach to prevention (informed by etiology) requires capitalizing on risk-attenuating (i.e., resilience) characteristics while ameliorating risk-enhancing characteristics. All factors pertinent to the three etiological domains, depicted in Figure 2, determine the person's overall risk (R), ranging from 0–1, of developing opioid addiction. Because the repertoire of risk-enhancing and risk-attenuating characteristics is uniquely configured in each individual, the prevention framework must be *adaptive*; that is, it must selectively use methods tailored to the particular needs of the individual. Adaptive prevention thus corresponds conceptually with person-centered medicine.

Etiology of opioid addiction is discussed briefly below, followed in the next section with a description of assessment methods and prevention tactics.

Individual Vulnerability

The psychological characteristics of the individual that predispose him or her to addiction aggregate into two main clusters: (1) suboptimal psychological self-regulation, and (2) deficient reward processing.

Psychological Self-Regulation

The capacity to exercise cognitive control over behavior and emotions is essential for social adaptation. Constituting the executive cognitive functions,

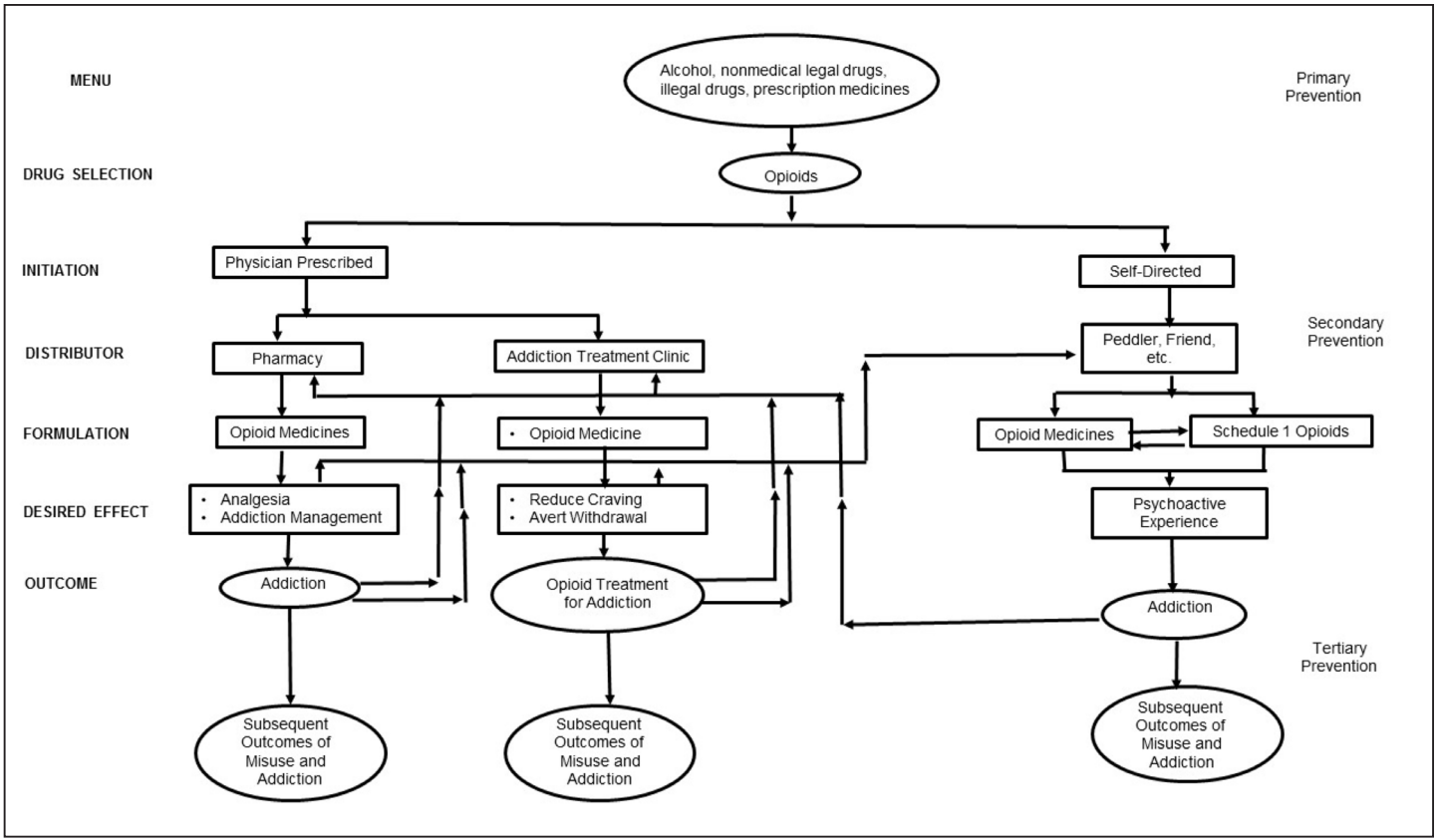

Figure 1. Etiological Pathways to Opioid Addiction to Inform Primary, Secondary, and Tertiary Prevention. (*Created by authors.*)

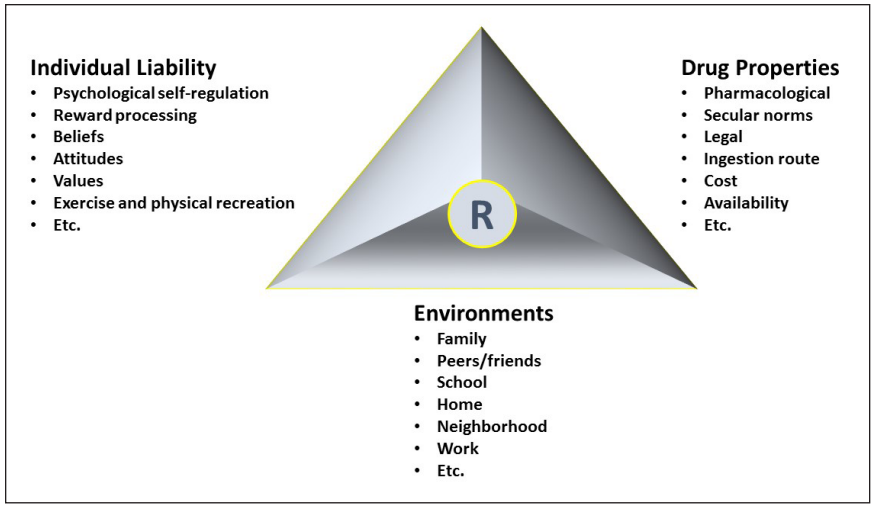

Figure 2. Opioid Addiction Risk (R) Results from the Interplay of Individual, Environmental, and Drug Characteristics. (*Created by authors.*)

this capacity is integral to planning distant goals (telescopic thinking), self-monitoring ongoing behavior, and changing motivational course in response to shifting circumstances. Internal language (thought) mediates these processes. For example, impulsivity, one of the cardinal features of addiction risk, is essentially acting without thinking. Preventing addiction should begin, therefore, with techniques that consolidate language competencies (reading, oral communication, problem solving, contingent "if-then" thinking, etc.) in early childhood.

Neuromaturation, beginning during fetal development and extending to 27–28 years of age, underlies the acquisition of psychological self-regulation. Approximately 1% of babies in the United States are born in opioid withdrawal. This disturbance, termed *neonatal abstinence syndrome* (NAS), is the result of exposure during gestation to medicinal and/or illegal (Schedule I) opioids. The main feature of NAS is severe physiological dysregulation, which, although usually subsiding within a month, challenges caregiver investment in the baby and parenting competencies. Moreover, frequently present characteristics of addicted women (psychiatric disturbance, medical disability, lack of social support, chronic stress) impede emotional bonding and parenting. One outcome of dysfunctional baby-caregiver bonding is development of behavioral disturbances in the young child, thereby biasing ontogeny toward nonnormative socialization, which almost invariably manifests as early age–onset substance use and other risky behaviors. In 2016, over 300 babies were born with NAS at the Magee Women's Hospital in Pittsburgh.

Transient disturbances during infancy, often mundane and considered innocuous, may also hamper development of psychological self-regulation and subsequent normative socialization. Colic, for example, is evinced as fussiness, intense crying, flushed face, clenched hands, and physical discomfort indicated by knees pulled up to the chest. Without reliable comforting from the caregiver (soothing, holding, stroking, mild exercise, etc.), emotional development of the baby may be jeopardized. Distress in the infant that is not alleviated by a caregiver hinders affectional bonding, which commonly manifests in later childhood and adolescence as a strong propensity for disruptive and antisocial behavior, including substance use.

During toddlerhood, suboptimal self-regulation, usually referred to as *difficult temperament*, consists of high emotionality, behavioral overactivity, low sociability, low persistence to goals, and distractibility. These emotion and behavior deviations in two-year-old children increase the risk for addiction two decades later (Horner et al. 2015). Low self-regulation in middle childhood is evinced as symptoms of attention deficit hyperactivity disorder (ADHD), often in conjunction with conduct disorder (CD). Both disorders amplify conflict with peers and adults, resulting in marginalization that is often accompanied by internalization of resentment, aggressivity, alienation, and affiliation with peers who are similarly undercontrolled and prone to deviant behavior. In effect, a friendship cluster forms consisting of youths who mutually encourage norm-violating behavior, including substance use. Notably, severely deficient psychological self-regulation in late childhood segues to addiction, consequent to the most negatively sanctioned drugs, such as cocaine and opioids (Krueger et al. 2002). By mid-adolescence, low psychological self-regulation often manifests as antisocial personality disorder (more often in males) and borderline personality disorder (more often in females), which are the most frequent presaging and co-occurring personality disturbances associated with hazardous substance use and addiction. Hence, the core individual characteristic comprising the liability to addiction is suboptimal psychological self-regulation, predisposing to nonnormative socialization and associated nonadherence with mores and laws.

Internal and external stressors may diminish previously acquired psychological self-regulation. Examples of internal stressors include psychiatric illness, sleep disorder, and pain. Examples of stressors having an external source include divorce, maltreatment, and unsafe neighborhood. Alcohol and other addictive drugs alleviate stress in the short term; however, habitual consumption results in neuroadaptation (chronic tolerance) and other symptoms of addiction. Stress associated with (1) preoccupation of ensuring a reliable opioid supply, (2) craving, and (3) staving off withdrawal symptoms catalyzes

strongly motivated drug seeking, which in severe cases manifests as compulsivity that may lower inhibition for criminal behavior.

Deficient Reward Processing

A body of empirical evidence, albeit not pertaining to opioids, documents deficient reward processing in individuals who subsequently develop addiction. Quality of reward experience, however, most likely predisposes to opioid addiction, considering that all addictive drugs impact the same dopaminergic mesolimbic circuitry comprising the reward system in the brain (Vanyukov et al. 2009).

The pharmacological actions of addictive drugs produce three types of subjective effects: (1) positive reinforcement (euphoria, pleasure), (2) negative reinforcement (relief from emotional and/or physical discomfort), and (3) punishment (e.g., panic, nausea). Experiencing punishment lowers the probability of repeated use, whereas positive and negative reinforcement increase the probability of repeated use, although not inevitably leading to addiction. However, because the potency of some opioids is very strong, risk for addiction is augmented in individuals who have low vulnerability to addiction. For example, fentanyl, a synthetic opioid, is several thousand times more potent than heroin. Notably, regular vigorous physical activity (i.e., exercise and recreation) is rewarding via enhancement of feelings of well-being and diminution of negative feelings (anxiety, depression, etc.). Hence, mediated by activation of the endogenous opioid system, physical activity may lower the desire to consume opioids (and other drugs).

Environment

Multiple environments (family, school, military, Moose Lodge, church, etc.) regulate individual behavior via (1) informal folkways (e.g., shaking hands in a greeting), (2) formal secular and cultural rules (e.g., not jumping position in a checkout line, desisting alcohol intoxication), and (3) laws (e.g., smoking in restaurants, giving alcohol to a minor). Social adjustment thus requires conformity with many expectations, spanning a large variety of different contexts. Where there is a mismatch, the person must accommodate or adapt to the discrepancy and associated stress. For example, gay marriage is proscribed by almost all religions, yet accepted in secular Western societies. A person with strong religious convictions must, therefore, reconcile discordant cultural and secular values. In the absence of resolution, alcohol or drug use may be adopted as a stress-coping tactic, which, over time and facilitating circumstances, segues to addiction. The point is that alcohol or drug use may ensue

from stress caused by adapting to multiple environments that place variable and often conflictual demands on the person.

Family

The family is a system of genetic and social relationships. It is the first and most important environment interacting with the fetus and the child. Parents, siblings, and extended family members inculcate in children the values, habits, and attitudes that guide behavior throughout life.

The importance of the family in addiction etiology cannot be overstated. Addiction in a parent increases addiction risk in the child up to sevenfold, consequent to conjoint influences of genetic liability and family environment. For example, adults with addiction not infrequently spiral into socioeconomic decline, thus forcing the family to relocate to a disadvantaged neighborhood in which illegal drugs are more readily available and their consumption is tolerated. Hence, the child is at heightened risk for addiction, concomitant to genetic predisposition along with adverse family and neighborhood environments. To cite another important example, it is well known that genetic risk for addiction is shared in large part with several psychiatric disorders and criminal behavior. These disorders in parents, especially when severe, may lower the threshold for maltreatment of their child. In effect, the child's risk for addiction and frequently co-occurring outcomes (e.g., crime) is determined conjointly by genotype and adverse home environment. Maximizing a positive environment by investing in addiction recovery and mental health services for parents is, therefore, integral to deterring addiction in children.

Many family characteristics bias the child toward addiction. Salient features during early childhood include weak affectional bonding with the primary caregiver, due either to disinterest or child-rearing incompetence. Additional risk-promoting factors include low family cohesion, poor communication among family members, insufficient supervision of the child, mutual dissatisfaction between parent and child, family disengagement from cultural/religious identity, and economic disadvantage. Single parenting, especially in the absence of extended family or other social support, is also potentially problematic. In summary, internalized societal norms and prosocial values are ordinarily transmitted from family members to children. Failure to inculcate traditional values and prosocial behavior portends deviant socialization and substance use onset at a young age.

Peers

Play during toddlerhood is essential for acquiring social competence. Cooperation inculcates trust, empathy, and skills required for optimal social

interactions. Where play is marked by aggression or dominance asserting behavior, risk for early age-onset substance use is heightened. Bullying behavior, for example, consolidates a spectrum of problematic behaviors that predispose to substance use. Victimization from a bully, on the other hand, may cause long-term emotional disturbance, including low self-esteem, leading to substance use as a stress-coping response.

Two aspects of the peer environment during adolescence exert a particularly strong influence on risk for addiction. The first factor, parental supervision, usually declines during adolescence in tandem with increasing opportunities for the youngster to affiliate with socially deviant peers, and thus initiate alcohol and drug consumption. In the absence of parental oversight, desisting a drug or alcohol offer is less likely among youth with suboptimal self-regulation. The second factor is timing and rate of physical growth and sexual maturation. Precocious onset of puberty manifests overtly as appearing older (e.g., facial hair in boys, breast development in girls) relative to actual chronological age. Consequently, the early-maturing youngster is at heightened risk for being drawn into a friendship cluster consisting of older peers who introduce them to risky behaviors, including substance use.

School

The school is a socially and cognitively demanding environment. Beginning with pre-K education, youths are prepared for citizenship by acquiring cognitive and behavioral competencies required for gainful employment and adult roles. Maladjustment in school and/or underachievement increase likelihood of truancy and dropout, which heightens risk for affiliation with socially nonnormative peers and substance use.

The school building, vacant about half the year, is a potentially valuable resource to provide health and social services, which, among other benefits, could lower risk for opioid addiction. Drug abuse education, family counseling, routine health services (e.g., vaccinations, orodental hygiene services), out-of-school physical recreation, and adult-supervised social recreation are examples of activities that lower risk for addiction, which can be easily implemented in the school building serving as a neighborhood hub.

Community

Economically disadvantaged communities have a higher density of retail outlets displaying and selling alcohol and tobacco products. This visibility normalizes consumption of addictive substances. Hence, drug peddling and consumption are more prevalent and tolerated in disadvantaged communities, especially when there is lax law enforcement and weak social cohesion.

Opportunity for seclusion in vacant buildings also facilitates illegal drug use. In sum, a socioeconomically disadvantaged neighborhood is more likely to tolerate, and in varying degrees acquiesce to, drug use.

Reducing opioid peddling and consumption (as well as other illegal behaviors) would, at first glance, appear to simply require rehabilitating the community. Often the cornerstone of urban renewal policy, this strategy is not likely to have a robust effect because it merely shifts illegal activity to another proximal disadvantaged neighborhood.

Disadvantaged neighborhoods are, however, not inevitably locked into a high rate of illegal behaviors, including drug distribution and consumption. Many neighborhoods inhabited by the low-income segment of the population do not have elevated rates of nonadherence to mores and laws. Accordingly, they provide good models for drug prevention programming. An important mitigating factor is the neighborhood's social capital; namely, leadership having expertise in and commitment to promoting the welfare of the residents in conjunction with preservation of the physical and social infrastructure of the neighborhood. Enforcing social norms, supporting legitimate economic activity, protecting societal institutions (health, social welfare, education, religious, legal), sustaining partnerships with philanthropic and business entities, and ensuring access to safe social and physical recreational activities (e.g., sports league, Scouts, etc.) are also essential for protecting the community from decline, thereby preventing an opening wedge for drug peddling and the opportunity for initiating drug use.

Drug Properties

Repetitive consumption of a drug that has reinforcement properties is the third etiological determinant of addiction. Importantly, opioid addiction risk is potentiated by consumption of other addictive substances. This is not surprising, however, considered in light of the fact that almost 100% of genetic risk is common to all addictions (Tsuang et al. 1998; Kendler et al. 2003). Hence, effective primary prevention of opioid addiction is contingent on averting the onset of consumption of other addictive substances.

Consumption usually advances from easily obtainable, inexpensive, and legal substances (e.g., alcohol, nicotine) to illegal or negatively sanctioned substances. This pattern has been widely thought to reflect a developmental progression in which cannabis is the pivotal (gateway) drug promoting transition from legal substances to "hard" drugs, including opioids. Usually referred to as the *gateway hypothesis* (Kandel and Yamaguchi 1999), this notion has been discredited on both logical and empirical grounds (Tarter et

al. 2006). It has long been known that (1) opioid use does not invariably ensue after cannabis use, and (2) most cannabis users do not transition to opioid use. Nevertheless, the gateway hypothesis has been the rationale underpinning the punishment of individuals caught smoking marijuana, even though there is no empirical evidence that consumption is the stepping stone to opioid use.

The rise in opioid use during the past two decades cannot be attributed to marijuana use. Other factors appear to have a more prominent influence. Opioids in contemporary society have, however, several special features. Whereas opium was once the only opioid product, there are currently dozens of formulations consisting of FDA-approved "medicines" and Schedule I (illegal) drugs. Consumption of medicines with physician prescription is socially responsible, indeed expected, in conformance with Aesculapian authority of the doctor for treatment of ailments; however, consumption without physician prescription is not severely negatively sanctioned, if at all. Moreover, there are currently readily available, albeit illicitly, potent medicinal opioids (e.g., fentanyl, carfentanyl) that accelerate progression to addiction and confer great fatality risk from overdose. Strong potency, low cost, and easy availability, in conjunction with quick sharp euphoria obtained via opioid administration using disposable syringes, converge to heighten the risk for consumption, and subsequently addiction. Because many individuals are not capable or motivated to initiate recovery from addiction, harm-reduction techniques (secondary prevention), such as providing clean needles and providing heroin legally in a controlled setting, lower the risk for disease and injury.

Opioid use, as can be seen in Figure 3, does not inevitably advance to hazardous use and addiction. Comprehensive reviews of the literature suggest that addiction ensues in only a subset of the population of patients using

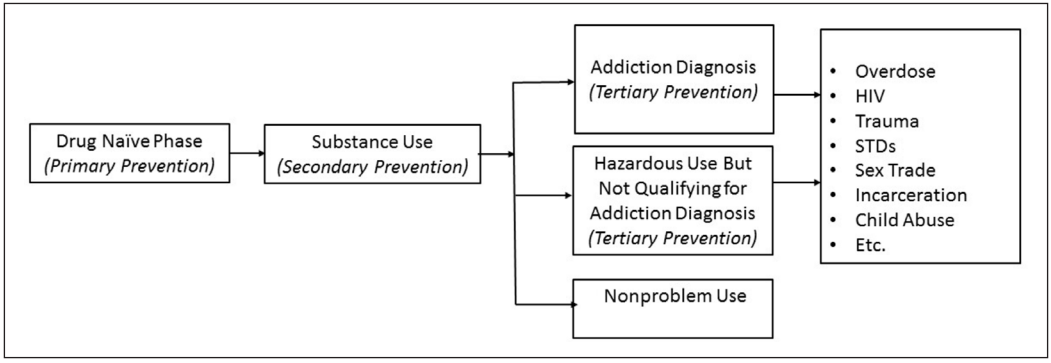

Figure 3. Phases of Addiction Development Synchronized with Prevention Type. (*Created by authors.*)

opioids for analgesia under physician oversight (Fields 2011). Determining whether the individual using an opioid is at high risk for transitioning to addiction is therefore a high priority for cost-efficient secondary prevention.

A change in the magnitude of risk for addiction can occur very quickly. Drug peddling entering the community, a parent receiving physician-prescribed opioid medication who unintentionally lets his children access the supply, and opioid consumption after surgery in vulnerable individuals can, for example, rapidly accelerate use culminating in addiction. Establishing an intimate relationship with a drug-abstinent partner or joining an organization that enforces mores prohibiting consumption lowers the risk for addiction. Temporally monitoring individuals who may be prone to addiction is, therefore, the key to timely intervention.

One location in which to conduct long-term monitoring is the community pharmacy. The pharmacist has specialized expertise in medication management, including promoting safe drug use and adherence with the prescribed regimen. Pharmacists are among the most accessible health care professionals. Indeed, 93% of the population resides within five miles of a retail pharmacy. Furthermore, the expansion of pharmacist-delivered services (e.g., influenza immunization clinics, blood pressure monitoring) requires allocating space in the pharmacy for private interactions with patients. Currently, 40% of pharmacies in the United States have a consulting room. In sum, the community pharmacy is an ideal setting in which patients receiving physician-prescribed opioids can be monitored for addiction risk, thereby enabling timely on-site prevention intervention. Notably, a recent study has found that approximately 15% of patients screened in four community pharmacies located in western Pennsylvania misuse their opioid medication (Cochran et al. 2015).

Lifespan Perspective of Opioid Addiction Etiology

The three phases of addiction etiology and development shown in Figure 3 correspond to primary, secondary, and tertiary prevention. Because individuals vary with respect to their duration in each phase, it is difficult, if even possible, to conduct effective prevention intervention in a fixed "one size fits all" program. For example, one person may consume a substance for many years before risk ramps up, leading to addiction, whereas another person may rapidly progress to addiction soon after initiating consumption. A schema of addiction etiology accounting for both chronological age and variability of duration in each addiction phase is depicted in Figure 4.

Initial magnitude of risk is established at the moment of conception. Thereafter, risk-enhancing and risk-attenuating factors constitute vectors (v_1, v_2, v_3, etc.), namely, quantities that have both force and direction (analogous

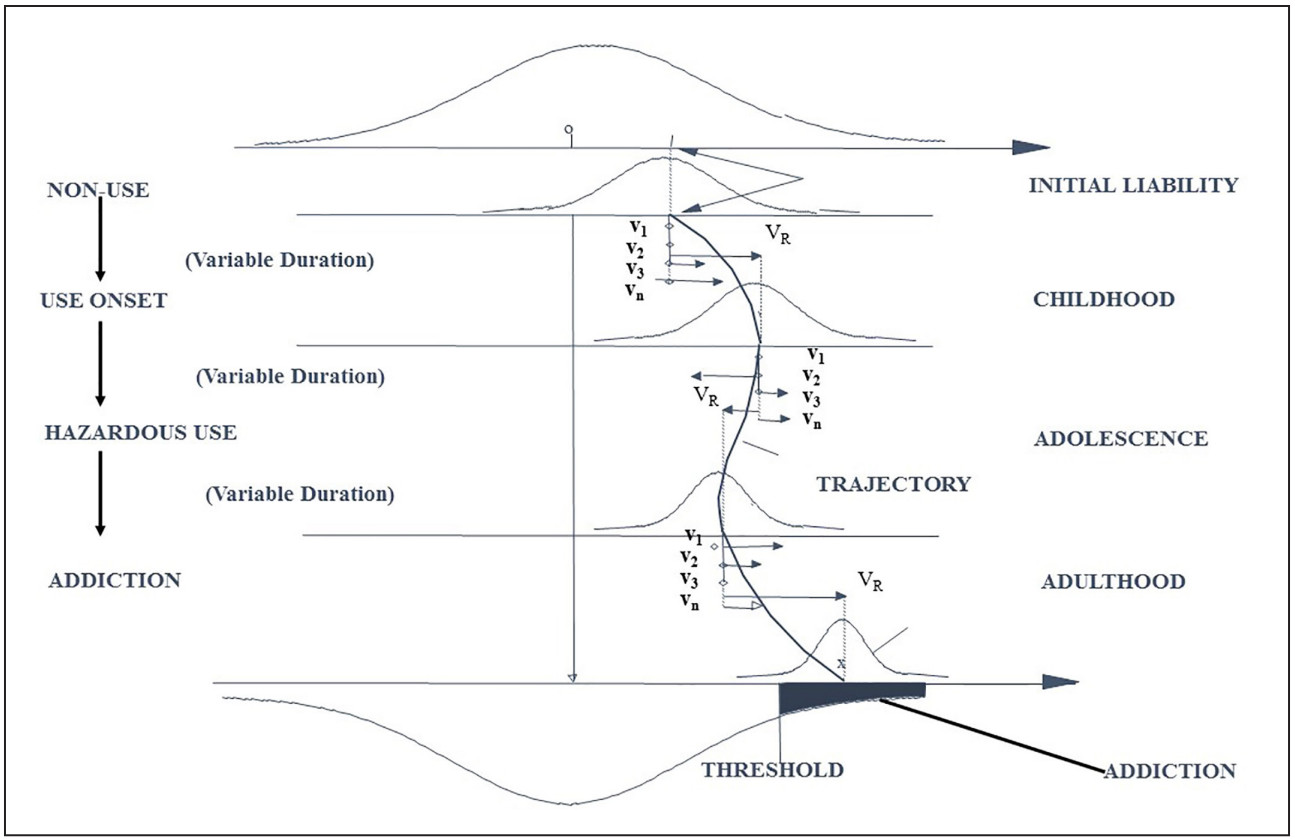

Figure 4. Variable Duration of Each Phase of Opioid Addiction Development Across the Lifespan. (*Created by authors.*)

to an airplane in flight). In aggregate, the vectors constitute the overall risk vector (V_R) biasing the person toward addiction with a particular momentum. Figure 4 illustrates also that the etiological trajectory is nonlinear. This is due to the fact that the person's biological and psychological risk characteristics change throughout life, concurrent with changing environmental contexts and exposure to an ever-expanding panoply of addictive substances. Risk magnitude, therefore, is not constant but variable. This important point has two noteworthy ramifications: (1) Because magnitude of addiction risk is changeable, it can be reduced, thereby providing the rationale for prevention; and (2) it is not practical or even possible to conduct long-term forecasting. Hence, once the need for prevention is determined, intervention needs to focus on lowering the risk of near future outcomes, so as to bias the trajectory away from addiction. This task requires comprehensive quantitative assessment.

Assessment of Addiction Risk

Employing the data obtained in a 25-year longitudinal study conducted by the Center for Education and Drug Abuse Research (CEDAR) at the University of Pittsburgh, assessment tools have been developed corresponding to the three components of addiction etiology (see Figure 2): namely, individual risk (Vanyukov et al. 2009), environmental risk (Kirisci et al. 2009), and drug use topology (Kirisci and Tarter 2001). Problems as well as assets that inform prevention targets can be expeditiously delineated (15–20 minutes) using the web-based revised Drug Use Screening Inventory (DUSI-R) (ecenterresearch.com). As shown in Table 1, problem severity (0%–100%) is quantified in multiple domains spanning mental and physical health, behavior, social skills, and key environments (family, peers, school, work). Importantly, the person's responses are immediately and automatically scored so that the results can be shared with the individual at the time of assessment. Denial of problems (a frequent defense by addicted individuals) is not possible since problem severity directly mirrors the person's responses on the inventory. Moreover, a Lie Scale detects intentional deception. Lastly, the data from the automated DUSI-R can be easily aggregated to evaluate effectiveness of the prevention program and to quantify magnitude of the benefit obtained from the intervention for each individual.

Prevention Tactics

The following discussion describes prevention techniques corresponding to the main addiction pathways (see Figure 1). It should be noted that the

Table 1. Scales of the Revised Drug Use Screening Inventory (DUSI-R) for Adolescents and Adult Versions

Primary Scales	
Frequency of Substance Use (20+ compounds)	
Substance Use Problems	Overall Problem Density Score (0%–100%)
Behavior Patterns	
Health Status	
Emotional Health	
Social Competence	
Family System	
School Performance	
Work Adjustment	
Peer Relationships	
Leisure and Recreation	
Lie Scale (validity check)	
Subscales	
Behavior Undercontrol	
Deviance Proneness	
Feeling Safe at Home and School	
Attention Deficit Hyperactivity Disorder	
Conduct Disorder	
Anxiety	
Depression	
Academic Underperformance	
Anger	
Dependence Syndrome	
Interpersonal Aggression	
Nonviolent Legal Violation	
Paranoia	
School Disengagement	
Social Withdrawal	

Source: Compiled by authors.

interventions below (primary, secondary, and tertiary prevention) target the three etiological components (Figure 2) spanning the three phases of addiction development (Figure 3). It is important to emphasize that the tactics deployed during each phase of addiction development must also include tactics that ameliorate the etiology influences that are present in the prior phase. For example, averting the transition to addiction in drug users must include interventions that address the factors that led to prodromal drug use. To reiterate, prevention encompasses three phases: targeting etiology pertaining to vulnerability disposition prior to onset of substance use, pattern of substance use, and addiction manifestations.

Subpopulation A: Self-Directed Opioid Use

This etiological pathway to addiction originates with behaviors that violate social mores and laws.

Primary Prevention (Pre-Drug Use Stage)

As appropriate:

- Ameliorate externalizing behavior (attention deficit hyperactivity disorder, conduct disorder, oppositional defiant disorder).
- Devise a personalized curriculum to potentiate academic achievement.
- Inculcate parenting and communication skills in caregivers.
- Ensure reliable presence of prosocial adult mentors.
- Prevent friendships with undersocialized peers.
- Connect the youngster with adult-led social, cultural, and recreational organizations.
- Cultivate the child's expertise in a skill (music, craft, sport, etc.).
- Encourage breastfeeding to promote affectional bonding between caregiver and baby.
- Enhance socialization in toddlerhood through cooperative play.
- Establish regularity in daily routine (eating, sleeping, homework, bathing, etc.).
- Monitor and supervise health promotion behaviors (oral hygiene, hand washing, seat belt use, etc.).
- Provide opportunity for and require regular vigorous exercise and recreation.
- Expect the child to regularly perform age-appropriate tasks that benefit a social group (e.g., household chores for the family, volunteer activities in a nursing home).
- Elevate the barriers to drug dealing in the neighborhood (watch committees, police presence, surveillance cameras, etc.).
- Provide safe adult-supervised outdoor recreational space for unstructured and adult-supervised recreation.
- Reduce ubiquity of legal retail sale of addictive substances, including tobacco and alcohol advertising.
- Strengthen cohesion, identity, and pride in the community (fairs, festivals, sports leagues, etc.).
- Prevent entry into vacant and abandoned buildings.
- Establish volunteer corps to upgrade attractiveness of the neighborhood.

- Incentivize long-term residence in the neighborhood.
- Repurpose school buildings as a community hub when not occupied for education.
- Provide neighborhood setting for AA, Al-Anon, and Alateen groups.
- Recruit businesses essential to a self-contained neighborhood.
- Provide multiyear drug education in schools.
- Establish home visitation program for high-risk children (e.g., parent in prison, single-parent families, parent receiving opioid medication).

Secondary Prevention (After Substance Use Onset)

As appropriate:

- Provide accessible drug/alcohol, mental health, and family/social professional services.
- Ensure treatment access for drug/alcohol offenders (e.g., DUI, drug possession).
- Create employment and job training opportunities, including apprenticeships.
- Implement program for school dropout prevention.
- Implement employment assistance program.
- Inculcate adaptive coping tactics to replace substance use.
- Terminate affiliation with norm-violating friends.
- Provide marital and family counseling services in the neighborhood.
- Conduct contingency management of substance use in conjunction with brief intervention tactics at point of health service (physician, pharmacy, social agencies).

+ Incorporate primary prevention tactics as appropriate.

Tertiary Prevention (Health and Legal Problems Subsequent to Addiction)

As appropriate:

- Ensure that opioid medication type and dose are therapeutically effective.
- Introduce long-term recovery resources (e.g., therapeutic community, AA/NA).
- Ensure access to psychiatric treatment.

- Provide social and legal support services.
- Implement behavioral interventions to reduce lifestyle risky behaviors.
- Conduct routine infection-risk monitoring (HIV, STD, etc.).
- Intervene with an individualized person-centered approach to formulate life goals, ingrain health promotion values, and instill self-motivated character development.
- Guide and oversee participation in prosocial organizations (e.g., church, sport league, social club).

+ Incorporate primary and secondary prevention tactics as appropriate.

Subpopulation B: Physician-Prescribed Opioid Use

A subset of patients receiving opioid medication (usually to manage pain) are at heightened risk for addiction.

Primary Prevention

N/A

Secondary Prevention

As appropriate:

- Monitor proactively in pharmacy at time of prescription refill.
- Ensure that medication for pain management is effective.
- Refrain, if possible, from taking psychotherapeutic medications that have addiction liability.
- Desist recreational use of addictive substances (alcohol, nicotine, etc.).
- Reduce environmental and internal stressors.
- Ensure access to psychiatric disorder treatment.
- Monitor healthy diet.
- Teach coping methods to manage pain (and other stressors) to replace alcohol or drugs.
- Provide education pertaining to addiction risk.
- Ensure understanding of the risk of adverse outcomes consequent to nonadherence with the physician-prescribed medication regimen.
- Prevent accumulation of an opioid supply via accessing multiple physicians and pharmacies.

- Quantitatively monitor change in magnitude of addiction risk at the point of service while on a medication regimen (e.g., retail pharmacy at each prescription refill).

+ Incorporate primary and secondary tactics as appropriate (re: Subpopulation A).

Tertiary Prevention

- Same as Subpopulation A

+ Incorporate primary and secondary tactics as appropriate (re: Subpopulations A and B).

Subpopulation C. Physician-Prescribed Opioid Use Transitions to Self-Directed Use of Medicinal and/or Schedule I Opioids

Some patients legitimately receiving opioid medicine transition to self-directed use.

Primary Prevention

N/A

Secondary Prevention

As appropriate:

- Ensure effective analgesia.
- Ensure that the dose is sufficient to avoid feelings of incipient withdrawal.
- Ensure that the patient can obtain legitimately prescribed opioid medication.
- Monitor risk status and intervene at the point of service (retail pharmacy).

+ Same as Subpopulations A and B as appropriate.

Tertiary Prevention

+ Incorporate the same interventions as Subpopulations A and B as appropriate.

Subpopulation D: Opioid Use to Manage Addiction under Medical Supervision Transitions to Self-Directed Use of Medicinal and/or Schedule I Products

Medicinal opioids are a standard treatment of opioid addiction. Some patients transition to self-directed use.

Primary Prevention

N/A

Secondary Prevention

N/A

Tertiary Prevention

As appropriate:

- Avert craving using behavioral and physiological tactics.
- Ensure transportation access to methadone clinic or other facility that dispenses opioid medications (e.g., physician's office).
- Provide social services support.
- Facilitate childcare assistance to enable accessing drug and nondrug treatment facilities.
- Obtain financial resources subsidy for medications and related treatment.
- Provide a community resident navigator.

+ Incorporate primary, secondary, and tertiary prevention tactics (re: Subpopulations A, B, C) as appropriate.

Prevention in Context of Politics and Policy

The discussion up to this point addressed: (1) etiology of opioid addiction, (2) cost-efficient scalable assessment, and (3) prevention tactics. Because the state has multiple interests (tax revenue, health promotion, protecting public safety, etc.), policies to prevent opioid addiction and its aftermath are unavoidably and intricately connected to politics.

From the standpoint of health promotion, the current constellation of federal and state laws and regulations lack consistency. In Pennsylvania, the state is the monopoly retailer of spirits, yet these beverages can be purchased in sufficient quantity to cause death from intoxication. Marijuana, which

Pennsylvania currently outlaws for recreational use, does not cause death from intoxication. Pennsylvania does not regulate distribution of powder caffeine, even though one tablespoon can be fatal. (This substance is often added to alcohol drinks to offset sedation.) With respect to toxic injury, cigarette smoking, legal at 18 years of age, is responsible for over 400,000 deaths each year in the United States, whereas alcohol, which accounts for about a fifth of this number of deaths, is legal at 21 years of age. Hookah, a coarse tobacco, is almost completely unregulated. Protection of safety effected through laws and regulations thus has consistency gaps and arguably lacks coherence.

The effectiveness of prevention of opioid addiction via laws and regulations is thus doubtful, especially considered in light of U.S. legislative history. The first attempt in the United States to regulate opioid consumption was the 1875 *Opium Den Ordinance Act* in San Francisco. This ordinance, like many statutes since, had racist and nativist sentiments insofar as it was aimed at reducing a perceived threat from Chinese immigrants. Violators were fined and occasionally jailed. Opium use was, however, not curbed. A subsequent law passed in California in 1907 ramped up enforcement, including covert police infiltration of distributors. Whereas consumption did not noticeably decline, opium distribution and consumption were driven underground, thereby establishing a new criminal population defined by using this drug. Once opium use by statute was designated as nonnormative or deviant, individuals with antisocial propensities as well as those with a socially nonconforming lifestyle (hipsters, artists, writers, jazz musicians, etc.) were inclined toward consumption.

During the past three decades, the population of opioid users has expanded by drawing in individuals from the normative segment of the general population. This has occurred for two main reasons: (1) normalization of a wide range of traditionally negatively sanctioned behaviors (e.g., gambling, tattoos, homosexual relationships); and (2) easy availability of opioid medicines that do not carry the stigma of heroin. An expanding spectrum of normative behaviors combined with access to medicinal opioids have thus largely catalyzed an upsurge in consumption. (Other factors that are beyond the scope of this discussion have also been influential.) Medicines do not carry the negativity associated with heroin, hence they most often comprise the first type of opioid consumed by the majority of individuals who subsequently become addicted. Among all illegal drugs, opioid use by youths ranks second only to cannabis.

The first national legislation aimed at curtailing opioids and cocaine use was the Harrison Act in 1914. This statute initially mandated obtaining a license to sell these drugs, but subsequently morphed into a prohibition law.

The Volstead Act, which prohibited the manufacture, distribution, and consumption of alcohol, was passed five years later. Attempts to deter the consumption of alcohol and other addictive substances for the past century have been primarily effected through laws enforced by specialized departments in the federal government such as the Food and Drug Administration, the Bureau of Alcohol, Tobacco, Firearms, and Explosives, and the Drug Enforcement Agency.

Within the guise of protecting public safety, prevention of addiction and prodromal consumption has emphasized control of drug supply. However, because addiction is essentially defined as compulsive drug seeking, it is clear that emphasis must also be given to reducing demand. Policies aimed at preventing consumption solely by eliminating or controlling supply will meet certain failure because individuals with intense demand (compulsive urge to consume the drug) constitute a reliable profitable consumer market for nefarious manufacturers and distributors.

The American Psychiatric Association officially designated addiction as a mental disorder upon publication of the second edition of the Diagnostic and Statistical Manual in 1968. The Supreme Court first ruled in 1963 (*Robinson v. California)* that addiction was a disease, asserting that the Eighth Amendment of the Constitution ("cruel and unusual punishment") protects narcotic addicts from incarceration. Nevertheless, to this day a substantial portion of the U.S. prison population is serving long sentences connected to alcohol and/or drug addiction. The point to be made is that shifting focus from reducing supply to lowering demand also requires a shift from a legal/regulatory framework of prevention to a health framework.

Accordingly, reducing demand for drugs can best be cost-efficiently conducted within a comprehensive health delivery system. The infrastructure and expertise required to provide age-appropriate interventions, spanning gestation to old age, are established. Considering that up to 20% of the U.S. population will develop addiction at some time in life, often with severe manifold co-occurring diseases, shifting emphasis to prevention is consistent with the mission of health providers. However, this shift in intervention resources to prevention must accommodate financial concerns, specifically the loss of future revenue accrued from treatment services.

A proposed solution is to fund all addiction services from a dedicated fund accrued from a small levy on all substances that have empirically documented addictive properties. In addition to prescription analgesics, stimulants, anxiolytics, and hypnotics, this tax would extend to nonprescription "nutrition" supplements, proprietary medicines, alcohol, and nicotine products. One immediate benefit of a dedicated tax is that it focuses attention on

addiction, which, with respect to opioids, constitutes a recently designated national emergency. From the practical perspective, tax on the addictive agent is insurance for the consumer; namely, it ensures that intervention for addiction and concomitant medical conditions will be available. In 2016, almost 45% of the U.S. population over 12 years of age used a prescribed psychotherapeutic drug having addictive properties. Hence, a one-penny tax on each dose, costing up to three dollars/month, would fund most, if not all, addiction prevention and treatment services.

Lastly, it should be noted that treatment of opioid addiction is largely, and not infrequently entirely, confined to long-term (i.e., lifetime) consumption of an opioid. The benefits of "medication-assisted treatment" have been well documented; however, lifetime opioid use for the purpose of forestalling craving and withdrawal is not *recovery*. Because secondary and tertiary prevention may require intensive and potentially long-term intervention, vacated facilities, including former state psychiatric hospitals, can be repurposed.

In conclusion, progress in addiction prevention is contingent on: (1) a shift in emphasis away from law enforcement to health promotion; (2) leadership by elected officials to provide stable funding for services throughout life in a health delivery system; and (3) expansion of educational resources, especially advanced degrees and training in prevention science and practice. It is increasingly obvious that it is not possible to incarcerate all offenders or provide treatment at pace with the growing addiction prevalence. Shifting resources to prevention is the only policy and practical option. From two centuries of public health experience, there is reason to be optimistic that it is feasible to prevent opioid and other addictions.

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